U. S. DEPARTMENT OF AGRICULTURE.

SUGGESTIONS

REGARDING

THE COOKING OF FOOD,

BY

EDWARD ATKINSON,

WITH

INTRODUCTORY STATEMENTS REGARDING THE NUTRITIVE VALUE OF COMMON FOOD MATERIALS, BY MRS. ELLEN H. RICHARDS.

PUBLISHED BY AUTHORITY OF THE SECRETARY OF AGRICULTURE.

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PREFATORY NOTE.

I have from time to time presented arguments in favor of the establishment of food laboratories, or I would rather say of food experiment stations, in connection with the agricultural experiment stations that are now existing or that may be hereafter established. The argument on which I have based this recommendation is that science and invention have, up to this time, been almost exclusively devoted to the production and distribution of food material, while the science of consumption, which includes the conversion of the food material into food, has been almost wholly neglected.

Within the last few years public interest has been aroused on this matter and the most urgent efforts are now being made to improve the nutrition of the people of this country. We now enjoy the greatest abundance of the best food materials at the least cost; but in common practice this food material is subjected to the very worst methods of cooking that can be conceived. Hence arises a monstrous waste of energy which might be readily saved, and I can conceive of no better place to make a beginning than at the agricultural experiment stations. I think there should be one or two food laboratories in which the highest scientific work may be conducted corresponding to that in Germany, where the greatest progress has been made; while, on the other hand, at the agricultural experiment stations arrangements may be made at very little cost for testing, in common practice, the application of the scientific data developed in the laboratory.

Mrs. Ellen H. Richards has kindly contributed some valuable introductory statements regarding the nutritive value of common food materials.

I hope that these efforts may be of service and that in this way the crude beginnings that I have made in the application of scientific principles to the construction and use of cooking apparatus may be developed so as to become an art readily applied by intelligent persons everywhere.

EDWARD ATKINSON.

BOSTON, MASS., *June 15, 1894.*

SUGGESTIONS REGARDING THE COOKING OF FOOD.

NUTRITIVE VALUE OF COMMON FOOD MATERIALS.

By Mrs. Ellen H. Richards.

The best coal for a locomotive is that which will enable it to haul the greatest number of tons over the longest distance. The best food for man is that which will enable him to do the most work in a given time and keep him in perfect condition for further work. Food is the only means by which the physical and mental power of man can be sustained. It behooves us to make the most of the supplies of food which are at our command.

The best coal is that which will burn freely but not too quickly; that which contains only a moderate amount of ash or stone to clog the fire grate and so to prevent a sufficient draft. An excess of ash also means a heavy weight of useless material. The best food is that which is freely digested but not too rapidly assimilated; that which contains only a modicum of woody fiber and other indigestible and burdensome material.

How shall we know what is the best food? Experience has taught all the different races of men what are the effective combinations, as instinct has taught other animals. The foods of different races, or of the people of different lands of the same race, will be found to be in the main the best foods attainable at the lowest cost; but as man becomes civilized and gains in wealth he loses his instinct and he loses his health at the same time. Therefore, when not forced by circumstances and conditions to make the right choice without an intelligent comprehension of the subject, he must learn to apply his reason to the choice of his food.

FUEL VALUE OF COMMON FOOD MATERIALS.

Continuing our simile of power we may compute the value of food in heat units or calories, a calorie being that amount of heat which is required to raise one pound of water 4° F. The following table shows the relative fuel value of 30 common substances; but this computation is but one of the elements which must be considered in making choice of the best food to eat.

TABLE I.*—*Calories of potential energy in 1 pound of each material.*

	Calories.
Melons	90
Cabbage	170
Oysters	230
Apples	275
Milk	310
Mackerel	365
Potatoes	395
Halibut	465
Turkey	525
Salmon	635
Eggs	655
Beef:	
Round	725
Sirloin	885
Mutton, leg	935
Canned salmon	1,005
Skimmed-milk cheese	1,165
Wheat bread	1,280
Mutton chops	1,470
Beans	1,585
Lentils	1,595
Rice	1,630
Wheat flour	1,660
Smoked ham	1,715
Sugar	1,900
Oatmeal	1,845
Whole-milk cheese	2,045
Pork, very fat	3,260
Oleomargarine	3,585
Butter	3,615
Lard	4,180

The reader must not, however, jump to the conclusion that lard and sugar are the best foods when taken alone. The locomotive burns coal only in order to produce power to haul the train. When it becomes worn or broken it is taken to the repair shop to be made as good as new. When its day is past it leaves on the world no impress of great thoughts, no inspiration to great deeds, transmits to no child the hopes and unfulfilled desires of higher things than have been possible to it. The higher forms of energy involved in the physical and mental life of man are unknown to the locomotive. Hence, in selecting the best foods, we must take cognizance of more than mere calories or heat units.

PROTEIN CONTENT OF COMMON FOOD MATERIALS.

The principal kinds of nutritive ingredients in foods are commonly classified as protein, fats, carbohydrates, and mineral matters. The term "protein" is used to include various nitrogenous substances which form the muscles, tendons, and other tissues, and which may also serve as fuel to supply warmth and energy to the body. The following table (II) gives the percentages of protein found in the foods named in Table I.

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* The data from which Tables I, II, and III are made are from Prof. Atwater's published papers.

TABLE II.—*Protein content of common food materials.*

	Per cent.		Per cent.
Lard	0.0	Wheat flour	11.1
Sugar	.3	Eggs	11.8
Apples	.4	Chops	12.5
Oleomargarine	.6	Salmon	14.3
Butter	1.0	Ham	14.6
Melons	1.1	Sirloin	15.0
Potatoes	1.8	Mutton, leg	15.0
Cabbage	1.9	Oatmeal	15.1
Pork	2.8	Turkey	15.4
Milk	3.4	Canned salmon	19.3
Oysters	6.0	Beef, round	20.7
Rice	7.4	Beans	23.2
Wheat bread	8.9	Lentils	25.1
Shad	9.2	Cheese, whole milk	27.1
Mackerel	10.0	Cheese, skim milk	38.4

A more complete statement of the nutritive ingredients of these foods may be found in the next table (III), which also shows their relative fuel value or potential energy.

TABLE III.—*Percentage composition of thirty common foods.*

Food.	Water.	Protein.	Fats.	Carbohydrates.	Mineral matters.	Calories of potential energy in 1 pound.
Beef:	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	
Round	60.0	20.7	8.1	....	1.2	725
Sirloin	45.0	15.0	14.3	....	.7	885
Mutton, leg	50.4	15.1	15.5	....	.7	935
Chops	41.3	12.5	29.3	....	.6	1,470
Smoked ham	36.3	14.6	32.2	....	.9	1,715
Pork	9.5	2.8	76.5	....	.8	3,280
Turkey	42.6	15.4	5.6	....	.8	525
Halibut	61.9	15.1	4.4	....	.9	465
Mackerel	40.4	10.0	4.3	....	.7	365
Oysters	87.1	6.0	1.2	3.7	2.0	230
Shad	35.2	9.2	4.8	....	.7	375
Salmon	40.6	14.3	8.8	....	1.0	635
Canned salmon	59.3	19.3	15.3	....	1.2	1,005
Eggs	63.1	11.8	10.2	.4	.8	655
Milk	87.4	3.4	3.7	4.8	.7	310
Butter	10.0	1.0	85.0	.5	3.5	3,615
Cheese, whole milk	32.2	27.1	35.5	2.3	3.9	2,045
Cheese, skimmed milk	41.3	38.4	6.8	8.9	4.5	1,165
Oleomargarine	10.0	6	84.5	4	4.5	3,585
Lard	1.0	....	99.0	....	0	4,180
Wheat bread	32.7	8.9	1.9	55.5	1.0	1,280
Wheat flour	11.6	11.1	1.1	75.6	6	1,660
Beans	13.7	23.2	2.1	57.4	3.6	1,585
Oatmeal	7.7	15.1	7.1	68.1	2.0	1,845
Rice	12.4	7.4	.4	79.4	4	1,630
Sugar	2.2	3	.2	96.7	8	1,800
Potatoes	68.0	1.8	.2	19.1	9	395
Cabbage	9.0	1.9	.2	6.2	1.2	170
Melons	95.2	1.1	.6	2.5	6	90
Apples	84.8	4	....	14.3	5	275

To these may be added two kinds of food in common use in this country, peanuts and bananas, and one in very common use in southern Europe and eastern countries, which is almost unknown to our native population, lentils. Bananas are given in Atwater's tables with a little difference in figures. These analyses are from Church & Pavy:

Food.	Water.	Nitrogenous matter.	Fats.	Carbohydrates.	Mineral matters.	Calories of potential energy in 1 pound.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	
Peanuts, shelled	7.5	24.5	50.0	11.7	1.8	2,760
Bananas	73.9	4.8	.6	19.7	.8	479
Lentils, shelled	11.7	25.1	1.3	58.4	2.2	1,595

In order to learn from this table the right amounts to be used, there must be given also the theoretical life requirement and the additional work requirement. From the various foods this daily requirement may be made up as shown in the following table:

Daily food requirement.

	Protein.	Fat.	Carbohydrates.	Calories.
	Pound.	*Pound.*	*Pounds.*	
Life ration	.166	.090	0.722	2,000
Work ration, maximum	.277	.277	1.0	3,500

This may be made up in various ways. The following will serve as an example:

	Protein.	Fat.	Carbohydrates.	Calories.
	Pound.	*Pound.*	*Pound.*	
1 pound potatoes	.018	.002	.191	....
1 pound bread	.089	.019	.555	....
1 pound beef (sirloin)	.150	.143	....	....
$\frac{1}{10}$ pound butter	.006	.085	.005	....
$\frac{1}{10}$ pound oatmeal	.015	.007	.068	....
$\frac{1}{10}$ pound sugar	.003	....	.097	....
$\frac{1}{10}$ pound rice	.007	.004	.079	....
Total	.288	.260	.995	3,447

At first sight it seems to the house provider a hopeless task to apportion rightly these elements, but the staple articles are few and the proportions easily learned. Skill in their combination and suitable preparation for the table is, of course, required, and there are difficult questions regarding the relative digestibility of foods and the elements which contribute to their palatability. A knowledge of their composition will, however, be found quite useful.

Given raw materials of the best quality and in sufficient quantity and with good flavor, another difficulty arises. What happens during the preparation for the table? How much of that which is bought reaches the consumer? What toll does the kitchen exact?

Per cent of waste in preparation for cooking.

	Per cent.
Potato:	
Boiled in jackets	7 to 10
Pared before boiling	35
Chicken	40
Beef, sirloin	25
Bananas	50
Shad	50
Oysters in shell	82

WASTE OF REJECTED PORTIONS OF COOKED FOOD.

In tongue and ham the waste of fat not eaten is 30 to 50 per cent of the cooked weight; in steaks and chops, 40 to 50 per cent; in bread, grains, and vegetables, about 15 per cent. It is in these wastes that the difference between the careless well-to-do and those who know how to save is seen. There is also loss in the body by imperfect digestion—the ash of the coal.

Per cent of food digested.

	Nitrogenous matter.	Carbohydrates.
	Per cent.	*Per cent.*
Fine white wheat bread	81	98.5
Fine rye bread	77	95
Coarse acid rye bread. (Schwartz-brod)	53	80

	Per cent digested.
Whole pease soaked and cooked	60
Pease cooked a long time and strained	82.5
Pea flour cooked with milk, butter, and eggs	92
Corn meal	80
Corn meal cooked with cheese	93

With these points in mind, we may now give an approximate estimate of the weekly requirement in essentials.

APPROXIMATE ESTIMATE OF THE REQUIREMENT OF A FAMILY OF FIVE PERSONS.

Three of the five, young or old people, require 2,000 calories each; one woman requires 3,000 calories, one man requires 3,500 calories, making an average of 2,500 per person. Besides tea, coffee, cocoa, and other extras, each person requires in a week about:

	Pounds.
Protein, reckoned as dry substance	1
Fat	1
Sugar and starch	6

This amount gives about 2,600 calories.

Butter, sugar, suet, bacon, beans, cheese, flour, and all grains are nearly dry food materials, containing only 10 or 12 per cent of water. Bread has 40 to 50, while potatoes, fresh meat, and eggs have 75 per cent, and fruit and vegetables contain 80 to 90 per cent of water.

Fresh meat, bacon, eggs, wheat, and oatmeal contain 12 to 15 per cent of nitrogenous substances. Cheese, ham, sausages, liver, beans, and lentils have 25 to 30 per cent, so that 3 or 4 pounds of these would suffice for a week's supply (that is, would give the 1 pound of dry nitrogenous substance), while it would take 7 pounds or more of the first class, and of milk 16 quarts to give the amount.

Meat, eggs, and cheese contain about as much of fat as of nitrogenous material, but if flour, grains, or beans are used (containing only 3 to 5 per cent of fat) then nearly a pound of butter or suet must be added.

One pound of sugar a week seems a fair average. This leaves 5 pounds of starch to be supplied. Since rice, macaroni, flour, and corn meal contain about 70 per cent of starch, 7 pounds of one or more of these substances must be eaten to furnish enough. Since potatoes contain only about 20 per cent, some 25 pounds are required to give the needed 5 pounds of starch, if no other source is used. But it has been found best to mix all these materials in varying proportions, in order to give the right amount of each nutrient without furnishing too much of any.

The following summary may serve as a guide to a satisfactory proportion:

	As bought.	Nitrogenous substances.	Fats.	Carbohydrates.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
Meats or meat substitutes	3	.40	.20	....
Flour and grains	5	.60	.05	3.50
Butter	0.8	....	.70	....
Sugar	1	....	....	.90
Vegetables, including potatoes	5	.06	.12	.60
Fruits	3	.01	....	.20
Total	17.8	1.07	1.07	5.20

The greatest efficiency in the noncalorific but most necessary flavors and appetizers must be judged by the work done. If the individual under consideration comes up to his maximum of clear inspiring words or steady work day after day then the apportionment and preparation may be approved, but the dull brain and lagging foot are sure indications of wrong proportions or unsuitable variety, always provided that the fire is kept burning by good stoking, namely, sufficient exercise.

The best food to eat, then, for any given individual, is that which will enable him to make the best of himself.

THE COOKING OF FOOD.

By Edward Atkinson.

Having become interested in the theory of nutrition many years ago, it lately occurred to me that the great mass of information which had been recently put into a thoroughly scientific form in this and other countries ought to be applied to common practice. In scientific terms the art of cooking consists in the application of a regulated degree of heat to the conversion of food material into appetizing and nutritious food. In other words, I reached the conclusion that the art of cooking should be brought into such simple form and rule that any intelligent person, with little or no previous experience, should become qualified to convert good food material into good feeding; whereas, in the present common practice, nothing could be worse than the bad results commonly brought upon the table from the domestic kitchen. Science seemed to have stopped outside the door of the kitchen, as will presently appear.

I read Dr. Mattieu Williams's "Chemistry of Cookery." I learned that the way to spoil meat was to boil it; the way to cook an egg was not to boil it; the way to render the best meat indigestible and to convert the finest flavor into bad smells was to subject it to the barbarous processes commonly practiced at an excessive heat on the iron stove and range. I learned that slow cooking at a moderate temperature is the only rule in ninety-five cases out of a hundred. It is the only rule in respect to meat, fish, and bread. I dived into innumerable cookery books and found that nine-tenths of the instruction in cooking was how to overcome the faults of the iron stove. I then wasted about $1,000 dollars in preliminary experiments of complex, indirect, and stupid kinds. I finally reached the simple solution; so simple, that one of my friends remarked, when he saw it, that "nobody but a fool would ever have thought of it." I took out several patents, in order to keep the control of the subject until I had exhausted it. The principle on which I worked is now dedicated to public use by myself, so that neither my patent nor any man's patent can stand in the way of the wide diffusion of these simple processes.

THE RIGHT WAY TO APPLY HEAT TO FOOD MATERIAL.

After observing the irremediable faults of all our iron stoves and ranges, it occurred to me that the right way to apply heat to food material would be to box it up in a nonheat-conducting chamber to which I could convey heat by measure and maintain it at any suitable and even temperature. This has been accomplished. Heat can be boxed up under an empty half barrel, under a common stable bucket, under a soap box lined with tin, or in an oven to which heat is conveyed through a hole in the bottom. One of the simplest and most effective types of this apparatus will now be described. (*See* Fig. 1).

A, box made of pine or of whitewood, or any other wood of close texture least liable to warp or shrink. This box may be made of board or plank, either 1 or 2 inches thick. The thicker, the less radiation or loss of heat there will be. It should be lined with tin, and the tin should be carried around the bottom edges and turned up outside so that the wooden surfaces of the edges may not come in direct contact with the metallic top of the table on which the oven is to be placed. If the outside of this box is also covered with tin or sheet metal of any kind, it will become absolutely safe to make use of it night or day, without any other precautions than due care of the lamp by which it is heated. But the outer covering of metal will make the box more expensive, and is not required for day service under supervision.

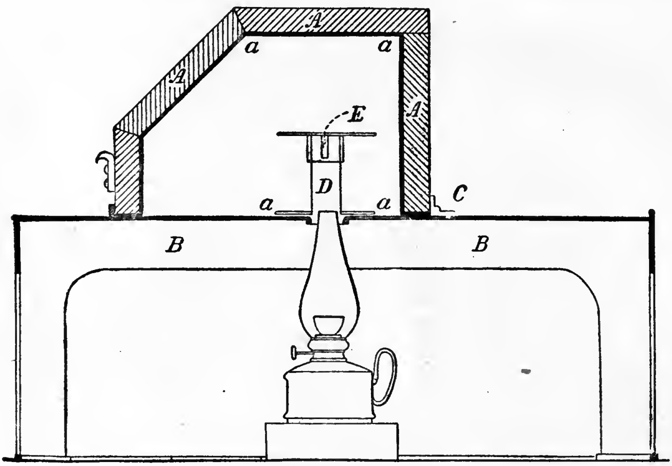

FIG. 1.—Section of cooking box.

B, metallic table, or a table with a metal top, on which the box is to be placed and to which it may be hinged. Hole in the middle 2½ inches in diameter.

C, hinge.

D, double tube open at the bottom over the lamp chimney and over the hole in the metallic table. Both tubes may be open at the sides by openings to match each other, say half an inch in width by 2 inches in length on each quarter. The upper tube, supporting a plate, may be turned on the lower tube so as to open the way for direct heat to pass into the box through the openings for very quick work, or the upper tube may be turned upon the lower one so as to close these openings, which are marked *E*. For the ordinary processes of cooking they should be closed.

A handle is shown by which this box may be turned backward or end up. A convenient size would be to make the space indicated by the four letters, *a*, *a*, *a*, *a*, 14 inches each way. In addition to that space will be the space within the box under the slant at the front. The object in adding this part under the slant is, that the box may clear any cooking vessel which is placed on the tube over the lamp when it is turned upon end. Otherwise, it is necessary to lift the box, which is an inconvenient method. In this space under the slant vessels may be placed for cooking the materials which require a lesser degree of heat. The hottest place will be immediately over the lamp on the upper tube. The next hottest places will be around the tube *D*. The lesser degree of heat will be in front, under the slant. I prefer earthen jars and dishes to metal, except for roasting pans, broiling, or *sautéing*.

A second diagram (Fig. 2) of the oven is given in perspective upon a table wide enough on every side to hold the fragments of the wooden box, in the remote contingency that through carelessness it should be ignited by an excess of heat. The ordinary heat required for cooking appears

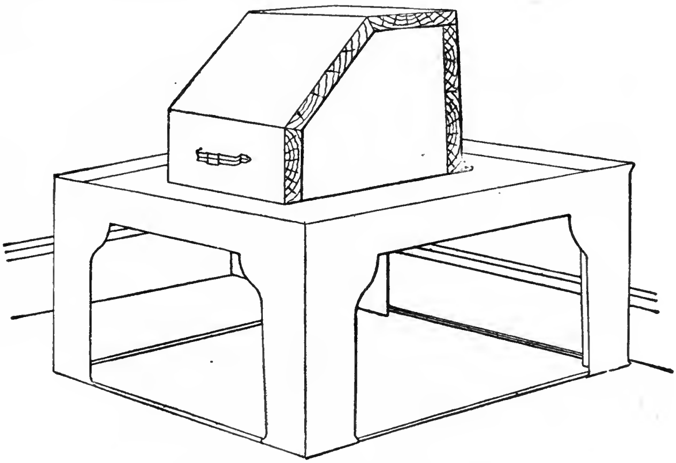

Fig. 2.—Cooking box in perspective.

to have no effect in scorching the wood. The heat may shrink even the best seasoned wood, so that after a few weeks' use it will become expedient to drive a strip into the cracks which may have opened at the joints. The oven might also possibly be scorched and even ignited if the lamp were placed under the hole in the table without the tube or any other obstruction between it and the top of the box.

For the reason that this cooking apparatus is made of wood, which may in a very long period be carbonized or may possibly be ignited by careless use, I do not recommend it for night work unless it is placed upon a table on which the fragments may burn without risk, or unless the table is placed upon a brick or concrete floor, where fragments of the cooking box might burn without hazard. There is no other non-heat-conducting material so effective and so cheap as the compact kinds of wood, like whitewood or pine, and with common prudence they may be safely used.

EVILS OF IMPROPERLY COOKED FOOD.

Anybody can cook with this apparatus. Minute directions, recipes, etc., are given in my book on the Science of Nutrition. Nobody can cook properly on an iron stove or range without wasting heat, time, temper, and even skill. It takes long practice to overcome the faults of the iron stove and of the fuel used in it, and then the results are often bad. The chief fault in cooking is cooking quickly at a high and varying temperature. One of the principal causes of indigestion is the chemical change which is wrought by a high heat upon the fats of meat. Dr. Pavy, one of the earliest investigators, uses the following language in his Treatise on Food and Dietetics: "Fat under a prolonged exposure to a strong heat undergoes decomposition, attended with a production of fatty acids and an acrid volatile product known as acroline, which may cause derangement of a weak stomach."

This evil can be avoided by my methods of cooking. I have on record many instances of the cure of dyspepsia and indigestion by the substitution of food cooked slowly at a moderate heat by the methods which I have promoted, proving conclusively what Dr. Pavy says. I have also two records of very puny children who needed meat and would not eat it when cooked in a cooking stove. Since my oven was adopted, they have eaten meat and have become stout and strong. I have become satisfied that about half the prevalent dyspepsia is due to semistarvation, because the victims can not digest badly cooked food. I am well satisfied that if any shrewd saloon-keeper who wants to make more money will make strong beef soup from the heads, palates, and well-cleaned hoofs of beef cattle, or lentil broth from lentils, it will cost him less than his whisky and beer now cost, and, if put on tap alongside either, each will sell freely in place of the liquor or in addition, because more than half the craving for stimulants is due to want of well-cooked food. Who will try this? "The saloon" will have a better reputation if this suggestion should prove to be profitable in practice.

The question has been put to me, what is the best food to eat? The reply is, the best-cooked food of every kind is the best to eat; the best food material when badly cooked is not fit to eat. The choice of the best food cooked in the right way must be left to each person. It will vary with the work which is to be accomplished, with the special taste and digestive power of each individual, and with other conditions.

DIVERS DIETARIES.

Dealing with the normal conditions of people at moderate work, dietaries have been computed. In my book will be found 12 dietaries, varying from a cost at the time they were computed in the city of Boston from a fraction under 14 cents a day to each adult person up to 28 cents a day. In the vernacular, "you pays your money and takes your choice of the kind of meat that you wishes to eat." It will be observed in the example given below that the grain, butter, and vegetables are called constants. They are the same in all the proposed dietaries. This part of the dietary would form a constant element in any normal selection. The variations may be made in the choice of meat and fish.

A man in active work may buy all the food that he can consume and digest in the city of Boston at the present time for less than $1 a week, if he is content with nutritious and appetizing dishes made of shin or neck of beef, scrag of mutton, halibut nape, etc. He may cook in his own room in a far better way, and bring the food to a much more appetizing and digestible condition, than any food that he can get at any common restaurant or boarding house at a reasonable price. If he can afford to do so, he can substitute for shin of beef any luxury, such as tenderloin of beef, venison, canvasback ducks, Philadelphia capons, terrapin, or soft-shelled crabs. He can also cook these luxuries in a manner equal to anything that can be done by the most skillful cook on the ordinary stove or range; in fact, better. If any one doubts this assertion, try it; any one can do it.

The method of computing these dietaries is now submitted, the example being No. 1 of the series of 12. The rest will be found in the Science of Nutrition.

Table showing the computation of dietary No. 1.

CONSTANTS IN DIETARY NO. 1—LOW COST.

Article.	Pounds.	Protein.	Fat.	Carbohydrate.	Calories.	Cost at Boston prices, 1891.
Flour	22	2.64	.44	15.18	36,520	$0.55
Grain	12	1.63	.84	7.60	19,800	.48
Butter	2	.02	1.73	....	7,230	.56
Suet	2	....	1.78	....	7,200	.12
Sugar	2	....	....	1.93	3,600	.10
Potatoes	10	.20	....	2.10	4,300	.25
Beets, Carrots, Onions, Squash, Cabbage, Parsnips	7	.13	.03	.50	1,120	.25
For thirty days	57	4.67	4.82	27.31	79,770	2.31
For one day	1.90	.155	.160	.910	2,659	.077

VARIABLES IN DIETARY NO. 1—LOW COST.

Article.	Pounds.	Protein.	Fat.	Carbohydrate.	Calories.	Cost at Boston prices, 1891.
Beef, neck, or shin (including waste)	12	2.00	.40	....	5,200	.72
Mutton, neck	5	.62	.34	....	2,476	.30
Bacon	4	.40	2.80	....	11,840	.48
Beef liver	2	.40	.10	....	1,120	.12
Veal	1	.19	.03	....	400	.08
Salt pork	1	.03	.78	....	3,160	.08
For thirty days	25	3.64	4.45	....	24,256	1.78
Total	82	8.31	9.27	27.31	10,026	4.09
For one day	2.73	.277	.309	.910	3,467.05	.136

The prices on which these computations are made were the retail prices in Boston, Mass., in the first six months of the year 1891. At the prices of the finer cuts of meat the same elements of nutrition cost 28 cents a day.

The art of making bread of the very best quality from good material is very simple, provided one be furnished with suitable apparatus and with a simple rule giving the time of each part of the operation. The art of broiling a steak under a soap box lined with tin, so that it shall be served in perfection, consists only in first lifting the box, then putting the pan and the grill, with the steak upon it, upon the plate, then placing the box over it, and then leaving it subject to the heat of the lamp for fifteen minutes to half an hour, according to the thickness of the steak. The art of cooking green vegetables consists in preparing them, putting them into the vegetable dishes in which they are to be served, with salt, pepper, or butter, or whatever is chosen to go with them. These accessories may be added in the process of cooking or after the vegetables are cooked. The whole art consists in placing the vegetable dishes on the metallic table, under which the lamp is placed, and then putting the soap box or the bucket over the dishes. A little water may be added if they are somewhat dry. Whoever thinks that he or she can accomplish this mystery in this way can become a good cook by practicing one, two, or three days—perhaps a week—on the rules laid down in my book, without any other teaching.

DIETARY FOR FIVE PERSONS—COST.

In the preceding article prepared by my coadjutor, a dietary is given for a family of five persons, old and young, on the standard of 3,500 heat units, or "calories," per day for a workingman, women, and children in due proportion. This dietary for five persons calls for 12,500 calories for the five, averaging 2,500 each. At the present prices of meat and vegetables in the city of Boston that number of calories can be bought at the rate of 70 cents or less a week for each of the five persons in wholesome, appetizing food material. This would make the cost of the food for the family $3.50, which comes to $182 a year. Add $8 for tea and coffee and you bring the subsistence of the family of five to a cost of $190 a year for the food material. Add $10 for fruit and sundries, and you reach $200—$40 each. Fifty dollars is a safer standard to work by, or $1 a week. This supply of food can be readily cooked in my cooking apparatus, with kerosene oil consumed in a common lamp at the rate of 1 quart a day. I buy a high grade of oil (150° F., flash test), at 10 cents a gallon, which is rather a fancy price. At that rate the fuel required at this standard of nutrition for five persons would cost less than $10 for the year—$2 each.

TESTIMONY IN FAVOR OF SCIENTIFIC COOKING.

On the testimony of several hundred witnesses who have learned to cook in the Aladdin* oven, and of quite a large number who are now practicing box and barrel cooking, the days of the iron stove and range

* The name "Aladdin" is used throughout this publication, and being the author's invention and used by him as a trade-mark, it should be noted that though patented by Dr. Atkinson he has dedicated his patents to the public use, and anyone who wishes to do so is at liberty to make and use these ovens. (*See* page 18.)

are numbered. The use of coal for cooking will be continued only by those who do not know how to cook. All ovens should be of non-metallic material; all fuel for cooking should be oil or gas.

The conclusion may be put in the words of two persons, each using the same language without collusion. Each makes the following report in almost the same words in answer to a general inquiry to all who have dared to try my methods: Life is better worth living with the Aladdin oven and without a cook than it ever was before without the oven and with such cooks as can be had in the rural districts.

The Rev. Booker Washington, the very able principal of the Tuskegee (colored) Institute, in Alabama, in order to promote the progress of the pupils, 600 in number, in the school in which he is principal, lately applied to me for a battery of Aladdin ovens with which he might cook the cheaper kinds of meats so as to make them suitable for the pupils.

I advised him not to expend so much money, and since I could not afford to give him the regular Aladdins, I made a plan for a large oven to be built of plank 2 or 3 inches thick, with a metal bottom, the interior to be plastered with common mortar on laths nailed solid, of a dovetailed shape.

He tried this first on a moderate-sized oven, in which he proved conclusively that even the toughest beef could be made nutritious, tender, and appetizing. He is now building a large oven with which to supply the whole school of several hundred students. I charged him not to place this oven in any building where the ignition of the plank could expose other property to any danger. It is not probable that there will be any danger. His undertaking appears to be an entire success.

SOME OBJECTIONS ANSWERED.

With this I leave the matter to the tender mercies of the incredulous, who, for lack of enterprise, will remain subject to what another witness named "stove slavery," from which she said she had herself been redeemed by the adoption of the Aladdin oven. The first objection usually is, what shall we do for hot water? My reply is, heat water with one of the many water-heaters now made. You will waste less coal. Make your tea on the table with water at the instant it comes to the boiling point, the only true way to make tea. But then comes the great bugbear, what shall we do for hot water to wash dishes in? Answer, do without it. Put cold water or tepid water in the pan, add a great spoonful of kerosene oil. Mop the dishes in that, and then wipe them. Kerosene oil has an affinity for grease; it is antiseptic. Your dishes will be cleaned in half the time and more thoroughly than with hot water and soap, and your hands will be less liable to become chapped in winter.

THE ALADDIN OVEN.

I retain for personal convenience the name of "Aladdin oven" as a trade mark to be affixed to such ovens as may be ordered from myself

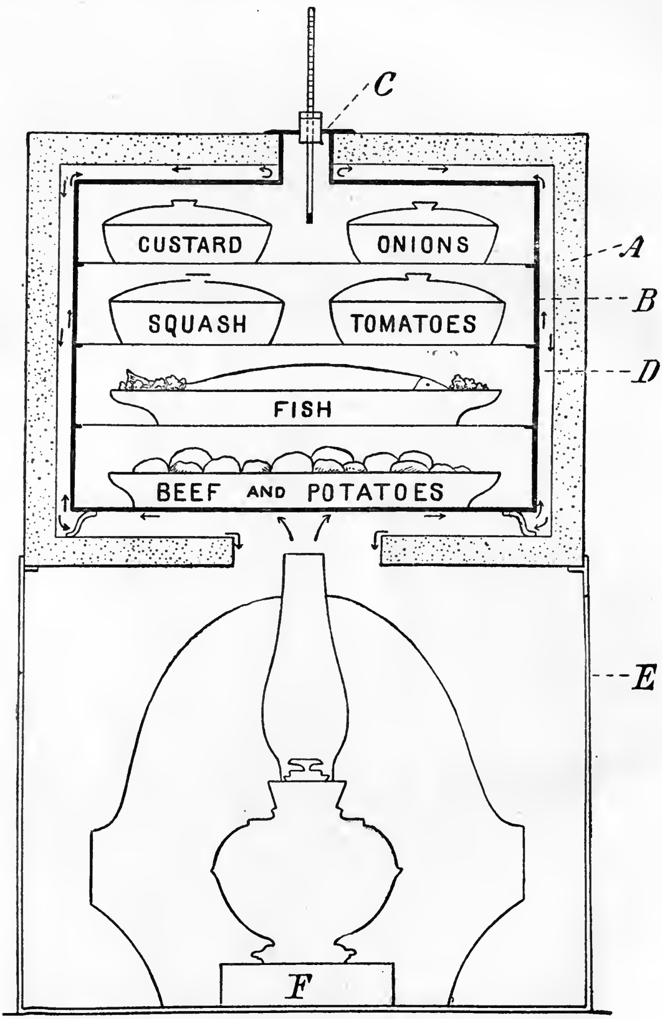

FIG. 3.—Sectional view of Aladdin oven.

or from my agents. I have taken patents on the development of this oven, which are now dedicated to public use without claim on my part for royalty or compensation. My purpose in taking these patents was to protect my processes until they had been perfected, but I can add nothing more to the form or structure of the Aladdin oven as it is now made. Any one who desires to do so is at liberty to make and use these ovens.

DESCRIPTION OF THE ALADDIN OVEN.

A, box made of nonheat-conducting material, which had better be incombustible. It should be lined with metal. I have used slabs of indurated fiber made of wood pulp vulcanized, with a padding of asbestos sponge inside these plates, between them and the metallic lining of the outer oven. The bottom of the oven must be made of incombustible material, as the heat close to the chimney would carbonize and perhaps ignite any combustible material. I make the bottom in the form of a metallic case packed with asbestos sponge.

B is the inner oven or food receptacle made of sheet iron, set on legs 1 inch in height. It will be remarked that there is no opening between the lamp and this inner oven. The heat circulates around the outside and the products of combustion escape by way of the same opening through which the heat passes. I use a reducing plate to diminish the size of this opening when I wish to get a greater heat than can be had with the opening of the full size.

C is a cap opening a ventilator to the inner oven, which it is sometimes useful to open to let off an excess of humidity in order to give a brown crust to articles that may be within. Those who wish to try scientific experiments to measure the heat may have this cap prepared so as to hold a thermometer with the bulb inside and the reading outside.

This oven is placed upon the metallic table *E*. It is desirable to have this metallic table placed on another one of about the same height, with a closed top on which the lamp is placed. These two metallic tables, the lamp, and sundry cooking utensils are supplied when the Alladin oven is ordered with the full equipment.

The door of the inner oven swings sideways on hinges at the right. The door of the outer oven is fitted with hinges on the lower side so that when let down it may be held vertically; or, if desired for use as a shelf, it is furnished with chains which hold it in a horizontal position.

The development of this oven has been a long and somewhat difficult process of empirical research; costly and in many respects useless in working by complex methods at first. In its final form, as it is now made, I think it is complete, and as simple as it can be for the most effective service.

Reference has been made in the text to ovens that have been made on this plan of pine plank plastered within with solid plastering, this box being placed upon the metallic table with a hole in the top through which the heat is passed. When such an oven is built for permanent use I should recommend putting a metal curb around the opening through which the heat passes to hold the plastering over the metal on the floor, else there may be a considerable loss of heat by radiation through the bottom of the outer oven. The walls of the outer oven that I am now constructing are about 1 inch thick. Of course the thicker these walls the more complete will be the check to the radiation of heat and the more fully will the heat be converted into the work of cooking.

I trust that these suggestions may lead to further research at the several agricultural experiment stations to the end that the science of cooking may be converted into a very simple art that any one of ordinary intelligence may practice. I am confident that such will be the conclusion of the whole matter, and I therefore respectfully present these plans and other matters contained in the text on my own behalf and that of my most efficient scientific coadjutor, Mrs. Richards, in the hope that they will serve a useful purpose.

COOKING AS NOW PRACTICED.

SCARCITY OF INFORMATION REGARDING COOKING.

The subject of cooking is now attracting wide attention. It is, however, being treated in a one-sided way, the problem dealt with being mainly how to promote instruction in cooking as a business, or how to promote a knowledge of cooking so as to enable employees to train cooks in their own service or to have them trained. All this is excellent in its way. Various methods are proposed, involving a long process of instruction, and implying the training of a class who will serve such other members of the community as are able to employ them. This view of the matter has of necessity been adopted because cooking has not yet been popularly treated or taught in any comprehensive manner as a department of the science of nutrition.

There are a great number of works of a more or less scientific character relating to the nutrition of the soil, the plant, and the beast, from which one who knows how to select can derive a vast deal of information; there are but few treatises upon the nutrition of mankind, and there is yet in common use no popular cookery book within my knowledge in which the art of cooking is explained in a really scientific manner. Cooking is commonly bad because science has stopped outside the door of the domestic kitchen and the present methods of teaching the art are almost wholly empirical.

There are certain great and comprehensive works upon cooking by those who have been held to be masters of the art. But of what were they masters? They may have been masters of the art of combining food material in order to secure certain flavors, but in cooking they were masters only of empirical methods of adapting to the development of certain results of an appetizing kind such apparatus as is in customary use in each country. Cooking apparatus varies in different countries, the variation being due in great measure to the relative scarcity or abundance of fuel. Ingenuity rather than science has been applied to making cooking apparatus more with a view to the consumption of the kind of fuel that is available in each country than to adapting the use of fuel and the development of heat to a true science of preparing food. It follows that under the pressure of necessity the practice of cooking in many countries where fuel is deficient is better comprehended by the poor who are compelled to exercise the greatest economy than by the rich.

EXPERIMENTAL SELECTION OF NUTRITIOUS FOOD.

It is also to be observed that without any knowledge of the science of nutrition the people of various countries and of different races have established by a process of natural selection certain kinds or combinations of food material that can be obtained at the least relative cost, but which are substantially complete in the relative proportions of the so-called nutrients—nitrogen, starch, and fat—each of which is necessary in due proportion to the nourishment and complete development of the human animal. They have also learned how to cook them so as to get the most nutriment from them. How very little the science of nutrition is comprehended may be witnessed by the frequent reference to the inhabitants of India, China, and Japan as being an almost exclusively rice-fed people. If they were wholly a rice-fed people they would be a half-starved people, because rice is very deficient in one of the most essential elements of nutrition, nitrogen.

It will be observed that the principal elements of nutrition consist in certain proportions, varying slightly in the standards that have been established on a scientific basis, but, according to the standard of this country, for a man in active work, consisting of 450 grams (about 1 pound) of the carbohydrates or starch compounds, 125 grams (about one-fourth pound) of the proteid or nitrogenous compounds, and 125 grams (about one-fourth pound) of fat, either vegetable or animal, per day. In dealing with this subject for the present purpose certain mineral elements, which are found in sufficient measure in almost every variety of food, need not be dealt with.

If regard be given to the actual diet of the people of India, it will be observed that leguminous plants are an essential element. The area of land devoted to the cultivation of beans, pease, lentils, and other legumes, all of which are rich in protein or the nitrogen element, is greater than the area of land devoted to the cultivation of rice. It is from the combination of these legumes with the rice that the energy, such as it is, of the people of India is sustained. The people of India and China also obtain a supply of vegetable oil or fat from beans and pease. The kernel of the common peanut when heated in moderate degree, and then pressed, yields one-half its weight in a food oil. Nearly one-half of the weight of the cake remaining after the oil has been expressed consists of albuminoids rich in nitrogen, and very nutritious when fed to stock or used as a fertilizer.

In Japan the common food of the working people is called "miso." This is a ferment of rice or barley combined with beans or pease, prepared so as to utilize the greatest amount of nutriment.

In the poorer countries of Europe it will be remarked that wherever meat, which is the chief source of nitrogen in the rich countries, is costly and therefore out of the reach of the masses, a nitrogenous substitute is found in cheese, especially the cheese made from skimmed milk, of which the Parmesan is one variety. This is wholly unfit to be eaten in the raw state, but very digestible and nutritious when cooked with macaroni or when grated and cooked in the hot vegetable soups with which it is commonly served.

Again, it will be remarked that Italians are, as a rule, good cooks. To what may this be attributed? May it not be to their enforced economy in fuel? They must save heat, and they cook slowly, which is the secret of good cooking. Next the French may be cited as, on the whole, a nation of good cooks, fully comprehending the art of enforced economy in the use both of food material and of fuel.

The French as a people are very skillful in the combination of leguminous plants and vegetables with other kinds of food material in their well-known *bouillon*, *pot-au-feu*, and other national dishes. Every one who has paid any attention to the subject has observed the extreme economy of the French in the use of fuel.

EVILS OF THE IRON COOKING RANGE.

The writer is not well enough informed to pass upon the common method of cooking in England where coal is relatively abundant and cheap, and where the common people are enabled to burn it in that most unscientific, unfit, and abominable invention, the cooking stove or range made of iron; very useful in its day and generation, but now about to be slowly but surely discarded. There is, however, one very safe standard by which to form a judgment in regard to the preparation of the food of any people. Wherever pills or quack medicines are plentiful and widely advertised the cooking is sure to be bad. Pills are conspicuously abundant in Great Britain, perhaps more so than in the United States.

Passing from England to this country, we come to the highest development of misdirected invention in the various kinds of iron stoves and ranges of the most infernal type conceivable. They are all warranted to work at the highest pressure in quickly cooking everything that is put into or upon them, quick cooking being as a rule very bad cooking. In the eastern part of this country we enjoy the greatest abundance of the most unsuitable fuel, anthracite coal; in the West a yet greater abundance of dirty, bituminous coal. We also enjoy the greatest abundance of every kind of food material, especially fat pork, which, in combination with other articles, is converted by the rapid and destructive heat of the American frying pan into the worst possible and most indigestible condition before it is served upon the table. We have also the greatest abundance of the best wheat flour and the most adequate supply of the worst bread, frequently served in the form of hot biscuits.

In the early settlement of many Western States, the supply of suitable fuel has been secured by raising and burning Indian corn (maize) rather than by mining and moving coal—sod corn, as the first crop is named, being produced at a cost of about $3 a ton, weighing corn and cob together.

If one had the faculty of composing another satirical poem on the model of "The Devil's Walk," one might represent the Devil as a commercial traveler placing before the people of this country the American cooking stove in its most attractive form fitted with the quickly heated oven and an abundant supply of frying pans. The motive of this work might be treated as the true vocation of his satanic majesty, to wit, the promotion of dyspepsia, of the thirst for liquor, and of all the other accompanying evils of bad cooking. He might also be acting at the same time as a commercial traveler for the sale of the innumerable types of quack medicines with which this country is infested to perhaps a greater extent than any other; the most malignant expression of this correlative of bad cooking being the disfigurement of our rural scenery by lying advertisements of the most atrocious kind.

INSTRUCTION OF ORDINARY COOKERY BOOKS.

If regard be given to the greater number of cookery books, it will be observed that the instructions given in them may be divided into two distinct parts, first, combining or mixing food material; second, subjecting this material to the application of heat. These instructions consist in directions for making the choice of food materials and for measuring them out in certain proportions and combining them in certain ways. What will be the result of these combinations depends much more upon how they are cooked than upon the method or proportion in which they are combined. Cooking consists in applying heat to the chemical conversion of these food materials, a work which corresponds to that of the chemical laboratory in the dissociation and synthesis of the subjects that are dealt with in chemistry.

The true problem in cooking is to substitute what may be called predigestion for a part of the work of the digestive organs in order to enable them to assimilate all that is suitable and reject that which does not nourish. This statement suggests a wide chapter in chemical physiology, which would be out of place in this treatise.

We may now take up the second class of instructions which are given in nearly all cookery books, carefully keeping this definition of cooking in mind. Of what do these instructions consist? Mainly in directions how to overcome or to avoid the faults of the apparatus in or upon which this fine process of chemical conversion is to be accomplished. "Put this into a quick oven;" "put that into a slow oven;" "boil this on the front of the stove directly over the fire;" "simmer that on the back of the stove away from the fire;" "keep stirring this as long as it is upon the stove;" "etc., etc." Yet in how very few if any of the cookery books is there any exact definition of the terms *quick oven* and *slow oven*, or any reason given why one thing should be boiled and why another should not.

EXAMPLES OF PROPER DIRECTIONS FOR COOKING.

One or two examples may be given as illustrations.

Take, for instance, the coffee berry. If the coffee berry is ground in its natural condition and made into an infusion, that liquid is not fit to drink. If the coffee berry is subjected to a heat high enough to burn it, or to carbonize it in excess, the infusion is unpalatable and unfit to drink. The coffee berry must be subjected to a regulated, even, and moderate degree of heat for a measured time in order to accomplish the chemical conversion which changes the crude material into the form from which we get the essential properties of coffee. Why is it necessary to stir the berries when an attempt is made to brown or roast the coffee berries in the domestic kitchen? Is it not simply to overcome the unsuitable quality of the stove?

Another example may be found in the egg. If an egg is boiled—that is to say, if it is subjected to a heat of 212° F. or over for ten minutes—the yolk will become mealy, but the albumen, or white of the egg, becomes hard, horny, and indigestible. If the egg is subjected to the high boiling heat for only three minutes, the white remains soft, but the heat will not penetrate the yolk to any considerable extent. In that condition the so-called soft-boiled egg is palatable, nutritious, and wholesome, but the yolk is substantially uncooked. Subject the egg to a moderate degree of heat, anywhere from 180° to 190° F. for ten minutes, or even at a less temperature for a longer time, and then the whole substance of the egg is cooked to a soft and jelly-like condition, which is digestible, nutritious, and appetizing.

Again, given a tough piece of meat, to boil it is to spoil it. It may be "boiled to rags," according to the common expression, the juices may be extracted and the meat may appear to be tender, but it is in fact stringy; each fiber is horny and separately so tough that it is unfit to eat. Subject the same tough muscle to a heat of about 190° F. for a long period of time, either in water or in a closed vessel in its own juices, subjected to heat outside, then, while the flavor and juices are all retained, the muscle is disintegrated, and the whole becomes as tender as the tenderest part of the animal. The beef's heart, which is the toughest muscle, when dealt with in this way, may be made as tender as the tenderloin. A tough old fowl may be converted into a tender roasted chicken, somewhat higher in flavor than a true chicken.

If these exceptions to common practice are sustained, it follows of necessity that a true science of cooking can not be established without very great and revolutionary changes. Moreover, it becomes manifest that if the apparatus in use is bad, the art of cooking must remain crude, empirical, and commonly bad.

THE REAL PROBLEM OF SECURING GOOD COOKS.

Another objection may be taken to the method in which the subject of cooking has been dealt with in magazine articles and other treatises and the various projects for teaching cooking as a business. The proportion of the people of any country who can afford to hire cooks to prepare their food is very small. The number of cooks required to meet this small demand may be insufficient, yet the demand itself is very limited. If that specific demand were fully met by any methods yet proposed the greater problem would still remain wholly unsolved. The greater problem consists in so developing both the science of nutrition and the science of cooking as to enable the great mass of the people, for whom one in each family must prepare and cook the food of the rest, to do that work in a simple, effective, economical, and nutritious manner. How shall every boy be taught to become his own cook; every girl also who can spare the time from what are apparently esteemed more important accomplishments? Is not that the true question? To that end the writer has devoted the leisure hours of a very active business life for many years. His attention was first called to the subject through his supervision of large numbers of working people, who were occupied in factories which were under his business charge. He claims no scientific knowledge; his function has simply been to search the records of nutrition which exist in the works of many physiologists, chemists, economists, physicians, and others who have dealt with this problem. His effort has been to sort out the simple elements which came within the comprehension of the uninstructed mind and with the aid of his scientific friends to present them in a practical way. (Science of Nutrition—Edward Atkinson. Damrell & Upham, Boston, Mass., U. S. A.) The solution of the problem was not far to seek, although it took a very long time, a great deal of misdirected energy, and much misspent money before it could be attained.

THE WAY TO IMPROVE COOKING.

The secret lies in this fact. What we call heat can be boxed up. I shall not attempt to use scientific terms in stating what I mean. A box may be made of incombustible material, substantially tight at the joints, with a hole in the bottom a very little larger than the top of the chimney of the lamp or gas-burner. The kerosene oil lamp is most effective, very easily managed, and the heat from kerosene oil costs less than gas in this country. I therefore use oil. If the top of the chimney of the lighted lamp be placed just under and as close as may be to this hole, so that the draft through the lamp chimney is not impaired, the heat may then be accumulated within the box in proportion to the amount of oil consumed by a given wick, in ratio to the size and non-heat-conducting properties of the box. The products of combustion force their way out at the side of the lamp chimney through a surprisingly small space. If the lamp is properly trimmed the combustion is complete and there will be no smoke. When the heat has thus been boxed up it can be converted into work. If a vent is opened at the top the heat escapes rapidly and its work is lessened. Heat must be accumulated without loss by unnecessary rapidity in circulation. If a current is imparted to it by a vent the motion becomes tangential or glancing on the outside of the inner oven, and then it is not converted into work.

The ordinary temperatures for cooking range from 180° F. in the simmering processes up to 320° F. to 350° F. in baking and in roasting. A considerable variation in the degree of heat may be compensated for by longer time. The degree of heat to be avoided is that which distils the animal fats or the juices of the meat and vegetables. A very little practice enables any person of common ability to apply the right degree of heat in this apparatus to every purpose, simmering, stewing, baking, roasting, or *sautéing* which is commonly called frying. The heat may be maintained at a very close measure for one hour, for twenty-four hours, or for any length of time.

Having been called upon to make apparatus for sterilizing the surgical instruments in an eye and ear infirmary, I had no difficulty in so constructing the inner oven with a double bottom as to overcome the difference in temperature between the top and the bottom, and I have furnished several occulists with sterilizing apparatus in which they had no difficulty in maintaining a temperature of 300° F. continuously with but very slight variation.

RULES OF THE ART OF COOKING.

The whole art of cooking may be reduced to two simple rules:

Rule No. 1.—Put some heat in a box and maintain it at an even temperature with a lamp or gas-burner as long as you wish to apply it.

Rule No. 2.—Mix one part of food material with one part of gumption in a cooking vessel; put this combination into the box where the heat is; the lamp or gas-burner will do the rest.

When these two rules are fully comprehended, any boy or girl who possesses the one element of gumption and who has learned to read can, in my judgment, be taught the art of bread-making, so that it will never be lost, in one written or printed lesson. The personal supervision of the teacher over the work is not called for.

In point of fact, the waste of food may be stopped. The waste of fuel may be stopped. The science of nutrition may be taught from a school book. The art of plain cooking and bread-making can be learned in a day. But in order that all this may be accomplished suitable apparatus and suitable fuel must displace the unfit cooking apparatus and the coal that are now commonly used.

Before any common conclusion can be reached in regard to these matters two definitions must be established in order that the whole process of reasoning may not be at cross purposes. The subjects with which we are called upon to deal are meat, fish, cereals, and vegetables. These are food materials, but are not food until cooked. They may be seasoned and flavored, but the finest art of cooking is to develop the special flavor of each kind of food.

IN WHAT DOES THE ART OF COOKING CONSIST?

Before dealing with the science we may define the art of cooking as consisting in applying heat to each of these subjects in such a way as (1) to render it digestible, so that its nutrient properties may be assimilated in true proportion in the human system; (2) to render it appetizing by the development of its own specific flavor; (3) to combine different kinds of food material in such a way that each will render the other palatable; (4) to remove certain portions which may not be palatable or digestible after the first application of heat, either as waste, like bone, as excess, like much of the fat that may be used for other purposes, or as woody fiber in many vegetables; (5) to add to the essential elements salt in its due proportion in almost every process, and sugar in some combinations, and other condiments, spices, or flavorings in such a way as to develop rather than to disguise the true flavor of the principal food material entering into each dish.

The science of cooking has already been defined. It is the application of heat at the right temperature for the right length of time to each element of food or to each combination.

The art of preparing or combining food material can be stated in specific terms or rules, and can be learned from printed forms, subject to very slight variation. In order to apply these rules, instruments of precision must be used to which any child can be habituated. The weights and measures are taught in the arithmetics. Their application in practice in pounds, ounces, quarts, etc., is within the power of any person of common intelligence. Any one of the average children in our public or common grammar schools, in some of which the art of cooking is now taught, can be supplied with written or printed instructions to go to certain shops and to buy given quantities of meat, fish, grain, vegetables, eggs, salt, etc. The exact quantities of each kind of food necessary to the complete nutrition of any given number of persons can then be weighed out by them and measured in due proportion, so that the combination shall give the approximate units of nitrogen, starch, and fat, and the approximate number of calories or mechanical units of heat which are necessary to sustain a man who is doing work corresponding to that of a German soldier in active service, or to that of a student or professional man of average powers of digestion. All these directions can be put into printed terms, and up to that point everything is simple. The scales and measures are simple. The divisions and combination of the food material are simple. Every part of the work up to this point can be done by rule by any one who can read and who is willing to take pains.

All these materials could also be bought and placed upon the kitchen table in the household of every child, where all the necessary utensils may also be kept upon the shelves of the kitchen. Up to that point every branch of physical science has been applied—to the production of the material, to its transportation and distribution, to the manufacture of the scales, weights, and measures, and to making the utensils that are to be used before the food material is cooked. Every branch of science has been applied to all these preceding processes. *At this point science stops.*

THE PRESENT ABSURD WAY OF TEACHING COOKING.

The teacher who comprehends the case must now begin a lecture upon cooking substantially in this way:

In order that these materials may become nutritious food you have brought them together, divided them, prepared them, and combined them without any aid from me, only following the rules which are given in the primers that I have put into your hands. This food is now to be cooked.

Cooking consists in applying a regulated degree of heat at the right temperature for the right length of time. If the heat is too great some of these materials will be spoiled. If it is not high enough others will not be cooked. If some are cooked too long they will be spoiled. If some are not cooked long enough they will not be fit to eat. If they are put in the wrong place on the stove they will be burned. If they are not looked after they will be dried up, and if they are not cared for during the whole process some of them will be heavy, or too moist, or overcooked, or raw.

The only stove that I can teach you to use is this one made of iron. It is to be heated with coal. You must first learn how to make the fire. It is very true that iron is not fit to be used in making a stove and coal is not fit to be burned in cooking. We might furnish you with gas stoves and we might make use of gas in this schoolhouse; but in many or most of your houses you are under the necessity of using coal, therefore you must be taught to burn coal. You need an even heat and you ought to be able to control it with certainty; but you can not always get a perfectly even heat from coal even by the closest watching, and you can not, as a rule, control it properly in any iron stove.

You must learn to measure the heat of the oven by putting your hand in now and then. That is not a true test, but it is the best that we can offer you. You must watch everything that is put on top of the stove all the time, even though the heat cooks you more than it cooks the food. You must stir these compounds with a spoon to prevent them from being burned. You must move some from the front to the back; you must proceed with patience and keep your temper. After a practice of two or three years perhaps one in five of you may succeed in not spoiling more than half the food material that you work upon when you take charge of the kitchen. Perhaps one in ten may become a tolerably good cook. About one in a hundred may prove an adept.

My object is to do away with this confusion and uncertainty. There is a close analogy between the art of cooking and the art of dyeing. One is the development of appetizing flavor by chemical conversion through the application of heat; the other is the development of attractive color by chemical conversion through the application of heat.

All the materials used in dyeing can be assembled; all the appliances can be set out and all the rules for combining the dyestuffs can be printed; but when heat is to be applied to their chemical conversion, what skillful dyer would rest satisfied with appliances corresponding to the common cooking stoves or ranges? Yet the science of cooking is to as great an extent a fine process of chemical conversion as is the science of dyeing. It is admitted that there are some processes in the preparation of dyeing compounds that still require the trained hand and eye of the expert. There are also some processes of cooking of the same kind, notably broiling and frying by immersion. These are, however, luxurious processes of cooking, not essential to nutrition, and if they are badly practiced they are quite the reverse.

THE ORIGIN OF THE ATKINSON THEORY OF COOKING.

The essential processes of baking, roasting, simmering, stewing, boiling, and *sautéing* can be reduced to rules. Heat can be applied without waste in sufficiently exact measure either from gas or oil. Apparatus has been made and is in use in which this heat can be applied without constant attention. Nothing need be burned, dried up, or wasted. All natural flavors can be developed and retained. All offensive odors can be prevented. Finally, by taking more time in the process almost the whole time of the cook may be saved; because, when the food is placed in a suitable cooking apparatus, the lamp or gas-burner will do all the rest of the work.

Benjamin Thompson, of Massachusetts, afterwards Count Rumford, of Bavaria, laid the foundation for this development of the science of cooking more than a hundred years ago. He failed only because he had not the control either of kerosene oil or gas, or of incombustible non-heat-conducting substances which can be used as a substitute for iron or brick in making an oven. He could not encase or box up his heat except in brick, and therefore he could not regulate it by as simple appliances as we have to-day.

The true foundation for a science of cooking has been laid in what is known as the Norwegian cooking box, from which the writer derived his own theory. When boiling water is placed in a wooden box lined with felt and then with metal, into which a water-tight receptacle containing food is placed and then covered up, the food is cooked in the most complete manner after a considerable lapse of time. All that the writer has done is to develop the Norwegian cooking box by adding appliances to it by which the heat encased in the box can be maintained for any length of time at any given temperature.

SIMPLE TESTS OF THE NORWEGIAN METHOD OF COOKING.

A very rough-and-ready test of this method may be made at a small expense. A small table may be constructed, with the top of sheet iron or tin; in the center should be made a hole 2½ inches in diameter;

underneath, at a convenient distance from the floor, should be a platform to hold a kerosene oil lamp with a central duct. The round-wick lamp, which consumes 1 quart of oil in eight hours, is best adapted to the purpose. When such a lamp is applied to the regularly constructed Aladdin oven it will cook three charges of bread and two of meat or fish and vegetables—in the aggregate 40 to 45 pounds—in eight hours, with the expenditure of 1 quart of oil.

Upon this table reverse a large crock of thick earthenware over the hole. Place the lighted lamp under the hole so that the top of the chimney may be almost in it. This crock will not save the heat as it should, but yet beneath this single crock different varieties of food may be placed in closed vessels, either of metal or of crockery ware, and the food will be nutritiously cooked in a certain lapse of time. A tile or earthen plate on supports about half an inch high will keep the heat from direct contact with the cooking vessels. No rule can be laid down for this service, and the heat will not be as uniform at the top and the bottom of the crock as it is in the inner food receptacle of the Aladdin oven, around which the heat circulates on all sides. If a second larger crock is put outside, the heat will be more effective. A felt "cosey" put over it will make it a very good approach to the cooking box.

Another experiment may be tried at the risk of carbonizing the material. It should therefore be conducted only on a brick hearth or stone floor, where no harm will be done if the wood suggested for use is set on fire.

Make a wooden box, without any top, about 18 inches long, 14 inches high, and 12 inches wide. Treat it, if you can, on the inside with plastering, or mortar, or some other fire retardent. Under this box, reversed, place a sheet iron oven on legs about an inch high. That is the principle of the Aladdin oven, but it is not safe for common use. It may be applied to experimental purposes and to the test of the methods suggested by myself. The Aladdin oven is made of an outer case of incombustible, nonheat-conducting, and nonmetallic material, within which the sheet-iron oven or cooking receptacle is safely placed.

ADVANTAGES OF THE NEW METHOD OF COOKING.

When proper apparatus is used, the cereals, meat and fish stews, pork and beans, corned beef and cabbage, pease porridge, brown bread made of maize meal, and many other kinds of food can be put into the oven at night, the lamp being then lighted. In the morning the cooked food is taken out, ready for consumption, without waste. Many kinds of most appetizing combinations can be placed in the oven by a workingman or a working woman after the breakfast is cleared, before leaving the house to go to work. Returning at midday the wholesome dinner is found ready to be eaten. The bread may then be mixed in a few minutes, with a mechanical bread-kneader, and placed in the bread-raiser, so that at a certain hour it will be ready for the oven. It can then be baked in the evening, by the light of the household lamp or gas-burner.

I am aware that in giving these details and in suggesting these experiments I may be enabling others to perfect my own somewhat costly devices. Yet, I think, no one can excel the oven which is sold under my trade-mark "Aladdin," and I may perhaps continue to ameliorate the condition of the rich by serving them with apparatus in which, according to the testimony of one lady, vegetables were cooked in such a way that, although she had been eating them all her life, she now tasted them for the first time, and from which the choicest game has been served in the highest perfection. It has also been my practice for some time to give, to parties of eight, dinners cooked in an oven placed behind my own chair in the dining room, in the china dishes in which the food is served. In this way experiments have been tried, without a single failure, upon persons who pride themselves on the refinement of their tastes. On one occasion my party numbered 12, to whom an eight-course dinner in the regular conventional order was served at an average cost of 2 cents per guest for each course—the total cost of the meat, fish, and other materials amounting to less than $2 for 12 persons.

THE NEW ENGLAND "CLAM BAKE."

Many persons are familiar with the appetizing results of cooking in the forest or by the seaside, over hot stones on which the food is placed and then covered with turf or seaweed. The New England clambake would give an experience to many persons that they would never forget. Platforms are made of flat stones gathered by the seaside, which are heated with wood fires. The ashes are then swept away and a layer of wet seaweed or rockweed put on; on this a layer of clams; then another layer of seaweed; then sweet corn in the milk; then more seaweed; then some fish and some lobsters; more seaweed; more clams; finally, in tin pans, Indian puddings, made of maize meal and molasses; then a final covering of seaweed, and the whole covered over with sail-cloth. The heated stones do the work of cooking. Clambakes are prepared for small parties, or for hundreds, or for thousands of people.

This was the method in which the Indian tribes of this country cooked clams and fish for vast numbers. Along the coast from Maine to Florida great piles of clam shells are found many feet in height, sometimes hundreds of feet in length, in which are intermingled relics of pottery, stone implements, and arrowheads, marking the places where the Indian clambakes were established. The name of one point in Massachusetts—Squantum—is said to mean the place for a clambake.

I am not aware how many persons there may be whose memory recalls the common use of the brick oven, heated with wood, in which the historic feasts of Thanksgiving as well as most of the daily bread were prepared in New England. The secret of that long-remembered and most excellent process of cooking was the moderate and long-continued heat radiating from the solid brick arches and floor. I believe they are still in occasional use in some of the old mansions of England.

THE PRINCIPLE OF THE ALADDIN OVEN.

The Aladdin oven has been patented, but the writer has published the methods and has dedicated them to public use without fee or royalty. It would not be suitable, except for this declaration, to advertise this apparatus in an article of this kind, the object of which is simply to state the true principle of cooking. This principle is that heat may be conveyed to the inside of a box, which box may be made of incombustible but nonheat-conducting material. It can there be maintained by measure either of the quantity of oil consumed per hour by a given lamp wick or by the number of feet discharged through a Bunsen gas-burner. An inner oven made of sheet metal, with shelves and in other ways corresponding to the common oven, may be placed in this outer box, without any direct communication with or opening to the source of heat and without any ventilator or other escape for gases than the pressure of the humid atmosphere generated in the processes exerts through the cracks of the door.

When the heat is kept below the distilling point of animal fats or of the juices of the vegetables, which may be put substantially at between 300° and 350° F., no offensive odors are generated and no injury done to the material. Meats, fish, cauliflower, potatoes, onions, and custard or other puddings may be cooked in the same oven at the same time without either imparting any flavor to the other or losing any of its own special flavor. Water only will be evaporated, and that only in sufficient measure to keep the condition of the oven favorable to the best results. If it is thought necessary that the roast should be æsthetically brown, it is better to roast the meat and bake the fish in a separate oven, basting, before the food is put into the oven, with butter and bread crumbs that turn to a brown color at a lower degree of temperature than the animal fats, opening the vent to secure a dry heat a little while before serving.

The only failure of the writer in this undertaking has been that as yet he has been unable to assemble the materials and have the ovens made at as low a cost as he had hoped to be able to attain, with a margin of profit sufficient to cover the maker's profit and pay for the distribution. The Standard oven, with its complete equipment of metallic table, lamp, and certain cooking vessels, can not be sold at less than $30, boxed and ready for shipment. This statement is made because many readers will desire to know the cost of the apparatus. The disappointment of the writer has been that after five years of experiment and practice, attracting wide attention, the demand has only developed in a very limited way by the sale of a few hundreds rather than thousands of ovens.

At the summer seaside dwelling of the writer no coal has been in use for cooking for more than four years, and the kitchen, which is open on one side to the sea and on the other to the woods, is about the coolest room in the house.

There are two great obstructions to be overcome before the revolution in the domestic kitchen will be accomplished, to wit, the inertia of woman and the incredulity of mankind.

SOME OF THE BENEFITS ALREADY OBTAINED.

In the meantime the writer has been enabled to teach a good many families of poor people how to reduce the prime cost of their food from one-half their income to one-third or one-quarter, with much better nutrition and with a great saving in comfort, time, and labor.

Dealing with this matter as a student and to some extent as a writer upon economic science, the writer has long been of the conviction that the unit of the family is the one to be maintained, and that he who aids in bringing within the reach of each separate family the economy which has yet been attained only in feeding great numbers of people in hotels or asylums will do more to establish modern society on a solid foundation than by working in any other direction. Unless the testimony of many hundred witnesses is to be absolutely and wholly discredited, that work is substantially accomplished.

It now remains to reduce the cost of the apparatus and to bring it into use at a commercial profit by ordinary methods. Yet then it will still be necessary to overcome the depraved appetite of vast numbers of people, especially in this country, who are averse to or are prejudiced against the right methods of bread-making and preparing food, and who are also utterly ignorant of the resources which lie right at their hands for supplying themselves in the most wholesome way at half the cost of their present methods.

It is now urged that food laboratories should be established in connection with the agricultural experiment stations now existing in the larger number of the States of the Union. It is admittedly absurd to devote energy, time, and money to the nutrition of the soil, the plant, and the beast, to the end that the most abundant product of every kind may be assured at the lowest measure of cost, and then to leave this abundance of the best food to be converted into bad feeding for lack of attention to the nutrition of man. In a few years the door of the domestic kitchen may be opened to science through the work of the food laboratories and the experimental cooking stations now contemplated.