FOODS AND FOOD ADULTERANTS.

THERE is hardly any subject with which we come into such daily and constant contact as that of food, about which there is so much ignorance and prejudice; and it is the purpose here to discuss the nature, properties, and some of the chief adulterants of the principal food-products in regard to their healthfulness and composition from a chemical standpoint.

There has been a large amount of information published in periodicals, official reports, general and monograph volumes, written in English, French, German, and other languages;[1] which, however, has not found its way to the general public, who, as a rule, have a feeling of uncertainty and insecurity on the subject of most food-products. When people hear that a certain food is adulterated, or is a food substitute, there is immediately a prejudice excited against the article, which it takes time and familiarity to allay, because they imagine that any substance used as an adulterant of, or a substitute for, a food-product, is to be avoided as being injurious to health. A moment's reflection ought to show that it would be directly contrary to the food-manufacturer's interest to add to, or substitute any thing for, a food-product which would cause injurious symptoms, as in that case his means of gain would be cut off by the refusal of consumers to buy his product. It is true that the unscrupulous manufacturer or dealer does not hesitate to cheat his customer in the interest of his own pecuniary profit and gain, but he does not want to poison him. Where, through carelessness or ignorance, injurious substances, such as the arsenic, copper, aniline, and other metallic and organic poisonous salts sometimes used for artificial colors, are added to foods, their presence is promptly revealed by the dangerous symptoms which they call forth in the consumer. About a year ago the case of the Philadelphia bakers, who added chromate of lead to color some of their cakes, and thus caused the death of several persons, and serious illness in nearly every one who ate any of these products, will be recalled by many.

Prejudice about Foods.

How much this nearly universal prejudice arises from misleading and sensational articles and advertisements in the daily newspapers, it would be hard to say. That a large proportion of the articles suitable for food, and produced in all countries, is wasted annually because of this prejudice, is undoubtedly true.

We do not object to eating a *live* oyster, but prefer all our other meats *dead*, and undergoing putrefaction to a slight extent, in order to get rid of the "toughness," as it is generally called, produced by the *rigor mortis*. Some people like to let the putrefaction proceed further until the meat is "gamy." The Texan cowboy eats goat's meat in preference to that of the cattle and sheep he is herding. Young puppies, rats, and birds' nests are considered delicacies by the Chinese. Frogs' legs and snails are among the highest priced dishes served at Delmonico's. Except the bones and hide, every part of an animal slaughtered for food is eaten by most civilized nations,—the brain; tongue; blood in the shape of black pudding and sausages; the liver; heart; lungs; stomach as tripe; the pancreas, thyroid, and sublingual glands, which are called sweetbreads, and considered a great delicacy; the feet in the way of jellies, and pickled; the intestines as sausage covering, etc. In the markets of Paris there is a steady demand for horse-flesh as food. The Arabs and other nomadic tribes prefer mare's or camel's to cow's milk. Many people would as soon eat a snake as an eel, yet the latter commands a higher price than most fish in many parts of the world. Lobsters, which are the scavengers of the sea, are eaten by people who would not touch pork. The Eskimo, who eats blubber and other solid fats, and the native of the tropics, who "butters" his bread with a liquid vegetable oil, have the same object in view; viz., to supply a concentrated form of fuel. The squirrel is considered a great delicacy in many parts of this country, but is not eaten in England. The vain efforts of Professor Riley some years ago to induce the starving people of Kansas to eat the food they had at their doors,—grasshoppers, sorghum and millet seeds, and squirrels,—himself setting them the example, will be recalled by many.

Our bodies are like a furnace, and require fuel and air to sustain the heat of combustion by the constant renewal of fresh material and the elimination of the waste products. The form, whether solid or liquid, of animal or vegetable origin, in which we supply this fuel, depends largely on local circumstances, climate, education, etc.; and, as long as the food employed goes to furnish the proper amount of fuel material for the maintenance of the body temperature, life is sustained.

The extent of the consumption of any new food will evidently depend on how it fulfils this requirement as a fuel, and by its pleasing appearance, its palatability, its capacity to appease hunger, its wholesomeness, and its relative cheapness, attracts public attention. If the new food is a manufactured product, its cheapness will depend upon the possibility of its production on a large scale from relatively cheap materials.

Classification of Foods.

Foods may conveniently be divided into two large divisions,—the first and chiefest, that which the Germans call *Nahrungsmittel*, in which the article of food supplies material for the renewing of some structure or the maintenance of some vital process, the nutrients; and the second, well expressed by the German *Genussmittel*, in which the food increases the vital actions to a much greater degree than the amount of nutritive value which it supplies would lead one to suppose, the stimulants.

These two divisions can again be subdivided into five different classes, according as they supply moisture, nitrogenous material, fats, carbohydrates, and mineral salts. A combination of all five in certain proportions will supply the whole wants of the body, or, in other words, make a perfect food. It is not essential that one food should supply all these wants, although this is eminently the case in regard to young infants, where the mother's or other milk contains the proper proportions of all five classes; but it is essential that it should supply one or more of these materials, so that, by judicious combinations of a variety of different foods, the proper amount of nourishment may be supplied.

This classification could be extended much further, into simple, compound, easily digested, economical, agreeable, flesh-forming and heat-forming, sweet, acid, etc.

Chemical Composition of the Human Body.

Before proceeding further, let us see what is the chemical composition of a human body, so that we may have some idea of what kind of material the food consists which is to support or increase its vital action.

An interesting collection will be found in some cases in

[1] In the report of the Commissioner of Internal Revenue for 1888, pp. xi-xxiii, will be found a short bibliography of the leading publications, prepared by the writer.

the United States National Museum at Washington, showing the approximate weights of the chemical elements found in the body of a man five feet eight inches high, weighing one hundred and forty-eight pounds (Table I.). It is obvious that the composition of the bodies of different persons will vary with age, size, sex, stoutness, etc.; so that the figures given in the following table can only be considered typical.

Table I.—Chemical Composition of the Human Body (calculated by Professor W. O. Atwater).

Elements.	Pounds.	Per Cent.	Compounds.	Pounds.	Per Cent.
Oxygen	92.40	62.4	Water	90.0	60.6
Carbon	31.30	21.2	Proteine	26.6	18.2
Hydrogen	14.60	9.9	Fats	23.0	15.5
Nitrogen	4.60	3.1	Carbohydrates	0.1	0.1
Calcium	2.80	1.9	Mineral matters	8.3	5.6
Phosphorus	1.40	0.9			
Potassium	.34				
Sulphur	.24				
Chlorine	.12				
Sodium	.12	0.6			
Magnesium	.04				
Iron	.02				
Fluorine	.02				
Total	148.00	100.0	Total	148.0	100.0

We find in the above table, that, when the innumerable organic and inorganic compounds of which our bodies are composed are reduced to the simple form of their chemical elements, they can be divided into three groups: first, gases (oxygen, hydrogen, nitrogen, chlorine, and fluorine,—five); second, solids, non-metals (carbon, phosphorus, and sulphur, —three); and, third, solids, metals (iron, calcium, magnesium, potassium, and sodium,—five). Besides these thirteen elements, minute quantities of a few others, as silicon, manganese, and copper, are found in the body.

The principal materials of which the body is composed may be briefly stated as follows. The flesh (muscles) consists of water, fat, inosite, fibrine, albumen, myosin, gelatine, certain extractives, and salts of lime, magnesia, potash, soda, iron, and phosphorus. Blood is in composition very similar in its elements to that of flesh. Bone, of which about 30 per cent is mineral matter composed of salts of lime, magnesia, potash, soda, and phosphorus, contains cartilage, gelatine, and fat. Cartilage consists of collagen and other gelatinoids, with salts of soda, potash, lime, magnesia, iron, phosphorus, and sulphur. The brain, nerves, and spinal cord contain substances called protagon, cerebrin, etc., consisting of nitrogenized and phosphorized fats, also water, and mineral salts. The liver is formed of water, fat, glycogen, and albuminoids, besides salts of potash, soda, lime, iron, and phosphorus. The lungs consist of gelatinoids and albuminoids, fibrine, various fatty and organic acids, cholestrin, and salts of soda and iron, and water.

Chemical Composition of Different Foods.

It will seem strange to many that substances seemingly as dissimilar as flesh and wheat should contain the same class of chemical elements; yet in both we find water and mineral salts, nitrogenous materials, fats, and carbohydrates, as Table II. shows.

Proteine.

The most important class of food-material is that containing nitrogen, which is usually present in the form of albuminoids; i.e., organic substances very similar in chemical composition to albumen or "white of egg," or in the form of gelatinoids, i.e., organic substances similar to gelatine in chemical composition; and it is customary for chemists to call both by the generic name of "proteine." Lean meat, the curd of milk, and the gluten of wheat, consist principally of proteine compounds. The "extractives," as chemists call the organic compounds, containing nitrogen, which are extracted from flesh by treatment with water,—beef-tea, extract of beef, etc.,—are interesting, in that they act as stimulants, like alcohol, and are not nutrients. The other two organic classes of foods, which, however, do not contain nitrogen, are the fats and the carbohydrates.

Fats.

The fats contain the chemical elements, carbon, hydrogen, and oxygen, and are known as the glycerides of the fatty

Table II.—Average Chemical Composition of Different Food-Materials.[1]

Food-Material.	In the Original Substance.					In the Dried Substance.			
	Water.	Proteine.[2]	Fat.	Carbohydrates[3]	Ash.	Proteine[2]	Fat.	Carbohydrates[3]	Ash.
Ox, flesh, very fat	53.05	16.75	29.28	—	0.92	35.68	62.37	—	1.95
" " medium fat	73.03	20.96	5.41	0.46	1.14	77.59	20.03	0.16	4.22
" " lean.	76.37	20.71	1.74	—	1.18	87.65	7.16	—	5.19
" fat, heart	65.66	19.61	13.75	0.10	0.88	57.10	40.04	0.30	2.53
" lungs	81.03	12.37	2.46	0.21	3.93	65.21	12.97	1.10	20.72
" liver	71.39	19.72	5.55	1.69	1.65	68.92	19.40	5.91	5.77
Cow, flesh, fat	70.96	19.86	7.70	0.41	1.07	68.40	26.52	1.39	3.69
" " lean	76.35	20.54	1.78	0.01	1.32	86.84	7.53	0.05	5.58
Calf, " fat	72.31	18.88	7.41	0.07	1.33	68.17	26.76	0.27	4.80
" " lean	78.84	19.86	0.82	—	0.50	93.86	3.88	—	2.26
Mutton, " very fat	53.31	16.62	28.61	0.54	0.93	35.60	61.28	1.13	1.99
" " medium fat	75.99	17.11	5.77	—	1.33	71.26	23.20	—	5.54
Hog, " fat	47.40	14.54	37.34	—	0.72	27.64	70.98	—	1.38
" " lean	72.57	20.25	6.81	—	1.10	73.83	24.83	—	1.34
Horse "	74.27	21.71	2.55	0.46	1.01	84.39	9.91	1.77	3.93
Blood	80.82	18.12	0.18	0.03	0.85	94.48	0.94	0.15	4.43
Salmon	64.29	21.60	12.72	—	1.39	60.48	35.63	—	3.89
Mackerel	71.20	19.36	8.08	—	1.36	67.23	28.05	—	4.72
Shad	70.44	18.76	9.45	—	1.35	63.47	31.97	—	4.56
Oysters, flesh	80.52	9.04	2.04	6.44	1.96	46.41	10.47	43.05	10.07
" liquor	95.76	1.42	0.03	0.70	2.09	33.49	0.71	16.51	49.29
" flesh and liquor	87.30	5.95	1.15	3.57	2.03	46.85	9.06	28.11	15.98
Woman's milk	87.41	2.29	3.78	6.21	0.31	18.19	30.02	49.33	2.46
Cow's "	87.17	3.55	3.69	4.88	0.71	27.67	28.74	38.06	5.53
Goat's "	85.71	4.29	4.78	4.46	0.76	30.02	33.45	31.21	5.32
Sheep's "	80.82	6.52	6.86	4.91	0.89	34.00	35.77	25.59	4.64
Butter	13.59	0.74	84.39	0.62	0.66	0.86	97.64	0.74	0.76
Oleomargarine	10.57	—	85.82	1.14	2.47	—	95.95	0.73	3.32
Cheese, full cream	38.00	25.35	30.25	1.43	4.97	40.89	48.79	2.30	8.02
" whole milk	39.79	29.67	23.92	1.79	4.73	49.23	39.68	3.24	7.85
" skimmed milk	46.00	34.06	11.65	3.42	4.87	63.08	21.58	6.32	9.02

[1] König's Chemie der menschlichen Nahrungs- und Genussmittel (Berlin, 1889), vol. i. p. 1100 *et seq.*
[2] Nitrogenous substances. [3] Nitrogen free substances.

Table II.—Continued.

FOOD-MATERIAL.	In the Original Substance. Water.	Pro-teine.[1]	Fat.[2]	Sugar.[2]	Dex-trine.[2]	Starch.[2]	Crude Fibre.	Ash.	In the Dried Substance. Pro-teine.[1]	Fat.[2]	Sugar.[2]	Dex-trine.[2]	Starch.[2]	Crude Fibre.	Ash.
Wheat, kernel	13.37	12.04	1.85	3.25	2.54	62.86	2.31	1.78	13.89	2.13	3.87	2.93	72.46	2.67	2.05
Chaff	13.37	11.84	1.85	0.98	1.74	65.52	2.65	2.07	13.66	2.13	1.13	1.98	75.65	3.06	2.39
Rye	13.37	10.81	1.77	1.87	4.57	63.77	1.78	2.06	12.47	2.04	2.16	5.27	73.63	2 05	2 38
Barley	14.05	9.66	1.93	1.23	3.75	62.01	4.95	2.42	11.23	2.24	1.43	1.36	72.17	5.76	2.81
Oat	12.11	10.66	4.99	1.72	1.89	54.76	10.58	3.29	12.13	5.68	1.96	2.15	73.30	12.01	3.74
Maize, corn	13.35	9.45	4.29	2.29	2.06	64.98	2.29	1.29	10.90	4.95	2.64	2.38	75.00	2.61	1.19
Rice, hulled	12.58	6.73	0.88	0.15	0.77	77.56	0.51	0.82	7.70	1.01	0.17	0.88	88.72	0.58	0.94
Buckwheat	14.12	11.32	2.61		54.86		14.32	2.77	13.18	3.04		63.88		16 68	3.22
Wheaten flour, fine	13.37	10.21	0.94	2.35	3.06	69.30	0.29	0.48	11.79	1.08	2.71	3.53	80.01	0.33	0.55
" " coarse	12.81	12.06	1.36	1.86	4.09	65.88	0.98	0.96	13.83	1.56	2.13	4.69	75.57	1.12	1.10
" grits	13.05	9.43	0.94		75.92		0.21	0.40	10.84	1.08		87.38		0.24	0.46
Rye-flour	13.71	11.57	2.08	3.89	7.16	58.66	1.59	1.44	13.41	2.41	4.51	8.30	68.06	1.84	1.67
Barley-flour	14.83	11.38	1.53	3.11	6.52	61.60	0.45	0.59	13.36	1.80	3.65	7.65	73.82	0.53	0.69
Oatmeal	9.65	13.44	5.92	2.26	3.08	61.67	1.86	2.12	14.88	6.55	2.51	2.41	69.24	2.06	2.35
Cornmeal	14.21	9.65	3.80	3.56	3.36	62.63	1.46	1.33	11.21	4.42	4.14	3 90	72.81	1.97	1.55
Rice flour	12.82	6.91	0.67		78.84		0.18	0.58	7.93	0.77		90.42		0.21	0.67
Buckwheat-flour	13.51	8.87	1.56	1.06	2.95	70.30	0.67	1.14	10.25	1.80	1.23	3.41	81.25	0.78	1.28
Wheaten bread, fine	35.59	7.06	0.46	4.02	52.56		0.32	1.09	10.95	0.71	6.24	79.91		0.50	1.69
" " coarse	40.45	6.15	0.44	2.08	49.04		0.62	1.22	9.71	0.69	2.28	84.41		0.98	1.93
" biscuit	13.28	8.55	0.98	1.82	73.28		0.59	1.50	9.86	1.13	2.10	84.50		0.68	1.73
Rye bread	42.27	6.11	0.43	2.31	46.95		0.49	1.46	10.58	0.74	4.00	81.30		0.85	2.53
Oat biscuit	13.04	8.39	6.03	4.09	60.12		5.28	3.05	9.65	6.93	4.70	69.14		6.07	3.51
Potato	74.98	2.08	0.15	0.28	20.73		0.69	1.09	8.31	0.60	1.12	82.85		2.76	4.36
Sweet-potato	82.52	1.78	0.14		14.04		0.64	0.88	9.12	0.72		82.37		3.28	4.51
Swedish turnip	87.80	1.54	0.21	2.71	5.51		1.32	0.91	12.62	0.25	3 24	81.22		1.58	1.09
Turnip	90.78	1.18	0.22		5.89		1.13	0.80	12.80	2.39		74.90		1 23	8.68
Beet	87.50	1.34	0.14	7.22	1.68		0.98	1.14	10.72	1.12	57.76	13.44		7.84	9.12
Sugar-beet	82.25	1.27	0.12	12.52	1.88		1.14	0.82	7.22	0.68	71.16	9.80		6.48	4.66
Carrot, large variety	86.79	1.23	0.30	6.71	2.46		1.49	1.02	9.31	2.27	50.79	18.63		11.28	7.72
" small "	88.84	1.07	0.21	1.58	6.59		0.98	0.73	9.59	1.88	14.16	59.05		8.78	6.54

[1] Nitrogenous substances. [2] Nitrogen free substances.

acids. The fats, of which there are many kinds, both animal and vegetable, may be said to be mixtures of three typical forms,—the solid variety, stearine, found in almost every animal and vegetable fat; the semi-solid form, palmitin, found especially in palm-oil, whence its name; and the liquid, oleine, found in olive-oil, human fat, etc.

Carbohydrates.

The carbohydrates contain the same chemical elements as the fats, but in different proportions, and are represented by sugar and starch in the vegetable, and by liver-sugar, glycogen, and muscle-sugar, inosite, in the animal kingdom.

The average composition of these three organic classes of foods may be given as follows:—

	Carbon. Per Cent.	Hydrogen. Per Cent.	Oxygen. Per Cent.	Nitrogen. Per Cent.	Total.
Proteine	53.0	7.0	24.0	16.0	100
Fats	76.5	12.0	11.5	None	100
Carbohydrates	44.0	6.0	50.0	None	100

Water.

Water, which forms nearly two-thirds of our bodies, is so important a constituent of both animals and plants, that we find it in large quantities disseminated throughout their structures.

Mineral Matters.

The mineral matters contained in both our bodies and foods are present in small quantities only.

Dietary.

It is fortunate that nature has provided these great varieties of food, so that man can make a selection suitable to his age, occupation, health, and other conditions of life. The subject of what are the proper proportions and kinds of food suitable to an economical and healthful diet covers too large a field for this series of articles; but it may be stated that people generally eat more than is requisite for the maintenance of their bodies in a state of perfect health.

The following table by Professor W. O. Atwater shows, in the form of debit and credit account, the daily income and expenditure of a man doing a moderate amount of work:—

Table III.—Assumed Daily Income and Expenditure of the Body of an Average Man doing a Moderate Amount of Muscular Labor.

INCOME.

Materials.		Weights.[1] Ounces.	Grams.
Nutrients of food.	Proteine	4.2	118
	Fats	2.0	56
	Carbohydrates	17.6	500
	Mineral matters	0.8	24
Water of food and drink		71.4	2,024
Oxygen of inhaled air		30.2	855
Total		126.2	3,577

OUTGO.

Materials.			Weights. Ounces.	Grams.
From digested food and inhaled oxygen.	Respiratory products excreted through lungs and skin.	Carbonic acid	38.8	1,100
		Water	12.7	361
	Excreted by kidneys.	Urea, etc.	1.2	34
		Mineral matters	0.7	20
Water otherwise excreted			71.4	2,024
Undigested matters (water free)			1.4	38
Total			126.2	3,577

[1] One pound avoirdupois, 453.6 grams; one ounce, 28.35 grams.

Various standards for daily dietaries for a man doing a moderate amount of work have been proposed by various authors, and the reader interested in such matters is referred to the last (third) edition of Dr. I. König's "Zusammensetzung der menschlichen Nahrungs und Genussmittel" (Berlin, 1889) for much information on the subject.

Below will be found a table,[1] prepared by Professor C. A. Meinert, giving the composition (in grams[2]) of the daily rations of the different European armies:—

Table IV.—Composition of the Rations of European Armies.

	Proteine.	Fat.	Carbo-hydrates.	Price.[1] Pfennig.	IN THE DAILY FOOD AS Meat, Raw.	Bread.
I. Imperial German Army						
Ordinary peace ration	107	22	489	33.4	150	750
Major " "	135	27	533	45 4	250	750
Ordinary field ration.						
Meat and bread	133	35	471	63.1	375	750
Pork " "	78	146	471	43 1	170[2]	750
Meat and biscuit	150	35	471	71 1	375	500[3]
Pork " "	97	146	471	51 1	170[2]	500[3]
Maximum ration	192	45	678	85 0	500	1000
II. Austria-Hungarian Army.						
In peace	100	51	474	40 0	187	900
In war.						
Meat	146	47	645	?	280	900
Pork	109	135	645	?	170[2]	{714 meal {100 bis.'t
III. French Army.						
In peace.	130	29	542	43	300	1000
In war						
Bread	139	31	574	48	312	1000
Biscuit	168	31	574	52	312	750[3]
Navy	136	44	478	46	330	750[3]
IV. Italian Army.						
In peace	127	45	613	57	300	918
In war	113	38	613	48	200	918
V. English Army.						
In peace	108	48	452	60	340	680
Navy						
Fresh meat	141	417		—	—	—
Salt "	165	535		—	—	—

[1] One mark equals 100 pfennigs, equal to 24 cents. [2] Pork. [3] Biscuit.

Digestibility of Foods.

The digestibility of foods is an important part of this subject, and it is to German chemists that we owe the greater part of our knowledge. The number of reliable investigations and experiments is very small, about sixty altogether, and the results obtained are tabulated in Table V.

Experiments in the digestibility of different cattle-foods have long been a subject of investigation by the different agricultural experiment stations in Europe, and the data obtained have been made use of in various ways, e.g., in quickly fattening cattle for the market.

The general method pursued consists in analyzing and weighing both the food consumed and the excreta; the latter representing the undigested materials, and the difference the amount digested. No trouble is found in feeding an ox or a horse on a diet of hay and water for a long period; but when a human being is taken for experiment, no matter how simple or palatable the food-material may be, it very soon becomes repugnant to him, the digestive functions are disturbed, and the accuracy of the experiment impaired. This is especially true where a diet of fat is tried.

Instead of the living subject, resort has been made to artificial digestion, when the food-material has been placed in a suitable vessel with a solution containing pepsin, and subjected, with occasional agitation, to the action of heat, at body temperature, for twenty-four hours, portions being taken out at different intervals and subjected to microscopical and chemical examination.

Table V.—Proportions of Nutrients Digested and not Digested from Food-Materials by Healthy Men (calculated by Professor Atwater).[1]

	PROTEINE. Total.	PROTEINE. Undigestible.	FATS. Total.	FATS. Undigestible.	CARBOHYDRATES. Total.	CARBOHYDRATES. Undigestible.	Mineral Matters.	Water.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Beef.								
Round	23.0	0.0	9.0	0.9	0.0	0.0	1.3	66.7
Sirloin	2[illegible].0	0.0	19.0	1.9	0 0	0.0	1.0	60.0
Pork, very fat	3.0	0.0	80.5	6.0	–	–	6.5	10.0
Haddock	17.1	0.0	0.3	–	0.0	0.0	1.2	81.4
Mackerel	18.8	0.0	8.2	0.8	0.0	0.0	1.4	71.6
Hen's eggs	13 4	0.0	11.8	2.4	0.7	0.0	1.0	73.1
Cow's milk	3.4	0.0	3.7	0.1	4.8	0.0	0.7	87.4
Cheese, whole milk	27.1	0.0	35.5	0.9	2.3	0.0	3.9	31.2
Butter	1.0	–	87.5	1.7	0.5	–	2.0	9.0
Oleomargarine	0.4	–	87.2	3.3	0.0	–	2 1	10.3
Sugar	0 3	–	–	–	96.7	0.0	0.8	2.2
Wheat-flour.								
Very fine	8.9	1.3	1.0	–	75.2	0.8	0.3	14.6
Medium	11.6	2.1	0.8	–	72.2	1.8	0.4	15.0
Coarse, whole wheat	10.9	2.7	1.8	–	71.7	5.3	1.2	14.4
Wheat-bread, average	8.9	1.2	1.9	–	55.5	0.6	1.0	32.7
Black bread	6.1	1.6	–	–	48.6	5.3	1.5	43.8
Pease	22.9	3.2	1.8	–	57.8	2.1	2.5	15.0
Corn-meal	9.1	1.2	3.8	–	71.0	2.3	1.6	14.5
Rice	7.4	1.2	0.4	–	79.4	0.7	0.4	12.4
Potatoes	2.0	0.5	0.2	–	21.3	1.6	1.0	75.5
Turnips	1.0	0.3	0.2	–	6.9	1.3	0.7	91.2

[1] Century, vol. xxxiv. p. 736.

From experiments made by Herr Jensen[1] in the laboratory of the University of Tübingen, it appears that raw meat is much sooner digested than cooked meat. The raw beef was digested in two hours; the boiled, "half done," was digested in two and a half hours; the boiled, "well done," was digested in three hours; the roasted, "half done," was digested in three hours; the roasted, "well done," was digested in four hours.

In regard to the relative digestibility of butter and oleomargarine, the only actual comparative tests on record are

[1] From König's Chemie der menschlichen Nahrungs- und Genussmittel (Berlin, 1889), p. 156.

[2] One gram equals 15.4 Troy grains; one ounce avoirdupois equals 28.35 grams.

[1] Century, xxxiv. p. 739.

a series made for three days on a man and a boy, by Professor A. Mayer, in Holland.[1] In these from 97.7 to 98.4 per cent of the fat of the butter, and from 96.1 to 96.3 per cent of the fat of the oleomargarine, were digested. The average difference was 1.6 per cent in favor of the butter. This proportion is so inconsiderable that in healthy persons it is of little or no importance. The slight difference in the chemical nature of the two fats would naturally lead to the same conclusion, as there is always a larger proportion of soluble glycerides in butter than in oleomargarine.

Dr. R. D. Clark made a series of artificial digestion experiments for the New York State Dairy Commission,[2] comparing oleomargarine with butter and other fats, including beef and mutton suet, and lard, cottonseed, sesame, and cod-liver oils. It was found from these tests that cod-liver oil exhibited the most perfect state of emulsion, after which came genuine butter, then "oleo" and lard oil, there being frequently no appreciative difference between them. The other animal fats and vegetable oils followed.

For healthy persons the difference between the genuine and artificial butter in digestibility was found to be nearly inappreciable. Cod-liver oil, which is the most readily digested of all the fats, cannot always be tolerated by invalids.

The difference between the digestibility of a piece of cold roast meat and oleomargarine would seem to be in favor of the latter, as the greater part of the more solid fats have been taken out of the latter in the process of manufacture; so that it more readily melts in the mouth and stomach, and from its fine state of division is readily emulsified.

Cooking.

Cooking, as far as animal food is concerned, has the effect of making it more pleasing to the taste, but is unnecessary; whereas with certain vegetables, especially those composed principally of starch, as grain and potatoes, it is required to fit them for use. The proper preparation of food is one that has not received the attention it demands. A badly cooked meal is more apt to disorganize the system than to prove nutritious and beneficial. The general teaching of cookery in our schools, both public and private, to girls would undoubtedly result in much improvement in this regard.

There is in boiling and frying foods a very simple problem in physics, which most people ignore; viz., that of latent heat. When a piece of meat, a vegetable, or other article of food, which is at the ordinary temperature, 60° to 75° F., is placed in boiling water or fat, the temperature of the solution is lowered proportionately to the mass and temperature of the article introduced; and it is not until the mass has absorbed more heat from the fire that the solution again comes to the boil. If care is taken, either by introducing the food in small quantities at a time into the boiling solution, so that very little lowering of the temperature takes place, or by a preliminary heating of the food before adding it to the solution, and in every case allowing the solution to boil before introducing any fresh material, the soddenness of improperly boiled or fried foods will be avoided.

Food-Products and their Chief Adulterants.

The great majority of substances used for food adulterants or substitutes consist of cheap and harmless substances, which are not injurious to health, as the following list of those most commonly met with in the principal food-products will show. This list has been compiled from the reports of the State boards of health, the returns of the British Inland Revenue Department, the reports of the British Local Government Board, and those of the Paris Municipal Laboratory.

[1] Landwirthsch. Versuchsstationen, 29, p. 215.

[2] Second Annual Report of the New York State Dairy Commissioner.

Table VI. — Food-Products and their Chief Adulterants.

FOOD-PRODUCT.	ADULTERANTS.
Milk	Water, removal of cream, addition of oleo-oil or lard to skimmed milk.
Butter	Water, salt, foreign fats, artificial coloring-matter.
Cheese	Lard, oleo-oil, cottonseed-oil.
Olive-oil[1]	Cottonseed and other vegetable oils.
Beer	Artificial glucose, malt and hop substitutes, sodium bicarbonate, salt, antiseptics.
Sirup	Artificial glucose.
Honey	Artificial glucose, cane-sugar.
Confectionery	Artificial glucose, starch, artificial essences, poisonous pigments, terra alba, gypsum.
Wines, liquors	Water, spirits, artificial coloring-matter, fictitious imitations, aromatic ethers, burnt sugar, antiseptics.
Vinegar	Water, other mineral or organic acid.
Flour, bread	Other meals, alum.
Baker's chemicals[1]	Starch, alum.
Spices[1]	Flour, starches of various kinds, turmeric.
Cocoa and chocolate	Sugar, starch, flour.
Coffee[1]	Chiccory, peas, beans, rye, corn, wheat, coloring-matter.
Tea	Exhausted tea-leaves, foreign leaves, tannin, indigo, Prussian blue, turmeric, gypsum, soapstone, sand.
Canned goods[1]	Metallic poisons.
Pickles	Salts of copper.

[1] For list of adulterated brands see Report of the Commissioner of Internal Revenue, 1889, pp. 181–184.

EDGAR RICHARDS.

NOTES AND NEWS.

EARLY this month there will be at the New York Academy of Medicine a joint discussion upon the pneumonias of this winter, by representatives of New York, Boston, and Philadelphia. Provost Pepper of the University of Pennsylvania has been appointed to represent Philadelphia. It is hoped that the discussion will lead to some positive conclusions as to the most effective method of dealing with *La Grippe*.

—At the meeting, on April 7, of the New York Academy of Sciences, Mr. George F. Kunz presented a paper on a remarkable find of meteorites in Kiowa County, Kan.

—The American Academy of Political and Social Science, organized in Philadelphia in December last, has met with unexpected success. It has already over three hundred members, though its working organization is scarcely two months old. Its membership list embraces many of the leading thinkers and workers in the economic and social field in this country and Canada. The first volume of its proceedings will appear early in June.

—At a meeting of the board of trustees of the University of Pennsylvania, held April 1, 1890, Dr. Hobart Amory Hare was elected clinical professor of the diseases of children, to succeed Dr. Louis Starr, resigned. Dr. Hare is a graduate of the University of Pennsylvania, 1884. He is a descendant of the distinguished Dr. Robert Hare, one of the early professors of the university. He has done much important original work, is a teacher of remarkable excellence, and, since his graduation in 1884, has won eight prizes for various essays, etc.

—The third national industrial exhibition of Japan opened at Tokio on April 1, and will continue until July 31. The directors of the exhibition have given special facilities for foreigners visiting their country, having made arrangements with railroad and steamboat lines for transportation all over the empire at a considerable reduction from the usual rates. These arrangements have been made by Mr. Iwamura Michitoshi, vice-president of the exhibition. Special tickets have been issued, entitling the bearer, on his arrival in Japan, to a passport which will enable him to travel through the empire. The exhibition includes a display of Japanese products and manufactures, art works, curios, etc.

—The St. Petersburg Academy of Sciences has issued the report for 1889, which was read at the annual meeting on Jan. 12. The report contains, according to *Nature*, a valuable analysis of the scientific work done by the members during the year. In mathematics, Professor Tchebysheff's applications of simple fractions to the investigation of the approximate value of the