pictures is put on a circular glass plate, which is rapidly turned round its axis; and, whenever a picture appears before the eye of the observer, it is lit up by an electric spark. By this means the natural motion of the object is reproduced with a degree of truth and accuracy that is absolutely bewildering. Looking thus at the representation of a man on a galloping horse, every single movement of horse and rider can be followed. Not only do the legs of the horse move according to the gait, but one sees the dust rise, the horse's mane and tail fly, and the nostrils extend. The rider is jerked in his saddle, he urges his horse, pulls the curb-chain, and moves back his leg to apply the spur, etc. Each series in this apparatus represents a bit of life — not a life-like picture, but life itself — with amazing naturalness and truth. One of these tachyscopes, and many notable examples of Mr. Anschuetz's work, have been brought to this country, and are now on exhibition at the show-rooms of the United States Photographic Supply Company on Fourteenth Street, this city.

SOME FOOD SUBSTITUTES AND ADULTERANTS.[1]

MR. PRESIDENT, LADIES AND GENTLEMEN,—In his address before this society last year, our late president, Dr. J. H. Kidder, presented the subject of air as one of the "two necessities of life which," he said, "are absolute," and "which we cannot live without;" namely, "food (including water) and air." It is more especially to a certain class of foods, whose increasing consumption and sale have of late years attracted public notice, that I wish to call your attention this evening; namely, that of cheap and wholesome food substitutes, which are also frequently used as food adulterants.

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.

From want of reliable information in regard to the materials employed in most new food products, there is a general feeling of uncertainty and insecurity on the subject. People, as a rule, imagine that any substance used as an adulterant of, or a substitute for, a food product is to be avoided as itself being injurious to health; and when they 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. 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 present.

[1] Annual address of the retiring president, Mr. Edgar Richards, delivered Jan. 23, 1890, before the Chemical Society of Washington.

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.

TABLE I.

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.

Water.

Ordinary potable water is not generally considered either externally or internally "injurious to health," yet it is probably the most common adulterant used. We find, indeed, in the Canadian "Adulteration Act," that "if water has been added" to milk, "it shall be deemed to have been adulterated in a manner injurious to health" (Section 15). The watering of milk is everywhere recognized as not only a fraud, but also a grave misdemeanor, if not actually a crime. This is the food on which the whole population under one year old is fed; and, where the mother cannot supply the proper nourishment for the child, she must depend for its bringing-up on cow's or other milk. It is self-evident that a pint of watered milk does not contain the same amount of nourishment as the same volume of whole milk, so that a child or invalid might be actually starved to death if compelled to rely on the former for its sole sustenance. The placing of watered and skimmed milk on the market should, in all large cities, call forth the active exertions of their health departments to supervise and as far as possible suppress their sale.

The skill of the milk adulterator has kept pace with the march of improvement, and to-day we find centrifugal machines costing over two hundred dollars placed on the market, designed solely to manufacture, from skimmed milk and oleo-oil and lard, an artificial cream or milk, depending on the amount of animal fat added, which, it is stated, can be used for all purposes in which the genuine article is employed. A description of such machines will be found in *Engineering* (vol. xliv. 1887, p. 478) and in the catalogues of the dealers.

Oleomargarine.

Within the past few years two artificial food products made from what had theretofore been considered waste products of the large slaughter-houses have come prominently before the public, and established a legitimate place for themselves as perfectly wholesome articles of food. Oleomargarine and "refined" or "compound" lard are now found on sale in most cities of this country and Europe. Against the former there has been a large amount of legislation directed with a view of controlling its production and sale, and with the unexpected result of increasing both.

Whatever may have been the production of oleomargarine in this country before the National law went into effect, we have no reliable statistics; but since the 1st of November, 1886, we have the monthly statements of the manufacturers, duly attested under oath, of the quantity of oleomargarine made and removed from the factories, tax paid for domestic consumption or in bond for export, each day of the month. These statements also give the quantity and kind of materials employed in the manufacture, and the names and addresses of the parties to whom the oleomargarine is sold or consigned.

The following table shows the monthly quantity of oleomargarine produced in this country from Nov. 1, 1886, to Nov. 1, 1889:—

TABLE II.

Showing the Quantity of Oleomargarine produced, withdrawn Tax paid, for Export, and Lost or Destroyed in Manufactories, from Nov. 1, 1886, *to Nov.* 1, 1889.

Year.	Quantity Produced. Pounds.	Withdrawn Tax paid. Pounds.	Lost or Destroyed. Pounds.	Withdrawn for Export. Pounds.
On hand Nov. 1, 1886.	181,090			
From Nov. 1, 1886, to Oct. 31, 1887.....	31,114,682	29,692,966	55,260	1,029,880
Highest, March, 1887.	3,568,254	3,512,138	12,472	96,499
Lowest, July, 1887 ...	1,208,638	1,170,136	1,191	33,240
From Nov. 1, 1887, to Oct. 31, 1888.....	35,530,146	33,655,423	6,442	1,937,907
Highest, March, 1888.	3,940,727	3,824,672	2,998	155,761
Lowest, July, 1888....	2,084,317	1,925,762	185	155,200
From Nov. 1, 1888, to Oct. 31, 1889.....	35,132,060	32,902,802	6,741	1,694,851
Highest, Dec., 1888...	4,181,317	4,025,336	10	109,385
Lowest, June, 1889....	1,575,362	1,514,658	—	58,579
On hand Oct. 31, 1889.	429,219			
Total for 3 years.....	101,786,888	96,251,191	68,443	4,662,638

During this period the number of factories has decreased from 37 to 21, notwithstanding which fact the production and sale have increased steadily. It is produced by expensive machinery in the large factories in such quantities that it can be sold nearly the whole year round at a less price than butter, although the high rate of tax paid by both the manufacturers and dealers, which is, of course, ultimately paid by the consumer, necessarily increases the market price. In the spring and early summer months the price of dairy butter is generally cheaper than oleomargarine, and consequently less of the latter is made and sold during that time. In July the production of oleomargarine reaches its lowest limits for the year, and obtains its highest in March.

The system followed by the Internal Revenue Bureau is such that each manufacturer's package can be traced from the time it leaves the factory till it reaches the hands of the retailer or consumer, or leaves the country.

The high rate of tax demanded from the manufacturers and dealers was undoubtedly intended to be nearly or quite prohibitory: when compared to those paid by other special tax-payers, rectifiers, brewers, etc., as shown in the following table, the amounts are from three to ten times as high:—

TABLE III.

Rate of Special Taxes per Annum.

	Oleomargarine.	Liquors.		Tobacco Manufactured.
		Distilled.	Malt.	
Manufacturer..... ..	$600 00	$200 00*	$100 00†	$6 00
Wholesale dealer.....	480 00	100 00	50 00	30 00‡
Retail dealer.....	48 00	25 00	20 00	2 40

* Rectifier of 500 barrels, or more, per annum.
† Annual manufacture, 500 barrels or more.
‡ Pedler of tobacco, first-class.

It is undoubtedly a fact that if the retailer's tax was as low as that for tobacco, the manufacturers of oleomargarine would pay the same to have at least one dealer to handle their goods in every village and town in this country. As it is, in the Chicago district, where there are seven factories, there were 974 retail dealers doing business in April, 1889, compared with 726 the April previous; in the Boston district, with its one factory, there were 460 retailers in April last year, and 405 at the corresponding time in 1888; in the Connecticut district, with four factories, there were 424 in 1889, and 384 the year previous; and in Michigan, with no factory, there were 290 and 267 respectively for the same periods. These four collection districts contain over one-half of the total number of retail dealers doing business at the close of the last special tax year (April 30, 1889). This would seem to indicate that where the public has been brought in unprejudiced contact with oleomargarine, as sold on its own merits, they have found it palatable and suitable to their wants.

I have been in retail stores in the lumber and mining regions of the upper peninsula of Michigan, in Boston, Chicago, and elsewhere, where as much as one-half to one ton of oleomargarine is sold per week, in quantities of less than ten pounds to any one purchaser at one time, put up in packages duly branded with the word "Oleomargarine," as required by the law and regulations. It may interest you to know that there was consigned to retail dealers, and presumably sold in Washington, between Jan. 1, 1889, and Dec. 1, 1889, 130,584 pounds of oleomargarine, as shown in the following table:—

TABLE IV.

Showing Monthly Shipments of Oleomargarine from Five Manufacturers Direct to Retail Dealers in Washington, D.C., from Jan. 1, 1889, *to Dec.* 1, 1889.

Month.	*Lbs. Oleomargarine.*
January.....	10,270
February.....	28,223
March.....	6,227
April.....	8,108
May.....	12,372
June.....	6,808
July.....	6,826
August.....	8,466
September.....	13,872
October.....	12,844
November.....	16,568
Total.....	130,584

The ingredients which enter into the manufacture of oleomargarine are (1) neutral or leaf lard, used in the proportion of from 25 to 60 per cent, made from the leaf fat of freshly slaughtered hogs; (2) oleo-oil, used in the proportion of from 20 to 50 per cent, made from the caul and suet fats of freshly slaughtered beeves; (3) some liquid vegetable oil, as cottonseed, sesame, peanut, used in the proportion of from 5 to 25 per cent, made by crushing the seeds and extracting the oil by pressure or solvents; (4) milk or cream, used in the proportion of from 10 to 20 per cent; (5) butter, used in the proportion of from 2 to 10 per cent, generally bought from the best creameries for its fine

flavor; (6) salt; and (7) annatto or other coloring-matter. Some factories employ no vegetable oils in their oleomargarine, preferring to use a larger proportion of "neutral" lard with a small amount of butter to obtain the desired butter consistency. In the higher grade of "creamery butterine" the proportions of oleo-oil are reduced, the vegetable oils are discarded, and butter is used to make up the charge for the churn.

The method of manufacture closely resembles that used in ordinary butter-making, except that the churn is steam-jacketed and the animal fats used are previously melted before being placed in it. From a personal inspection of some of the largest factories, I am convinced that the greatest cleanliness is observed throughout all the operations; that nothing but the freshest animal fats are used; that machinery is employed as much as possible, and large quantities worked at a time, to reduce the expense. The factories are as well arranged as the best creameries; and it is to the manufacturer's interest to produce a palatable and wholesome product, which is, however, not intended to compete with "gilt-edge" butter.

Oleo-Oil.

Owing to the construction by the attorney-general of Section 2 of the oleomargarine law, the internal revenue officers exercise no control over the production and sale of oleo-oil, although the commissioner has recommended that Congress amend the law in that regard. From inquiries that were made over a year ago by the collectors of internal revenue, there was found to have been produced during the year ended June 30, 1888, 69,623,795 pounds of oleo-oil in nine States. There was used in the manufacture of oleomargarine, as stated in the manufacturers' returns, 12,265,800 pounds during that period, and 30,146,595 pounds were exported, leaving 27,211,400 pounds used otherwise. As oleo-oil is sold at a much higher rate than tallow, it is presumable that this large quantity is used in some other food products, as emulsified cream and cheeses.

There is a special provision in the law in regard to the use of any unwholesome material or product in the manufacture of oleomargarine, but no sample has ever been submitted to the commissioner of internal revenue under it. From the testimony and investigations of the most prominent chemists, both here and in Europe, there is a consensus of opinion that oleomargarine, when made from fresh fats and in a cleanly manner, is a perfectly wholesome article of food.

Compound Lard.

In the manufacture of oleo-oil there is left behind on the filter-presses a hard white or slightly yellow fat, the beef or oleo-stearine. This for many years was sold to the candle and soap makers, but is now used in the extensive manufacture of "refined" or "compound" lard by being melted and mixed with some cottonseed-oil and a little leaf-lard until the mixture has attained the desired consistency.[1]

From the testimony given before the Congressional Lard Committee, "prime steam lard" is about as disgusting a mixture as can be imagined. The entrails and other viscera, head, feet, in fact every part of the animal which contains the faintest traces of fat, are dumped into the rendering-tanks, and live steam turned on until all the fat is thoroughly melted out. The liquid is then allowed to cool, the water containing a highly savored mass of impurities is run off, and the remaining fat is tierced or canned. If it smells too "loud," it is washed with hot water, allowed to cool, and then repacked.

The oleo-stearine and cottonseed-oil mixture is prepared from clean and wholesome materials, and does not suggest any such filthy practices as "prime steam lard." The manufacturers are generally abandoning the designation of "refined," and are now calling such mixtures "compound lards."

Cottonseed-oil.

The enormous and constantly increasing production of cotton-seed-oil in this country is noteworthy as showing to what an extent it has come to be employed as an article of food, both here and abroad. The principal domestic consumption of the oil is in the manufacture of "compound lard." It is also used as a substitute for, and an adulterant of, olive-oil for cooking and table use, and in medicinal preparations. It is employed instead of the more expensive animal and vegetable oils in the mining regions for the miners' lamps. There are a hundred and twenty-five mills in operation, with a capital invested, in the South, estimated at $25,000,000. Twelve thousand hands, receiving $24,000, are employed per day. The amount of seed crushed last season was 875,000 tons,[1] yielding, on an average, 37½ gallons of crude oil per ton.

[1] My thanks are due to Messrs. Fairbanks & Co. of Chicago for a set of samples illustrating the manufacture of compound lard.

Some Queer Prejudices.

A large proportion of the articles suitable for food, and produced in all countries, is wasted annually because of people's prejudice against them. The old saws, "What is one man's meat is another man's poison," and "There is no accounting for taste," are trite, but warranted by the facts.

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 bird's nests are considered delicacies by the Chinese. Frog's 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 present.

Cooking.

From experiments made by Jensen in the laboratory of the University of Tübingen, it appears that raw meat is much sooner digested than cooked meat. 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.

Glucose.

In April, 1882, the commissioner of internal revenue addressed a letter to the president of the National Academy of Sciences, requesting "the appointment of a committee of the academy to examine as to the composition, nature, and properties of the article commonly known as 'glucose' or 'grape-sugar.'" In the report on this subject, made in January, 1884, the committee, consisting of Professors Barker, Brewer, Gibbs, Chandler, and

[1] This information was kindly furnished me by Mr. A. D. Fulton, editor of the Oil, Paint, and Drug Reporter, in a letter dated Dec. 28, 1889.

Remsen, from the results they had obtained, summed up briefly as follows:—

"1st, Starch-sugar as found in commerce is a mixture, in varying proportions, of two sugars, called dextrose and maltose, and of dextrine, or starch-gum. Dextrose was discovered in grapes by Lowitz in 1792, and was first prepared from starch by Kirchhoff in 1811. In 1819, Braconnot prepared it from woody fibre. Maltose was first recognized as a distinct sugar by Dubrunfaut, in 1847, in the product of the action of malt on starch. No dextrose is thus produced, according to O'Sullivan.

"2d, The process of making starch-sugar consists, first, in separating the starch from the corn by soaking, grinding, straining, and settling; and, second, in converting the starch into sugar by the action of dilute sulphuric acid, this acid being subsequently removed by the action of chalk. To make the solid, 'grape-sugar,' the conversion is carried further than to make the liquid, 'glucose.' After clarifying, the liquid is concentrated in vacuum-pans, and is decolorized with bone-black.

"3d, The starch-sugar industry in the United States gives employment to twenty-nine factories, having an estimated capital of five millions of dollars, consuming about forty thousand bushels of corn per day, and producing grape-sugar and glucose of the annual value of nearly ten millions of dollars. In Germany, in 1881–82, there were thirty-nine factories of this sort, consuming over seventy thousand tons of starch, and producing about forty thousand tons of starch-sugar."

Since this report of the National Academy was printed, the number of starch-sugar factories in the United States has decreased to twelve, with a capital invested estimated at from twelve to fifteen million dollars, consuming about fifty thousand bushels of corn per day, and having an annual production of 450,000,000 pounds, valued at $10,500,000.[1]

"4th, Starch-sugar is chiefly used in making table-sirup, in brewing beer as a substitute for malt, and in adulterating cane-sugar. It is also used to replace cane-sugar in confectionery, in canning fruits, in making fruit-jellies, and in cooking. Artificial honey is made with it; and so, also, is vinegar.

"5th, Starch-sugar represents one distinct class of sugars, as cane-sugar does the other; the former being obtained naturally from the grape, as the latter is from the cane and the beet. Starch-sugar, which is a term chemically synonymous with dextrose and glucose, when pure, has about two-thirds the sweetening power of cane-sugar. By the action of the dilute acids, both cane-sugar and starch yield dextrose. In the case of starch, however, dextrose constitutes the sole final product.

"6th, The commercial samples of starch-sugar obtained by the committee showed a fairly uniform composition on analysis. The liquid form, or 'glucose,' contains from 34.3 to 42.8 per cent of dextrose, from 0 to 19.3 per cent of maltose, from 29.8 to 45.3 per cent of dextrine, and from 14.2 to 22.6 per cent of water. The solid form, 'grape-sugar,' gave from 72 to 73.4 per cent of dextrose, from 0 to 3.6 per cent of maltose, from 4.2 to 9.1 per cent of dextrine, and from 14 to 17.6 per cent of water. Three specimens of especially prepared 'grape-sugar' contained 87.1, 93.2, and 99.4 per cent of dextrose respectively. The last of these was crystalline anhydrous dextrose.

"7th, Of mineral or inorganic constituents, the samples of starch-sugar examined contained only minute quantities. The total ash formed in the 'glucose' was only from 0.325 to 1.060 per cent, and in the 'grape-sugars' only from 0 335 to 0.750 per cent. No impurities, either organic or inorganic in character, other than those mentioned, were detected in any of the samples examined.

"8th, The elaborate experiments upon the fermentation of starch-sugar would seem to be final on the question of the healthfulness, not only of glucose itself, but also of the substances produced by the action of a ferment upon it. Large quantities of a concentrated extract from the fermentation, representing from one-third to one-half a pound of starch-sugar, were taken internally by the experimenter, and this repeatedly, without the slightest observable effect. This result, rigidly applied, holds of course only for those sugars which, like this, are made from the starch of Indian-corn or maize."

From the foregoing facts the committee reached the following conclusions: "First, that the manufacture of sugar from starch is a long-established industry, scientifically valuable and commercially important; second, that the processes which it employs at the present time are unobjectionable in their character, and leave the product uncontaminated; third, that the starch-sugar thus made and sent into commerce is of exceptional purity and uniformity of composition, and contains no injurious substances; and, fourth, that though having at best only about two-thirds the sweetening power of cane-sugar, yet starch-sugar is in no way inferior to cane-sugar in healthfulness, there being no evidence before the committee that maize-starch sugar, either in its normal condition or fermented, has any deleterious effect upon the system, even when taken in large quantities."[1]

Some Other Adulterants.

The use of flours and starches of various kinds—wheat, corn, rye, peas, beans, etc. — as food adulterants cannot be considered injurious to health. However much the public may be cheated in the purchase of such adulterated articles of food, as ground spices, coffee, etc., they are not poisoned by their consumption It is a question how much a purchaser is himself to blame, in his endeavor to secure a "bargain," when he demands so great a quantity of any given material at less than it can be purchased at wholesale in the market, that he compels the unscrupulous manufacturer to make a compound which has never more and generally less than the proportion of the genuine material represented by the price asked.

Many articles of food spoil in transportation; and, under the plea of preventing further fermentation, resort is had to antiseptics, such as salicylic acid, sulphite of soda, borax, etc. These deserve mention as being additions to foods of a class of substances used to cloak carelessness in manufacture and otherwise, and producing in many cases deleterious effects on the human economy. In France and Germany the use of such antiseptics as salicylic acid in food products is prohibited, although in the latter country such addition is tolerated when the food product is exported to countries where such use is not prohibited.

Legislation on Food Adulteration.

The adulteration of food, generally being aimed at the pocket and not at the health of the consumer, ought to be easily remedied, one would suppose, by legislation. On, however, turning to our different State laws on the subject, I am sorry to say that most of them are drawn up in a follow-the-leader style, under the popular but erroneous impression that any substance used as an adulterant of or a substitute for a food product is necessarily injurious to health, with the consequence that these laws are, with very few exceptions, merely dead letters.[2] New York and Massachusetts have laws nearly identical in wording, whose enforement is intrusted to their respective boards of health. In the former State the law has proved a failure, because in an action brought to obtain "an injunction against the sale of certain Ping Suey teas it was held by the court, in refusing to grant the same, that, although the teas in question had been clearly shown to be adulterated with gypsum, Prussian blue, sand, etc., it was likewise necessary to prove that the effect of these admixtures was such as to constitute a serious danger to public health"[3] In Massachusetts, however, the law has been enforced with vigor by the State Board of Health, and the yearly reports show a diminution in the percentage of adulteration of the samples submitted to analysis.

In this country the British Sale of Food and Drugs Act, 1875, with all its imperfections, has served as a model for our legislation; and until we have a general law on the subject, drawn up

[1] This information was kindly furnished me by the American Glucose Company of Buffalo, N.Y., in a recent letter, December, 1889, who also sent samples of liquid and solid glucose.

[1] Report on Glucose, prepared by the National Academy of Sciences, in response to a request made by the commissioner of internal revenue, Washington, 1884.

[2] For list of State laws on food adulteration see Report of the Commissioner of Internal Revenue, 1888, p. ccix.

[3] Battershall, Food Adulteration and its Detection, p. 8 (New York, 1887).

with clear definitions of adulteration, and adequate means for the enforcement, by the co-operation of State and National authorities, of its provisions in regard to this class of fraud, the food sophisticator will pursue the even tenor of his way undisturbed. The European Continental legislation on this subject is much superior to the English act.[1] Under Continental statutes, every dealer is held responsible for the quality of his merchandise, whether of foreign or domestic origin, and every food material must be sold under its true name; artificial products imitating a natural product must be properly labelled in a conspicuous and legible manner; all unwholesome foods are confiscated and destroyed without compensation to the owner; and adulterations generally are considered acts of fraud. Suitable police supervision and control are provided for the enforcement of these statutes; and, although these laws are somewhat of a paternal nature, they are much more effective than any we have.

The average American repudiates the idea of a paternal government supervision over his affairs, or any thing tainted with the idea. He realizes that he is a full-grown man and a sovereign, and that therefore he is perfectly competent to take care of himself; and no cheat or swindler can ever get the better of him. He may be willing to support, even to clamor for, a legislative measure to regulate the production or sale of a food product, provided it advances his particular business interests. He would, however, regard with apathy any general law that would guarantee to the public the liberty of purchasing pure food, with a reasonable certainty that they were not imposed upon in their purchases, if it was incumbent on him to take the necessary steps to execute its provisions by bringing samples for analysis, etc.

It may be, however, that some day he will reach the conclusion that his individual smartness, great as it may be, is not sufficient to wage successful warfare against the food sophisticator's combinations, which have made this country for years the choice dumping-ground of the frauds of Europe, Asia, and Africa. When this happens, we may hope that the proper laws will be passed to suppress the fraud, and that we, the chemists of the country, will have opened to us a new field of usefulness,—a field in which we ought to put forth our best efforts, with the constant aim to maintain the purity and wholesomeness of the food for suffering humanity.

[1] For copies of European laws on food adulteration see Reports of the Commissioner of Internal Revenue for 1888 and 1889; and for a summary of their leading features see Science, 1 9, xiv. p. 308.

THE ORIGIN OF HUMAN FACULTY.

IN a paper read before the Neurological Society, Dr. Romanes has presented in very convenient shape an outline of his recent work, "Mental Evolution in Man," which, being at once authoritative and brief, may be appropriately noticed in these columns. Taking for granted the truth of his first proposition, that no exception must be made in the case of the human mind to the law of continuous evolution,—a proposition fully discussed in the original work,—Dr. Romanes concentrates his energies upon tracing the probable causes and history of this transition from the intelligence of brute to that of man.

For this purpose it is found necessary to agree upon a working classification of mental products or ideas. The division adopted is that of simple ideas, which are simply the traces left in the mind by a sense-impression,—the seeing with the mind's eye, as it were; of compound, or, better, generic ideas, which are obtained by a fusion of several impressions, and so involve some amount of comparison; and, finally, of general ideas, which are named abstractions,—a symbolic mode of referring to a group of ideas. These may be more briefly referred to as percepts, recepts, and concepts. The first two are common to animals and men. A dog has a generic idea of man, and a simple idea of some particular man; but he cannot make the third step, and call the one by the word "man" and the other by the word "John." This is the distinction most usually insisted upon as dividing men from the most intelligent of animals, and not only involves a substitution of a symbol for an idea, but, to get this idea, requires the mind to look in upon itself and observe its own actions,—introspection or self-consciousness. While these concepts may at first be very simple, they may be subjected to mutual comparison, and the relations thus deduced again give rise to concepts, and thus a kind of algebra of recepts and their corresponding concepts be formed,—an algebra of the imagination, in which all the higher intellectual work is accomplished. Now, the difference between a mind capable of however limited a degree of conceptual ideation and one having only receptual ideation is usually agreed to be the possession of language by the first, and its absence in the other. We must therefore consider the mental powers involved in language. Language, considered broadly, is the faculty of making signs: this intelligent animals do. The dog barks to have the door opened, a parrot will give rise to sounds to express its wants, and so on. But there is a broad difference between this which is receptual sign-making, and the peculiarly human conceptual sign-making. The man can think about the name, which is to the animal merely an association of sound with thing. "The difference between naming a thing receptually by mere association, and naming a thing conceptually by intentional thought, is all the difference between knowing that thing and knowing that we know it." It is, then, the genesis of the self-conscious faculty that forms the special object of study,—the faculty that enables us to think of words as words, and of ideas as ideas. But we must remember that even in the human infant there is a stage of sign-making anterior to self-consciousness. There is first the indicative stage, in which the child, like the dog or parrot, makes intentionally significant signs or tones; there is then the denotative stage, in which the child uses names receptually by mere association, just as the talking birds do; upon this follows the connotative stage, in which a child will apply a name not alone to the object with which it was first learned, but also to objects with varying degrees of similarity to it,—will extend the meaning of "bow-wow" from the house terrier to other dogs, to pictures of dogs, to a person imitating the dog, etc. (parrots have been observed to possess the rudiments of this connotative stage); lastly there is the denominative stage, where the name is consciously bestowed as such (this occurs in the child between the second and third years, when the child arranges its names in statements). It is important to note that the first three stages occur in animals, but that they occur in a very much more perfect development in the child, before it reaches the distinctively human form of speech. The receptual intelligence of the child is greatly in advance of that of any animal; although this supremacy must not blind us to the fact that it is a difference of degree only, and not of kind. This preconceptual intelligence of a child is superior to that of a dog in the same sense as the dog is more intelligent than a bird. An intelligent chimpanzee, Dr. Romanes believes, would "follow a child through what would probably seem a surprising distance in the use of denotative names and receptually connotative words," if it had the power of articulation; and it would, too, under this condition, have been able to "answer us in the same way that a child answers us when first emerging from infancy." From here on, the child rapidly advances beyond the capacity of any animal, though it has still a long development to pass through before it reaches the truly human or self-conscious stage. A very large share of mental activity at this period is formed by the making of propositions which, to distinguish from the later propositions, may be called preconceptual propositions. If a child sees its sister crying, and its words for the person and the act are "Dit ki," this is a statement, but one made for the child by the "logic of events." It is not conceptual or introspective, but is of the "psychological kind that we might have expected a monkey to make, if a monkey had been able to pronounce denotative names as well as it can understand them." Up to this point we have been considering differences of degree only: the issue is thus narrowed down to the transition from the preconceptual to the conceptual stage.