

and to examine the same. To avoid, as far as possible, all suggestion or danger of specimens having been tampered with, each analyst shall keep each specimen in his possession in a suitable and secure place, labelled in such a manner as to prevent any person from having access to the same without the knowledge and presence of the analyst.

Analyses of perishable articles should be made promptly after they are received.

7. An analyst shall give no information, under any circumstances, regarding the result of any analysis, to any person except to the secretary of the board, prior to any trial in court in reference to such analysis.

The analysts shall carefully avoid any error regarding the inspector's number attached to each sample, and shall report the results of their work in detail to the secretary.

In the case of all articles having a numerical standard provided by statute, the result of the analysis should show their relation to such standard.

8. Before beginning the analysis of any sample, the analyst shall reserve a portion, which shall be sealed, and in the event of finding the portion analyzed to be adulterated, he shall preserve the sealed portion, so that in case of a complaint against any person the last-named portion may, on application, be delivered by the secretary to the defendant or to his attorney.

9. Each analyst shall present to the secretary, on the Monday before the first Thursday of each month, a summary of the analyses made by him during the previous month.

Each analyst shall also present, on or before the first of January of each year, an annual report of the work done for the year ending on the 30th of September preceding.

10. The secretary shall have charge of the reports of analyses, and shall cause cases founded on such reports to be submitted to the courts for prosecution.

In each case of a retailer, and of every dealer not a manufacturer or producer, he may, if the party has not been previously complained of in court, issue a notice or warning of any violation of the law relative to the adulteration of food and drugs, and of the offender's liability to prosecution on a repetition of the sale.

11. Should the result obtained by any analyst be questioned in any given case, another analyst shall repeat the analysis, unless otherwise instructed by the board, provided a sufficient sum to meet the expense of the analysis be deposited with the secretary by any interested party feeling aggrieved, which sum will not be returned unless the second analysis fails to confirm the first in essential particulars.

12. Any appeal from the decision of an analyst shall be filed with the secretary, who shall report it, and any matter in controversy to the board, giving his judgment thereon, and the board shall supervise and control the action of its officers in executing the law.

13. Where standards of strength, quality, or purity are not fixed by the act, the analysts shall present to the secretary such standard as in their judgment should be fixed, and the secretary shall report the same to the board for its action. The standards set by the British Society of Public Analysts will be followed, as nearly as practicable, until otherwise ordered.

14. Whenever a drug or preparation, not prescribed in a national pharmacopœia or other standard work on materia medica, shall be manufactured, offered for sale, or used in this State, the standard of such drug, and the standard and proportion of the ingredients of such preparation, and the range of variability from such standard or standards, shall be ascertained by the analysts, who shall report the same through the secretary to the board.

15. The analysts shall occupy such time in the performance of their respective duties as a reasonable compliance with the terms of the statute shall require, and shall be present one hour of each day, at such time of the day and at such place as shall be designated by the board,

to meet the convenience of interested parties and the public.

The following classified list embraces most of the examinations of articles of food examined in Massachusetts under the Food and Drug Acts up to October 1st, 1898:

Articles examined.	Total examined.	Number adulterated or below standard.	Per cent. of adulteration.
Milk	51,198	20,771	40.6
Condensed milk	247	21	8.5
Butter	3,563	413	11.6
Cheese	473	1	0.2
Vinegar	1,750	927	53.0
Lard	450	126	28.0
Olive oil	524	257	49.0
Spices and condiments	14,902	2,674	17.9
Coffee	1,088	245	22.5
Tea	976	31	3.2
Cocoa and chocolate	208	53	25.5
Wheat flour	197	5	3.0
Bread and cake	86	1	1.2
Cornmeal and other cereals	18	0	.0
Sago, tapioca, and corn starch	21	0	.0
Cream of tartar	4,486	465	10.4
Soda and saleratus	100	2	2.0
Molasses	2,394	305	12.7
Syrups	122	56	45.9
Maple syrup	483	135	28.0
Maple sugar	395	87	22.8
Sugar	156	9	5.7
Honey	716	209	29.2
Confectionery	784	65	8.3
Pickles	29	2	7.0
Lime juice and lemon juice	28	21	75.0
Horseradish	20	8	40.0
Arrowroot	21	4	19.0
Gelatin	34	3	9.0
Salt	21	1	4.8
Canned food*	523	244	46.8
Flavoring extracts	39	5	12.8
Sardines	5	4	80.0
Jellies and jams	112	47	42.0
Spirits, wine, ale, beer and cider†	192	121	63.0
Miscellaneous‡	1,493	523	35.0
Drugs	9,898	3,532	35.7

* A considerable portion of these were French vegetables, which were examined for the presence of copper as a coloring agent.

† A large number of examinations of spirits and wines is included in the item of drugs.

‡ Under this head are included samples of sage, marjoram, macaroni, vermicelli, poultry dressing, desiccated cocoanut, citron, compressed yeast, meat extracts, cooking utensils, food wrappers, wall paper, clothing and textile fabrics, bottle stoppers, food preservatives, coloring matter, etc.

A broad view of the subject of food inspection would include the examination of water as one of the necessities of life, since it is essential to the preparation of most articles of food, and also a convenient vehicle for the administration of very many of them. It is also absolutely necessary to the healthy growth of the human organism.

The important work of water analysis has been conducted by the Engineering Department of the State board of health since 1887, and this work has been extended to the examination of the waters of the ponds, streams, springs, reservoirs, and wells used as public supplies by about 160 cities and towns in the State. The total number of such examinations has been about 30,000. Full reports upon this subject may be found in the reports of the board for the years 1887 to 1900, and in the special document upon the examination of water supplies published in 1890.

In addition to the regular routine mode of food and drug inspection in Massachusetts, much has been accomplished by work in special directions during the eighteen years since the work was begun. These may be enumerated as follows:

Investigations relating to the quality of milk as produced by the cow.

Analysis of Injurious and other Empirical Preparations.—Hair dyes, cosmetics, bitters, and tonics; alleged cures for the opium and alcohol habits, catarrh and asthma cures containing cocaine, etc.

Coloring Matters in Food.—Milk, butter, oleomargarine, preserved vegetables, salts of tin in molasses, etc.

Food preservatives; the quality of wines and liquors; report upon oleomargarine; the uses of glucose in food; the presence of trichina in pork products; the standard of vinegar; the use of the word "compound," etc.

The Standard of Milk.—For the purpose of determining the consistency of the existing standard of milk in Massachusetts, analyses were made in 1884 of the milk of six hundred cows, the samples being collected in different parts of the State, and from different herds of animals, of different ages, and in different seasons of the year. The average total solids of the entire number was found to be very nearly thirteen and one-third per cent. (the legal standard of Massachusetts is thirteen per cent. in winter, and twelve per cent. in summer). In later years these figures have been confirmed by further examinations upon the same point.

With reference to breeds of cows the results of analyses were as follows:

The average milk of 11 Jerseys	had 14.02 total solids and 4.34 fat.
" " " 92 native cows	" 13.00 " " " 3.31 "
" " " 30 Ayrshires	" 12.97 " " " 3.35 "
" " " 51 Durhams	" 12.73 " " " 3.28 "
" " " 47 Holsteins	" 12.51 " " " 3.29 "

Artificial Coloring Matter in Food.—The practice of employing coloring matters in connection with different articles of food is very common. The following may be named as very common examples:

Certain condiments, such as mustard, ginger and other spices, sugar, confectionery, preserved and canned goods (especially peas, beans, and tomatoes), milk, butter, oleomargarine, pickles, cake, syrups, jellies, jams, preserves, fruit syrups, flavoring extracts, and various sorts of beverages.

The coloring matters employed in connection with these articles of food may be classified as follows:

1. Harmless Colors.—These are usually made from some comparatively harmless organic products, such as annatto, caramel, turmeric, and cochineal. Aniline dyes, the products of coal tar, are also quite largely used for the coloring of milk, jellies, jams, preserves, and other articles of food.

2. Injurious Colors.—These are usually some of the metallic compounds, such as lead, copper, and tin.

It cannot be urged in regard to any of these colors, whether harmless or otherwise, that they have any true value as articles of food, and the demand for their use comes mainly from the trader, and not from the actual consumer, excepting, so far as the latter has been erroneously educated by the former as to color standards in the matter of food. No good and useful end is attained by their use, so far as the question of nutriment is concerned, and not only may harm ensue, but also even fatal consequences.

The use of artificial food colors is usually a fraudulent one, and they are consequently employed mainly for the purpose of giving to an inferior article of food a fictitious value, and thus to imitate other articles of a similar character, but of better quality, at least so far as their actual cost is concerned. The difference in actual nutritive value as articles of food may, however, be but little or nothing.

When examinations of milk were made in Massachusetts soon after the enactment of the law of 1882, it was found that the addition of coloring matter to milk was a very common practice in the cities. From the fact that colored samples of milk were almost invariably found to be adulterated in other ways, it was inferred that artificial coloring was practised for the purpose of concealing fraud, and of giving to milk which had been skimmed and watered the appearance of milk of good standard quality. Hence a vigorous warfare was made against the practice until it disappeared.

The question of the sale of preserved vegetables colored bright green by sulphate of copper came to the attention of the board, and the safe ground was taken that the introduction of poisonous metallic colors in any amount whatever should have no legitimate place in the food-supply of the people. A general law forbidding the

use of any sort of coloring matter in food would diminish the amount of food adulteration very decidedly.

Trichina in Pork.—Among the many questions relating to the food supply in Massachusetts the quality of the pork offered for sale has not been overlooked. Nearly thirteen thousand hogs have been examined under the direction of the board for the presence of trichina. Of this number 791, or 6.3 per cent., were found to be trichinous. Western hogs were found to contain less than Eastern, and of those raised in Massachusetts, those reared in public institutions and upon the refuse of cities were found to suffer the most. An examination was also made of sausages, and only one out of 365 was found to contain trichina.

Baking Powders.—No class of substances employed in the preparation of food has been the subject of so much discussion as these; and this is true notwithstanding the fact that, as elements in the matter of food economy, or as nutritive constituents of the necessary food of mankind, they have absolutely no value. Their use in the preparation of food was unknown until the early part of the present century, and for ages the human race thrived without them. Whenever bread was desired which should possess the properties of porosity and lightness of texture, in early times, some sort of leaven or yeast was employed for the purpose.

The use of baking powders at the present day is due, undoubtedly, to several causes, prominent among which is a demand for rapid and convenient methods of preparing bread and pastry for cooking; and, also, to the stimulus of trade produced by excessive advertising.

If the statements of rival manufacturers as to the poisonous qualities of all other baking powders except their own were to be credited, the use of these preparations would soon cease. Such false teaching does harm in misleading the community and creating a distrust. The fallacy lies partly in the want of discrimination between large and small doses of the ingredients of such powders. For example, common salt and mustard act as poisons in large doses and produce vomiting. In small doses, on the contrary, neither of them is harmful. Again the process of cooking changes the character of all baking powders.

It should be remembered that the introduction of these articles is of comparatively recent date; that they are compounded of several ingredients; that different manufacturers employ different ingredients to attain the same object or end, and, except in a few instances, standards of purity have not been adopted for this class of articles; hence the use of the terms *purity* and *impurity*, as applied to them, must be considered as arbitrary, or at least merely conventional. Experiments have been undertaken with the view of settling the question as to whether the ingredients of certain baking powders were injurious to health; and, while positively harmful results have in some instances been reached by the ingestion of considerable doses of such ingredients, when taken singly, still, the question of actual injury to the health of human beings on the one hand, or of freedom from harm on the other, from the use of baking powders in food, cannot be regarded as settled.

Intoxicating Liquors and Beverages.—The examinations of intoxicating liquors (including those of wines, ale, and beer), which have been made by the chemists of the board, have embraced samples which have been obtained both as drugs and as beverages, the former having been obtained exclusively from drug-stores, and the latter from places where such articles are retailed as beverages.

These examinations have shown that while adulteration of intoxicating liquors is a matter of very common occurrence, the presence of harmful adulterations, contrary to popular opinion, is rare. The following statement of the analyst in the report of 1886 is also confirmed by more recent examinations.

"For the sake of the public health, it is a cause for congratulation that the chief deviations from the requirements of the Pharmacopœia consist almost exclusively in the addition of alcohol, of water, and of harmless sweet-

ening and flavoring substances. Not a single sample of adulterated spirits in the popular understanding of that term, that is, one containing a more injurious ingredient than alcohol itself, was met with, although very few were exactly what they purported to be" ("Supplementary Report of Health Department, Mass.," 1886, p. 184).

Mixtures or Compounds.—The work of inspection includes a careful examination of the methods in which food is offered for sale, especially with reference to the question of labelling and the agreement of the label with the actual contents of the package to which it is affixed, since the statute of Massachusetts provides that "mixtures or compounds" are not to be treated as adulterated in the eye of the law, "provided that the same are not injurious to health and are distinctly labeled as mixtures or compounds with the name and per cent. of each ingredient therein."

This provision of the law is frequently disregarded, especially in the case of spices; and while the term "compound" is to be found after prolonged search upon the label, it often occupies an obscure position, or is printed in extremely small type, so that the term "distinctly labelled" does not apply.

It is not always safe to infer that all parts or packages in a lot of spices or similar articles of food are pure, because a single sample or package proves to be pure. The following case is an illustration: Two packages of powdered cloves were obtained at a grocery. The packages were in unbroken tin boxes of one-quarter pound each, and were purchased at an interval of three weeks; each package was of the same size, and each had exactly the same brand or label. On inquiry of the retailer it was found that both of the packages came from the same lot. It appeared on examination that the first package was considerably adulterated and the second was pure. A notice of this fact was therefore sent as usual to the retailer, who transmitted the notice to the manufacturer, who lives outside the limits of the State; he denied the charge, and hence, as is customary in cases of disputed analysis, samples were sent to a second analyst, who confirmed the statements of the first; and finally, four analyses were made with the same result, neither chemist knowing anything of the source of the samples, nor did either know that a previous analysis had been made.

This circumstance shows that it is not always safe to judge of the character of any group or lot of articles from the examination of a single sample.

Gross Appearances.—It is evident that very little reliance can be placed upon the mere external inspection of articles of food, such as may be made by the employment of the senses of taste, touch, smell, and sight, since the principal object of the falsifier of food preparations is to deceive the senses of the consumer by every possible resource of his art. It is a common experience in this department of work to receive articles of food from various sources, which are believed by the persons presenting them for examination to be adulterated, but which the analyst finds to be pure. This experience is true in the case of many of the articles of food which are liable to adulteration, and also of some articles which are scarcely ever found to be adulterated. The same experience has been met by other authorities who have had charge of similar work ("Report of Commissioner of Internal Revenue," Washington, 1887, p. cxliii.). Among the various articles which have been thus submitted to the board for examination (under the impression of the person submitting them that they were adulterated) were the following: Flour, sugar, molasses, vinegar, cream of tartar, honey, milk, butter, cheese, lard, salt, and several kinds of spices or condiments.

The reasons for these false notions with reference to the quality of articles of food are mainly the following: 1. A liability to mistake the deterioration of an article, or an inferiority in grade or quality, for an actual falsification or substitution. 2. A lack of familiarity with the true physical characteristics of the article in question.

Notices to Retailers.—It has been the custom of the board to issue a warning notice to retailers selling articles

found to be adulterated, in cases in which there was a reasonable probability that the retailer was not aware that such articles were adulterated.

In certain articles of food which have been specially liable to fraud, such as the various sorts of spices, condiments, cream of tartar, etc., adulteration has been greatly diminished, and is in many instances limited to parties whose business is conducted outside of the State, and cannot therefore be easily reached except through the customary notice sent to the retailer who buys of such outside parties.

These notices have proved to be a very efficient mode of diminishing adulteration. It is not the retailer who is seriously affected by the receipt of such a notice, but the wholesale dealer or manufacturer to whom it is speedily forwarded by the retailer, and who finds that he cannot afford to continue a wholesale imposition.

In the following table the ratio of adulteration found in articles of food and drugs examined in England and in Massachusetts during the period of inspection and enforcement of the laws is presented:

PERCENTAGE OF ADULTERATION AS GIVEN IN THE REPORTS OF EACH YEAR.

Year.	—England and Wales.—		Year.	Massachusetts. Ratio of adulteration. Per cent.
	Ratio of adulteration. Per cent.	Average five years. Per cent.		
1877.....	19.2	16.2		
1878.....	17.2			
1879.....	14.8			
1880.....	15.7			
1881.....	14.7			
1882.....	15.1	13.9	1883.....	44.5
1883.....	15.0		1884.....	54.2
1884.....	14.4		1885.....	42.4
1885.....	13.2		1886.....	38.7
1886.....	11.9		1887.....	34.3
1887.....	12.8	12.7	1888.....	30.3
1888.....	10.8		1889.....	31.9
1889.....	11.5		1890.....	31.5
1890.....	11.2		1891.....	32.8
1891.....	12.2		1892.....	33.7
1892.....	12.4	10.8	1893.....	31.2
1893.....	12.9		1894.....	31.9
1894.....	10.3		1895.....	38.5
1895.....	9.3		1896.....	26.6
1896.....	9.2		1897.....	24.8
1897.....	9.4	1898.....	25.2	
1898.....	8.7	1899.....	24.3	
		1900.....	26.1	

As a comment upon the foregoing table and the diagram below the following observations may be made:

First. The gradual lessening of adulteration under the action of judicious legislation.

Second. The much greater ratio presented in the column headed Massachusetts than in that of England and Wales. The reason for this great difference may be found, first, in the fact that in conformity to the requirements of the statutes in Massachusetts more than half the samples examined were milk. The standard of milk in the State is unusually high as compared with that of other countries (thirteen per cent. of solids, in winter, and twelve per cent. in summer). Hence it is the custom to report all samples as adulterated which are found to be below the foregoing limits. Now, there are many animals, especially those of the Holstein breed, which habitually produce milk having less than thirteen per cent. of solids. Hence it has not been deemed prudent to enter complaints at court to the full extent of the legal requirements. In the case of milk, therefore, the ratio of adulteration as reported is for the most part an apparent and not an actual adulteration. *Secondly*, the samples selected under the Massachusetts law are mainly such as are known or suspected to be adulterated, while in England many samples of such staple articles as bread, flour, sugar, and tea are annually examined, which are practically free from adulteration.

A prominent feature in the execution of the Massachusetts law is that of expenditures. The sum appropri-

ated for the work of the first year was \$3,000; of the second year, \$5,000; of the third year, \$10,000, and for the past nine years, ended 1901, it has been \$11,500 per year. About \$35,000 has been collected since and includ-

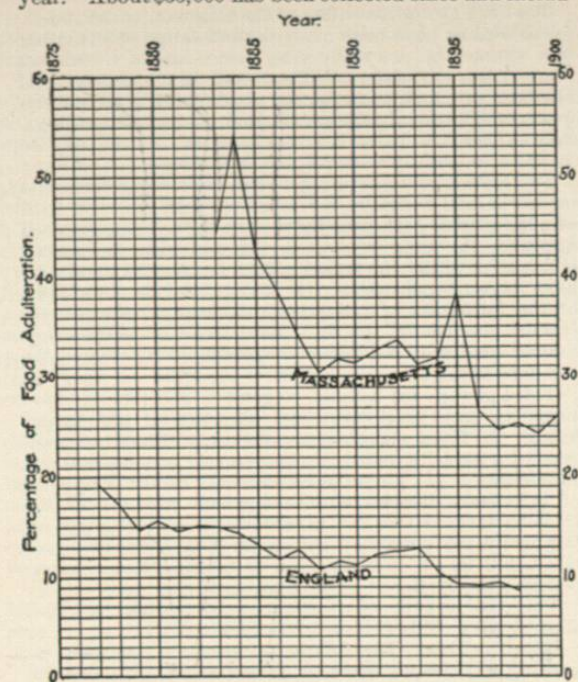


FIG. 2098.—Diagram showing the Ratio of Adulteration in England, 1877-1898, and in Massachusetts, 1883-1900.

ing 1888 in fines for violation of the law, this amount being returned to the treasuries of cities, towns, and counties.

Small amounts were expended annually at first for legal services, the entire amount for the first twelve years being \$1,639.63, or less than \$150 per year. But for the past six years, no expenses whatever have been incurred in the employment of counsel, the inspectors having become familiar with the methods of presentation of cases at court.

The annual ratio of samples of food collected for examination to the whole population in recent years has been as follows:

In England and Wales (1895-99).....	about 1 to each	700 inhabitants.
In Paris (1885-90).....	" 1 "	100 "
In Massachusetts (1895-99).....	" 1 "	250 "
In Ohio (1898) (612 samples).....	" 1 "	6,635 "
In Connecticut (1898) (1,265 samples).....	" 1 "	665 "
In New Jersey (1899) (1,792 ").....	" 1 "	1,026 "
In Minnesota* (1897-98) $\frac{1582}{2}$ samples).....	" 1 "	1,062 "
In New York (1895) (2,391 ").....	" 1 "	2,774 "

CONNECTICUT.—Acting under the provisions of a Law of 1895, the Connecticut Agricultural Experiment Station makes analyses of "food products on sale in Connecticut suspected of being adulterated," and is provided with an annual appropriation of \$2,500 for this purpose. The station also examines food products submitted by the Dairy Commissioners.

During the year 1898, the number of samples thus examined, exclusive of cattle feeds, was 1,265. The principal articles examined were as follows:

Jellies.—Seventy samples, 43 adulterated, the chief adulterants consisted of gelatinous materials (starch, paste, gelatin, agar-agar, and apple jelly), sweetness (glucose, and saccharin). Saccharin costs \$15 per pound, but is 500 times as sweet as sugar. It has no nutritive

* Biennial Report.

qualities. Coloring matter (mostly aniline dyes); fruit flavors, acids, and chemical preservatives. The report publishes the name of the brand and wholesale dealer and of the retailer in each case, also the place of sale, quantity, and price.

Of 51 samples of jams, preserves, and marmalades 45 were found to be adulterated, the principal adulterants were glucose, salicylic acid, and aniline or other artificial colors.

Tea.—Eighty-nine samples were examined and "none of the samples were found adulterated other than by facing."

Coffee.—Of 73 samples 11 were found adulterated, or 11 out of 45 to which the statutes would apply.

The percentage of adulteration of coffee in the past three years was as follows: 1896, 63.3 per cent.; 1897, 57.7, and in 1898, 24.4. This improvement the board attributes to the operation of the pure food law.

Ginger.—Ninety-one samples were examined, 24 adulterated.

Ale and Beer.—In 47 samples 12 were found to contain salicylic acid.

Sausage.—Of 19 samples 14 contained borax and 10 contained starch.

Honey.—Of 37 samples of honey the report says "five are probably pure, 22 may be genuine, though they seem to be made by bees fed somewhat with cane-sugar, or to have had invert sugar added to them; 2 unquestionably contain cane-sugar added as an adulterant, and 8 are adulterated with glucose syrup."

Examinations of milk, cream, maple syrup, mince meat, and canned vegetables failed to find any adulterations worthy of note.

Of 332 samples of spices in bulk and 242 samples in packages examined in the three years (1896-98) 41.5 per cent. of the former and 23.5 per cent. of the latter were adulterated.

The report recommends as the only safe course in buying spices, that they should be bought in "sealed packages, bearing the name of a reliable house whose goods have not been found adulterated."

Of 203 samples of molasses, 34 were found to be adulterated with glucose.

OHIO.—The Dairy and Food Commission of Ohio reports upon the examination of 612 samples of food examined in 1898, of which 292 or 47.7 per cent. were adulterated.

The principal articles examined were 31 samples of flour of which 4 were adulterated; 15 of maple syrup, 7 adulterated; 110 of milk, 31 adulterated; whiskey 54, of which 27 (or one-half) were adulterated; spices, 18, of which only one, a sample of cinnamon, was adulterated; wine 6, all pure; flavoring extracts, 17, of which 8 were adulterated; cream of tartar 6, of which 1 was adulterated; cheese 4, all genuine.

The number of prosecutions instituted was 68, of which 14 were for adulteration of milk, 33 for butter, and 5 for whiskey.

\$2,064.40 was collected in fines and fees. About \$8,000 was expended for legal services.

NEW JERSEY.—The Dairy Commission of New Jersey reports for the year 1899 that 1,792 samples of food were examined. Of these 712 were samples of milk, 959 butter and oleomargarine, 46 linseed oil, 46 condensed milk.

Six hundred and three of the milk samples were above the standard of 12 per cent. solids. Fifty of the samples purchased as butter proved to be oleomargarine; the remainder were pure butter.

Only five samples of milk contained formalin.

Five samples of linseed oil out of 46 were adulterated. \$3,050 were collected in fines.

MINNESOTA.—The Dairy and Food Commissioner of Minnesota, in his biennial report for the two years ended July 31st, 1898, presented the operations of his department under the dairy and food laws of the State. In addition to the general statutes relating to inspection of dairy products, other special laws have been enacted in

Minnesota for the prevention of adulteration of honey, confections, jellies, spices, and condiments.

The whole number of samples of food examined in the two years was 1,582, of which 807, or 51 per cent., were adulterated. The principal articles examined were as follows:

Vinegar,	807 samples, of which 466 were adulterated.	
Baking powder,	175 " " " "	131 " (alum).
Butter,	25 " " " "	4 " "
Cheese,	148 " " " "	18 " "
Cream of tartar,	2 " " " "	2 " "
Hominy,	32 " " " "	8 " "
Spices,	162 " " " "	26 " "
Jelly and jam,	28 " " " "	15 " "
Lard,	84 " " " "	34 " "

NEW YORK.—The State board of health of New York, in its fifteenth annual report (1895), presents the statistics of 2,391 samples examined during the year. Nearly all of these were drugs, which the chemist classified as follows:

Of good quality	1,307, or 57.1 per cent.
" fair quality	284, " 12.4 " "
" inferior quality	588, " 26.1 " "
Not as called for	41, " 1.8 " "
Excessive strength	59, " 2.6 " "
Total drug samples	2,289

The principal articles examined were 230 samples of ether, of which 114 were not of standard quality.

Compound spirits of ether, 109 samples examined, of which only 35 were of good quality.

Hydriodic acid, 127 samples, of which 111 were of good quality.

Dilute hydrochloric acid, 105 samples, of which 71 were of good quality.

Tincture of iodine, 205 samples, of which only 39 were of good quality.

Magnesia, 149 samples, of which 65 were of good quality.

Diluted phosphoric acid, 162 samples, 126 of good quality.

Aromatic sulphuric acid, 120 samples, only 9 of which were considered to be of good quality.

Precipitated sulphur, 104 samples, 38 of good quality.

Fifty-nine samples "contained large quantities of sulphate of lime."

The chemist also examined 102 samples of canned tomatoes, to determine whether they contained artificial coloring matter. Only 2 samples were found to be colored with eosin.

In the seventeenth report of the board, the director of the laboratory states: "Through lack of funds available for the purpose, the systematic collection and examination of food and drugs was suspended June 1st, 1895."

In INDIANA the State board of health has been authorized "to prepare rules and ordinances, where and when necessary, regulating minimum standards for food and drugs, defining specific adulteration, and determining the proper methods of collecting and examining drugs and articles of food." Under this provision the board has published standards for the following articles of food:

Milk, butter, margarin, cheese, coffee, tea, candy, cider, flour, jellies and preserves, honey, lard, molasses and syrups, olive oil, spices, vinegar, baking powders, and spirituous liquors and wines. The use of preservatives is also regulated. Milk must contain no added coloring matter nor preservative. It must not be sold if taken within ten days after calving, or within twenty-one days before expected calving; nor must it be sold if taken from a cow fed with damaged food, or such as will impart a disagreeable flavor. It must not be taken from a sick or diseased cow, nor from one to which polluted water has been given, nor from one which has been "kept under conditions contrary to the rules of the State board of health governing dairies."

CLASSIFICATION OF WORK.—The work of a food analyst embraces a variety of branches. In a recent monograph by two French army surgeons, Polin and Labit, the following classification of such work is presented.

Three principal groups, as follows: 1. Examination of articles in which the alterations in character are either of a chemical or of a mechanical kind. 2. Those which are biological. 3. Those which are parasitic.

The first group is subject to the following subdivision: (a) Additions have been made to the food products either of a commercial or a fraudulent nature, and of substances more or less harmful. (b) The vessel in which the food has been prepared or preserved renders the food poisonous. (c) The manipulation of food, or its surroundings, may expose it to harmful contamination. (d) It may be mixed accidentally with foreign substances.

The second group is subject to the following divisions: (a) An animal designed for food has been fed with food of a harmful or poisonous character; the poisons absorbed appear in the milk, or, not having had time to become eliminated, either the whole animal or some of its organs have become poisonous. (b) Recognizes the possibility of the formation of poisonous ptomaines in meat, under certain conditions. (c) In consequence of certain unknown conditions wholesome vegetable food occasionally becomes harmful.

Third group: (a) Animal, vegetable, and mineral food products may be invaded by parasites of the larger kinds. (b) Food may become the prey of micro-organisms of a parasitic nature, involving the processes of (1) fermentation, (2) putrefaction, and (3) the development of infectious diseases, either of which may render the food harmful, either by infection, by ptomain poisoning, or by the combined action of both. (c) Food contaminated by its surroundings, or by infectious contact, becomes the carrier of pathogenic germs.

This list is sufficiently ample to show that the food analyst has a wide field of investigation.

REGULATIONS.—The following special regulations regarding food inspection were published by Dr. Schumacher Kopp, canton chemist of Lucerne, and also a member of the International Jury of Award at the Paris Exposition of 1889.

The following extract is taken from his report: *Collection of Food.*—In collecting food the greatest cleanliness should be observed. Clean bottles, and, if possible, new ones, should be used in collecting fluids. Bottles should be closed only with new corks.

In collecting drinks, the local experts must be present, and the beverages should be drawn from the regular source of supply.

In collecting milk, fill the bottle to the cork; seal every bottle at once after corking it. If milk is collected in a stable, the cows must be milked quite dry, by a disinterested person, and in the presence of the local magistrate or a policeman.

Strong glass, or porcelain, or crockery vessels should be used for the collection of butter.

For coffee, tea, and meal, boxes of clean wood or pasteboard should be used.

The use of paper bags for collecting samples is forbidden.

Bread and sausages should be wrapped in clean white paper; if possible, parchment paper.

The use of printed or colored paper for this purpose is forbidden.

Quantity of Food Necessary for Examination.—1. For the local health authority: Beer, 1 litre; bread, one whole loaf; brandy, 0.3 litre; butter, 50 gm.; vinegar, 0.2 litre; coffee, 30 gm.; meal, 200 gm.; milk, 0.5 litre; cider, 0.5 litre; tea, 10 gm.; drinking-water, 1 litre; wine, 0.5 litre; small sausages, one whole sausage; large sausages, 100 gm.; honey, 50 gm.

For the canton chemist the quantities are nearly the same as the foregoing, but in most instances two samples are taken. When two samples are taken, for example, of water, 2 litres in one bottle are not meant, but two bottles each containing 1 litre.

Sealing.—The samples collected must be sealed at once upon the spot, with an official seal. This seal must cover the whole head of the bottle, in order to keep the air out and to avoid leakage.

Marking.—The samples should be plainly marked in two different places immediately after collection, one on the neck of the bottle, and the other on the opposite side of the body of the bottle. Each marking must contain: (1) The number and name of the article collected; (2) name of the jurisdiction authorizing the collection, and of the collector.

Provision is made for the collection of two samples when necessary, so that, in case of a dispute, the second may be examined under the auspices of a superior authority. The samples sent to the canton chemist must contain no information as to their source. A report must also be sent to the health officer, stating the articles collected, the date of their collection, name of the dealer, his source of supply, and in every case his remarks upon the character of his goods. This report must be signed by the local expert and by the police assisting in the collection. All samples sent to the canton chemist must be so packed with sawdust, paper, or wadding, that they may be transmitted without injury. The name of the sender must accompany all packages, letters, etc., and they must be prepaid; otherwise they will not be received.

In sending milk to the canton chemist, observe especially: 1. That the milk is thoroughly cooled in cold water before it is forwarded. 2. (a) In the accompanying report mention must be made first of the number of cows from which a sample of mixed milk is taken; (b) how many cows, if any, are in the stable which have calved within fourteen days of collection of the milk; (c) how many cows, if any, are near the time of calving.

FOOD STANDARDS.—Bread.—The water in a freshly baked loaf of bread should not be more than thirty per cent. of its weight, and the ash, after deducting the common salt, should not be more than one per cent.

Butter.—This name should be associated only with the fat which is made from milk only. Artificial butter must be properly marked as such, being designated as margarine, and packed in separate parcels. Such names as "cheap butter," "tub butter," and "Alpine butter," are forbidden, except as applied to pure butter.

Vinegar must contain four per cent. of acetic acid. The addition of other acids, flavoring matter, and aniline colors, is forbidden.

Honey must be called honey only when it is free from adulteration. Such terms as "table honey," "Swiss honey," and "Appenzell honey," etc., are forbidden, except when applied to pure honey. Substitutes for honey, such as syrups, etc., and also mixtures of these with pure honey, must be plainly marked as such.

Coffee must not yield more than four per cent. of ash (Mocha, eight per cent.). Artificial coloring is to be regarded as adulteration. Mixtures of coffee with other substances are not to be called coffee.

Rye meal should not yield more than two per cent. of ash.

Wheat meal should not yield more than one and a half per cent. of ash. The water of rye and wheat meal should not be more than fifteen per cent. of its weight, and that of other meals eighteen per cent.

Milk.—Milk must be sold as drawn from the cow. Its specific gravity at a temperature of 15° C. (60° F.) before skimming should not be less than 1.029 nor more than 1.033, and when skimmed after twenty-four hours it should not be less than 1.033 nor more than 1.037. The chemical examination should show at least 11.5 per cent. of solid residue, and at least three per cent. of fat.* When taking milk at dairies for comparison, it is desirable to have examinations made within the shortest possible time, three days at the longest, and the cows should be milked dry by disinterested persons. "Centrifugal" milk should be marked as such, and when inspected at a

* The standard of whole milk in Paris is a minimum of 11.5 per cent. of solids and 2.7 fat. That of the British Society of Public Analysts is 11.5 total solids and 2.5 fat. That of the State of New York is 12 per cent. of solids and 3 per cent. fat. Of New Jersey 12 per cent. of solids. Of Massachusetts 13.7 per cent. of solids in winter and 12 per cent. in summer.

temperature of 15° C. should have a specific gravity of from 1.034 to 1.037, and should have at least 8.4 per cent. of solids. The sale of the milk of sick cows is forbidden, as well as that of cows within eight days before and after the time of calving.

Cider, after fermentation, must not have less than three per cent. by weight, and 3.76 per cent. by volume of alcohol, and not less than 1.5 per cent. of solids, nor less than 0.15 of one per cent. of ash.

Tea must not have more than seven per cent. of ash.

Water for domestic use must have neither color nor sediment. Nor should it have smell or bad taste. Water containing infusoria and bacteria should be avoided.

Sausages should be made only of healthy, fresh meat, fat, and spices in general use. Any additions of starches are considered as adulterants.

PROPRIETY OF INTERNATIONAL LAWS ON THE SUBJECT OF FOOD INSPECTION.—Dr. Von Hamel Roos expressed his opinion at the International Congress of Hygiene at London, in 1891, that a *codex alimentarius* should be adopted for civilized nations, as agreed upon by a competent commission for general use. He commented upon the different standards of different countries, and as an example quoted the milk standard of Massachusetts (which is thirteen per cent. of solids in winter and twelve per cent. in summer), while milk having 11.5 per cent. solids is deemed to be pure in Holland.

At the International Congress of Agriculture at The Hague, in the following month (September, 1891), conclusions were formulated as to the need of uniform laws relative to food adulteration and the protection of food products. It was then voted "that each State should establish a commission of competent men, who should be charged with the duty of investigating the methods of analysis in use, and of determining the proper methods of such analysis, and that each state should publish an annual report of its proceedings and exchange reports with other states."

NEW FORMS OF ADULTERATION WHICH HAVE APPEARED RECENTLY.—*Arsenic in Food, in Drink, and in Drugs.*—In the preparation of many articles of food and drink, glucose enters as an ingredient, being a cheaper form of sugar than that which is prepared from the sugar-cane. In the manufacture of glucose it is necessary to use sulphuric acid, this acid being removed before the process is completed. The crude sulphuric acid often contains arsenic in consequence of the presence of arsenic in the iron pyrites from which a large part of the acid in the market is made.

Glucose is now used largely in the manufacture of beer, and as a consequence beer-drinkers in England have suffered seriously from arsenical poisoning. From the report of Dr. Buchanan to the local government board, dated February 7th, 1901, it appears that 3,652 cases of arsenical poisoning had occurred in Manchester, Liverpool, Chester, Salford, and neighboring places, and that many deaths had taken place among this number. Most of these persons were habitual beer-drinkers.*

A parliamentary committee was appointed in February, 1901, charged with the duty of investigating this subject and reporting upon it. This committee reported in July, substantially confirming the statement of the local government board. It was found, according to this report, that the glucose used came from one firm of manufacturers of brewing sugar, and upon analysis of several samples by different chemists quantities of arsenic were found, amounting in one instance to 9.17 grains per pound of glucose.

The conclusions of this commission, as summed up in this preliminary report of July 10th, 1901, are as follows:

"On consideration of all the circumstances connected with the recent epidemic, we think that some improvement in administrative measures is called for. It is evident that amendments have to be considered, not only with reference to the question of arsenic in beer, but also

* Report to the Local Government Board on "Recent Arsenical Poisoning Attributed to Beer," by Dr. G. S. Buchanan, London, 1901.

in relation to the broader question of the machinery available to public health authorities to obviate the risk of arsenic or other poisonous substances reaching articles of food and drink in general.

"Upon this important general question we consider it essential to await further evidence before making final recommendations. But meanwhile, seeing that the epidemic of 1900 has been caused solely by beer, and that there exists in the case of breweries (although for another purpose) a system of close inspection by a government department—the board of inland revenue—we think that as a provisional measure the machinery under this system might effectively be turned to account to check the introduction of arsenic into beer by way of its ingredients.

"To this end we recommend that the board of inland revenue should possess and should exercise powers to specify in detail individual ingredients of beer which are liable from their origin or mode of preparation to be contaminated by arsenic, to prescribe for every such ingredient, and for the different materials used in their preparation, an adequate test which should insure their freedom from arsenic; and to prohibit, under penalty, the use in a brewery of any material which infringes the prescribed test.

"We are of opinion that by requiring the brewer to produce satisfactory evidence (whether in the form of a guarantee from the vendor, or as the result of analysis by the brewer's chemist, stated in such terms as the board of inland revenue may determine) that the prescribed tests have been applied to all the ingredients of beer at the brewery which have been specified as liable to contain arsenic, and that, by the examination of samples in the government laboratory, an immediate and effective safeguard to the public with regard to arsenic in beer can be secured."

Among the adulterations which have increased very much in recent years are the various preparations of preserved fruits, jams, jellies, and marmalades, which, in the majority of instances of those which are sold at a low price, are adulterated with a multitude of substances other than those which they profess to be. They are also often highly colored with aniline dyes. Flavoring extracts are also adulterated seriously in many ways, and often contain none of the essential oil which is named upon the label. This form of adulteration has greatly increased in the past two years.

Artificial Coffee Berries.—An artificial coffee berry was made in New Jersey and advertised for sale. The berry was a very good imitation of the genuine in shape and color, but was entirely devoid of the taste of coffee. Its texture was easily distinguished by the microscope, and hence it proved to be a failure as a practicable adulteration. It was composed of burnt flour or starch.

False Nutmegs.—Dr. Vanderplanken† describes an artificial nutmeg having the following characteristics:

1. Absence of vegetable structure on section.
2. When treated for three minutes with boiling water, the nut is softened and breaks into a powder under the pressure of the fingers.
3. The ash amounts to more than eleven per cent., that of the genuine nut being from two to three per cent.
4. They are heavier than the genuine nuts.

A very good photograph of the true and false nuts is presented in the paper of Dr. Vanderplanken.

Coloring Matter.—The use of caramel and annatto is less frequently used for the false coloration of milk, and an aniline dye is now used, the quantity required being comparatively small.

Preservatives.—The use of boric and salicylic acids has increased recently for the preservation of meat, fish, milk, and other perishable articles of food, and still more recently formalin has come into use for the same pur-

* First Report of the Royal Commission appointed to inquire into arsenical poisoning from the consumption of beer, and other articles of food and drink. Part I. London, July 10th, 1901.
† Revue Internationale des Falsifications, vol. xlii., April, 1900, p. 44.

pose. The method employed for the detection of formalin is detailed in the report of the State board of health of Massachusetts for 1897.

Saccharin.—The question of the propriety of using saccharin as a sweetening agent in place of sugar is under discussion in France.*

The following list embraces most of the common articles of food which are liable to adulteration, together with the character of the adulteration.

ARTICLES LIABLE TO ADULTERATION, WITH THE CHARACTER OF ADULTERATION.

Name of article.	Harmful adulterants.	Fraudulent adulterations.
Arrowroot.....		Other and cheaper starches.
Alcoholic liquors.....	Excess of fusel oil, harmful coloring matter.	Added water, sugar, alcohol, and coloring matter.
Bread.....	Alum, used as such; rare in United States.	Other and cheaper kinds of flour than those which are called for. The contained water should not be over forty-five per cent.
Butter.....		Other animal and vegetable fats, such as beef suet and cotton-seed oil, lard, coloring matter, and excess of water.
Beer.....	Salicylic acid and other preservatives; arsenic as an impurity in glucose; water polluted with sewage.	Burnt sugar, licorice, molasses, glucose, quassia, salt, etc.
Canned goods.....	Lead, tin, and zinc from interior of cans and from solder; copper as a coloring agent; harmful preservatives.	Contents of cans damaged by improper sealing and from other causes; use of coloring matter; use of old and damaged articles such as "soaked" peas.
Catsup.....	Salicylic acid and other preservatives.	
Cheese.....	Poisonous colors in the rind.	Lard, cotton-seed oil, and deficiency in fats.
Cider.....	Salicylic acid and other preservatives.	Water.
Cloves.....		Corn, wheat, allspice, nutshells, peas, ginger, pepper, charcoal, dirt, and clove stems.
Cocoa.....		Animal fats, starch, flour, sugar, and caramel.
Coffee.....	Harmful colors.....	Chicory, dandelion, beans, peas, rye, wheat, almond shells, and brown bread, imitation berries made of burnt starch, etc.
Confectionery.....	Harmful colors and flavors, terra alba, talc, baryta, fusel oil, and brandy.	The term "confectionery" has no standard and many substances enter into its composition. Glucose is largely used as well as cane-sugar, neither of which is harmful.
Cooking utensils.....	Arsenic; antimony and lead in the glazing.	
Dried fruits.....	Occasional slight traces of zinc from the evaporating trays.	
Flavoring extracts.....		Deficiency in essential oils and alcohol; excess of water; substitution of cheaper flavoring ingredients, addition of artificial colors.
Flour.....		Rarely adulterated in United States except with corn-meal.
Fruit syrups.....	Aniline colors and flavors.	Coloring agents generally; cheaper fruits and often no fruit whatever.
Ginger.....		Turmeric, Cayenne pepper, mustard, inferior and exhausted powder.
Gluten meal.....		Starch (injurious when the meal is employed as a diabetic food). Very few of the so-called gluten meal preparations found in the market consist of true gluten without starch.
Honey.....		Glucose, sugar, molasses, syrups, and dead bees introduced for effect.

† Revue Internationale des Falsifications, vol. xlii., 1899, p. 134.

ARTICLES LIABLE TO ADULTERATION, WITH THE CHARACTER OF ADULTERATION.—Continued.

Name of article.	Harmful adulterants.	Fraudulent adulterations.
Horseradish.....		Turnips.
Ice cream.....	Poisonous dyes and flavors and as an accidental ingredient, poisonous ptomaines.	
Jams and jellies.....	Harmful dyes and flavors.	Glucose, gelatin, substitution of cheaper fruits, cores, parings, and seeds.
Lard.....		Other animal and vegetable fats and water.
Lime juice.....	Mineral acids and preservatives.	Tartaric and other organic acids.
Mace.....		Starches, and substitution of wild mace for true mace.
Maple sugar.....		Usually cane-sugar.
Maple syrup.....		Glucose and cheaper cane syrups.
Meat.....	The product of diseased animals; presence of parasites, and of ptomaines.	Substitution of cheaper kinds.
Milk.....	Substitution of water and removal of cream. These are much more than mere commercial frauds, they rob the milk of its valuable nutritious constituents; use of preservatives.	Addition of coloring matters, caramel, annatto, aniline dyes.
Milk-sugar.....		Cane-sugar and glucose.
Molasses.....	Salts of tin.....	Glucose.
Pickles.....	Copper, alum, mineral acids.	
Preserves.....	Aniline dyes and preservatives.	Apples, pumpkins, turnips, glucose, and generally cheaper sorts of fruit, and fruit and vegetable seeds and other refuse products.
Sago.....		Cheaper starches.
Sausages.....		Colored with Bismarck brown and other colors. Made from meat of diseased animals.
Spices.....	Lead coloring matter in Cayenne pepper.	Starches generally, sawdust and other forms of wood, ground nut shells, olive and date stones, turmeric, charcoal, dirt, pepper and mustard hulls, cheaper kinds of spice, removal of essential oils; substitution of wild mace for mace.
Sugar.....	Salts of tin.....	Cane-sugar is rarely adulterated in United States except by use of ultramarine, which is employed to give a better color (bluish-white instead of yellowish-white) for same purpose as indigo is added to starch. So far as can be learned the ultramarine is harmless.
Tea.....	Lead, Prussian blue and other earths.	Leaves of other plants, spent tea, and substitution of cheaper kinds.
Vinegar.....	Mineral acids and aniline colors.	Glucose, apple pomace and jelly, water; cheaper vinegar for cider vinegar; caramel and other coloring matter.
Wines.....	Plaster of Paris, sulphur, harmful colors.	Alcohol (fortification), water (dilution), sugar; entire substitution of other articles as cider for champagne; fictitious imitations.

ADULTERATION OF DRUGS.

In nearly all countries in which efficient laws have been enacted for the purpose of preventing the adulteration of food, additional powers have also been provided for similar action in regard to drugs. Since, while it is important that the nutriment intended for the daily support of man should be of the best quality, it is also important that those articles which are used in the treatment of disease should be free from impurity.

In Great Britain and the continental countries of Europe generally, modern legislation for this purpose is very efficient, and the means provided for drug inspection are similar to those which are provided for food, the collections being made by the same set of officials, the

examinations by the same analysts, and the work performed in the same laboratories.

ENGLAND.—In England the inspection of drugs is carried out under the provisions of the Sale of Food and Drug Act of 1875. The substance of this act is presented elsewhere in the section on Food Inspection. Dr. Hime says of this statute: "There are probably no statutes of the length of the Sale of Food and Drugs Act which have been the source of as much litigation and of as many appeals."* By the provisions of this act "the term 'drug' includes medicine for external or internal use."

It is also provided that "no person shall treat any drug so as to affect injuriously the quality or potency of the drug, with intent that the same may be sold in that state, under a penalty of not exceeding £50 for the first offence."

Under the operation of this law 235 public analysts have been appointed to carry out the work of inspection of such articles of food and drugs as are collected in the different districts of England.

The following figures present a condensed summary of the inspection of drugs since 1877:†

Percentage of adulteration found on examination: For the five-year period 1877-81, 22 per cent.; 1882-86, 13.6 per cent.; 1887-91, 13.1 per cent.; 1892-96, 12.3 per cent.

During the year 1896-97 the percentage of adulteration was 11.3 per cent. During 1897-98 it was 10.5 per cent.

The total number of samples of drugs examined in 1896-97 was 1,380, of which 156 were found to be adulterated. In 1897-98 the adulterated samples were 206 out of 1,964. The principal articles found to be adulterated in 1897-98 were sweet spirits of nitre, 39 samples out of 156; rhubarb, 35 out of 198; quinine, 10 out of 99; sulphur, 2 out of 90; glycerin, 23 out of 345; lime water, 13 out of 20. To these should be added in the former year: wine of ipecac, 10 samples out of 29; and beeswax, 10 samples out of 46.

The number of prosecutions conducted in 1897-98 against offenders of this class was 87, and 53 fines were imposed.

GERMANY.—The German code of laws relating to the sale of drugs is contained in a series of statutes which have been enacted and amended at different times during the past century. Special care is given in these statutes in relation to the sale of poisons, and lists of such poisons are published, allowing certain classes of poisons to be sold under restrictions (Law of 1890, January 27th).‡

The law in regard to the sale of proprietary medicines is also quite explicit. By these statutes it is provided:

1. That unapproved panaceas cannot be sold.
2. In consequence of the unrestricted sale of patent medicines of a worthless character, a decree was published in 1867 that "all requests for the right to prepare and sell a secret remedy, although shown to be harmless, will be denied to private individuals, but concessions granted exceptionally in former years are to expire with the decease of the persons to whom they are granted, and cannot be transmitted to others."
3. Advertisements or private announcements of secret remedies are strictly forbidden.

In Berlin the police authorities cause patent medicines to be analyzed with reference to their composition. Attention is also paid to the price of such articles, and if necessary they can acquire information relative to the methods of manufacture. It is also allowable to publish the composition, the actual value as a remedy, and also any facts that may be revealed as to the character of the manufacture, and if necessary to warn the public against its use.

These regulations have had a salutary influence in Berlin, and have had the effect of driving the traffic in such articles into outlying provinces, where the manufacturers continue to plunder the public without hindrance (und daselbst das Publikum auszubeuten versuchen) (Ministerial Rescript of April 10th, 1886).

* "The Practical Guide to the Public Health Acts," by Thomas Whiteside Hime, B.A., M.D., London, 1901.

UNITED STATES.—A statute existed in several States at an early date, providing that "whoever adulterates, for the purpose of sale, any drug or medicine, or sells any fraudulently adulterated medicine, knowing the same to be adulterated," shall be subject to a penalty.* Experience has shown, however, that laws of this character, requiring proof of guilty knowledge of the fact of adulteration in order to secure conviction, are of but little value in affording protection to the community. Hence it was that in subsequent legislation the sale of adulterated articles was deemed to be an offence subject to a penalty. Under the rigid enforcement, however, of such a law, much hardship might be inflicted upon retailers who purchase most of their stock at wholesale, and systems have therefore been devised by which retailers have been given the benefit of a warning notice to the effect that certain articles sold by them were adulterated, and that their sale should not be continued, or that they should be sold under some legal limitation, with the understanding on the part of the purchaser that they were goods of inferior quality. Such notices are usually forwarded direct to the wholesaler, and have a wholesome effect in correcting abuses.³

In a report made by C. L. Diehl to the national board of health in 1880⁴ appears the following statement: "Previous to 1848 and for some years afterward, the condition of the drug market appears to have been in a very unsatisfactory state. This condition was largely attributed to the importation of inferior and adulterated drugs, which, in the absence of a law specifying a standard of quality, were freely admitted at our ports of entry. In 1848 Congress passed a law regulating the importation of drugs, which went into effect July 15th of that year, and during the first ten months Dr. M. I. Bailey, the special examiner at New York, had occasion to reject about 90,000 lbs. of drugs, such as rhubarb, senna, opium, jalap, gamboge, iodine, croton oil, sarsaparilla, etc.; and during the administration of his office, from 1848 to 1857, he found it necessary to reject over 900,000 lbs. of 'unsafe,' adulterated, and improper drugs and medicines. As a result of this action, the character of the drugs imported soon showed decided improvement."

The operation of this law does not appear to have been entirely satisfactory, if we may judge from the report of a committee of the American Pharmaceutical Association, which in 1855 "referred to the disregard that is paid to proper qualifications in the appointment of officers to carry out the requirements of the drug law." At a later date Mr. Diehl says: "Some attention is paid to the fitness and qualification of applicants, and the execution of the law is in the main satisfactory, though by no means incapable of being improved and rendered more efficient by wise revision."

After the establishment of State boards of health, investigations were begun in several States relative to the quality of the drugs found and offered for sale in these States, the result showing that legislation was necessary to prevent adulteration in the sale of drugs as well as in their importation. Laws have therefore been enacted, usually in conjunction with the food laws, for protection against this class of adulterations.

The term "drugs" in the Massachusetts Act of 1882 embraces "all medicines for internal and external use, antiseptics, disinfectants, and cosmetics." Hence the work of the State board of health, in this direction, has not been confined to the remedies defined in the United States Pharmacopœia, but has embraced many other articles, and especially empirical preparations of a more or less harmful character.⁵

The following section of the Massachusetts Act presents the requirements of the law relating to the standard of pure drugs, and has been enacted in practically the same form in the following States, according to Dr. Chapin: California, Connecticut, District of Columbia, Illinois, Indiana, Kansas, Kentucky, Michigan, Mississippi, Nebraska, New Jersey, New York, North Caro-

* Law of 1853, Mass., P. S. 208, § 5.

ina, Ohio, Oregon, Pennsylvania, South Dakota, Tennessee, and Wisconsin.

Acts of 1882, 263, § 3, Mass., as amended by later statutes.

An article shall be deemed to be adulterated within the meaning of this act—

(a) In the case of drugs: (1) If, when sold under or by a name recognized by the United States Pharmacopœia, it differs from the standard of strength, quality, or purity laid down therein, unless the order calls for an article inferior to such standard, or unless such difference is made known or so appears to the purchaser at the time of such sale; (2) if, when sold under or by a name not recognized in the United States Pharmacopœia but which is found in some other pharmacopœia or other standard work on *materia medica*, it differs materially from the standard of strength, quality, or purity laid down in such work; (3) if its strength or purity falls below the professed standard under which it is sold.

Of the drugs found to be of a specially inferior quality during the earlier investigations of the analysts in 1883 and 1884 were the following:

Tincture of opium (U. S. P., 1.20 to 1.60 parts per 100 of morphine), 144 samples out of 197 fell below the required limit of 1.2, and some had as little as 0.01, 0.14, 0.17, or a mere fraction only of the minimum requirement. Citrate of iron and quinine (legal requirement twelve per cent. of quinine), eighty-five per cent. of the samples had less than the required amount, and several had as little as 3 and 3.5 per cent., or but little more than a quarter of the requirement. Of powdered jalap only one sample out of twelve conformed to the pharmacopœial standard. Of 192 samples of powdered drugs, 39 were found to be adulterated in various forms. Of 19 samples of compound spirits of ether, 2 only contained the required amount of the ethereal oil required by the statutes. Of 23 samples of spirit of nitrous ether, scarcely any had the required amount of ethyl nitrite.

Twenty-two samples or lots of the quinine pills made by different manufacturers were examined. These were examined in two groups, at an interval of several months, during which time the manufacturers had become aware of the work of the board in this direction. The analysis of the second group showed in nearly every instance an improvement. The following figures indicate the percentages of the required weight of the pills made by nine manufacturers, in the two series of analyses:

	First series.	Second series.		First series.	Second series.
1.....	93.5	97.9	6.....	84.7	89.5
2.....	86.6	97.3	7.....	93.8	101.1
3.....	93.3	99.6	8.....	104.4	100.5
4.....	93.8	100.7	9.....	97.0	97.1
5.....	107.6	76.5			

The foregoing list shows an improvement in each case except two. Of 106 samples of pharmacopœial spirits and wines, only 10, or 9.4 per cent., conformed to the legal requirements.

In proof of the improvement under the action of the statutes, very marked changes for the better have been found to have taken place in many of the foregoing articles.

Among the non-pharmacopœial preparations examined in 1885 were 11 hair dyes, all of which contained lead in large amounts; also 20 different fraudulent nostrums advertised for the cure of the opium habit, most of which were solutions of morphine. One of them was the so-called "Keeley gold cure," which was found to contain no gold whatever. In 1887 about fifty proprietary articles, sold as tonics and bitters (some of which were advocated as temperance drinks), were examined chiefly for their alcoholic contents. All were found to contain alcohol in the proportion of six to forty-eight per cent. by volume. One of these, which was advertised as a remedy for inebriety and the opium habit, was the celebrated "Scotch oats essence," containing alcohol and morphine, the latter in varying proportions. This nostrum very soon disappeared after its analysis had been

published. Cocaine as a common ingredient in the composition of remedies for asthma, hay fever, and catarrh has also been the subject of examination.

Cosmetics for the complexion, termed face bleaches, freckle lotions, skin tonics, have been examined and found to consist of strong solutions of corrosive sublimate. Of this class were Ruppert's complexion bleach, and Yale's complexion bleach, Perry's freckle lotion (39 grains corrosive sublimate in an eight-ounce bottle), and Mrs. McCarrison's diamond lotion.

Skin Success Ointment contained red oxide of mercury. Cocaine as an active ingredient was found in Dr. Birney's catarrh remedy, Instant cold relief, Dr. Tucker's asthma cure, Azmayde, and Coca-kola.

It was required that such articles, if sold at all, should be labelled as poisons, and sold only under careful restrictions. Seventeen complaints were made against parties selling the most poisonous of these articles in violation of the statutes.

The powerful influence of the proprietary medicine interest, however, prevailed, and that section of the statutes which required that poisonous patent medicines should be labelled as poisons was repealed, so that the people are now deprived of that protection which was once afforded by law.

As an evidence of the character of the most poisonous of these preparations (cosmetics), it may be said that the cost of a bottle of face bleach which sells at \$2 is about five cents, bottle included, and the package is often marked "harmless."

In later years the following were some of the more important adulterations found upon analysis:

In 1897, of 18 samples of chlorinated lime, all proved to be below the required standard. Eight of these were very deficient in available chlorine. All the samples obtained in 1898 and 1899 were also deficient.

Of distilled water, only 19 samples out of 69 obtained in 1897, 1898, and 1899 were free from solid residue. The highest amount of solid residue in any sample was 23.7 per 100,000. A comparison of the water collected from drug stores in certain localities with that collected from the public water supplies of the same cities and towns, made it apparent that it was quite a common custom for druggists to fill orders for distilled water from the faucet supplying the city water.

Of 61 samples of powdered opium collected in the same years and in 1900, 20 were deficient in morphine strength. (This result shows a decided improvement over the samples collected in 1883-84.) Of 172 samples of tincture of opium, 133 were deficient, but many of them were quite near the minimum limit of 1.3 per cent. of morphine.

Of 30 samples of compound spirits of ether, 18 were deficient in ethereal oil.

Of 113 samples of tincture of iodine, 95 were deficient in iodine.

Of 156 samples of olive oil, 47 were either wholly or in part cotton-seed oil.

Of 37 samples of lime juice, all except 1 contained salicylic acid; and one sample marked "Santiago, W. I., triple refined," consisted of a dilute solution of hydrochloric acid flavored with oil of lemon and preserved with salicylic acid. It contained no lime juice whatever.

Thirteen samples of so-called diabetic flour were examined for starch, and only 3 were free from it; 7 of these contained as much as 60 per cent. of starch in each sample.

In 1900 and in 1901 special attention has been given to the analysis of drugs for arsenic, with the result of finding it in appreciable amounts in glycerin and in phosphate of soda.

Of 11 samples of grape juice collected in 1900 5 were found to contain either boracic or salicylic acid.

The pharmacopœial wines and liquors were found to be quite generally falsified by the addition either of alcohol, water, or sugar, and only very rarely with substances of a more injurious character than the alcohol.

NEW YORK.—The State board of health of New York for several years maintained a system of drug inspection

under the direction of a competent chemist, which was practically discontinued in 1895 by withdrawal of the necessary appropriation.⁷

In its report for the year 1893, it appears that 2,637 samples of drugs were collected and 2,434 were examined, making a total of 7,035 samples collected and 6,832 examined since 1891. These were all official articles having a definite standard, and of these 1,018, or 41.9 per cent., were of "good" quality; 446, or 18.4 per cent., were classed as "fair"; 699, or 28.7 per cent., as "injurious"; 131, or 5.3 per cent., were "not as called for"; and 140, or 5.7 per cent., were of "excessive strength."

The principal articles were as follows: Dilute acetic acid, 231 samples examined, 61 good, 52 fair, 78 inferior, 34 excessive strength, 6 not as called for.

Water of Ammonia, 297 samples, 77 good, 66 fair, 94 inferior, 54 excessive strength, 6 not as called for.

Capsicum, 17 samples, 13 good, 1 fair, 3 inferior.

Cresote, 222 samples, 119 good, the remainder consisted chiefly of carbolic acid.

Compound Spirits of Ether, 206 samples, 54 good, 22 fair, 129 inferior.

Stronger Ether, 144 samples, 91 good, 7 fair, 46 inferior.

Ginger, 15 samples, all good. Dilute Hydrochloric Acid, 232 samples, 151 good, 45 fair, 32 inferior, 4 excessive strength.

Compound Solution of Iodine, 100 samples, 68 good, 23 fair, 7 inferior, 1 excessive strength, 10 not as called for.

Tincture of Iodine, 237 samples, 57 good, 96 fair, 81 inferior, 3 excessive strength.

Ipecac, 15 samples, all good except one. *Tincture of Iron*, 21 samples, 19 good, 2 fair.

Magnesia, 111 samples, 52 good, 3 fair, 50 inferior, 6 not as called for.

Aromatic Sulphuric Acid, 289 samples examined, 29 good, 93 fair, 167 inferior.

Dilute Sulphuric Acid, 259 samples, 171 good, 33 fair, 11 inferior, 44 excessive strength. Samuel W. Abbott.

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⁶ C. V. Chapin: Municipal Sanitation in the United States, pp. 325-327, Providence, R. I.
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FOOD: METHODS OF INSPECTION AND ANALYSIS.—There is no field of chemical analysis more unique in itself than that covered by the food analyst, who necessarily employs methods of a much more varied character than almost any other chemical specialist. Processes of food analysis are not exclusively chemical. Physical methods are frequently employed, especially those along optical lines involving the use of the microscope, the polariscope, the spectroscope, and the refractometer. Besides these instruments, the food analyst should be provided with a water bath, a delicate balance, a Babcock centrifuge, the usual laboratory glassware and reagents, and, if possible, with a number of platinum dishes.

It is desirable in the examination of foods to employ quick processes for separating the pure from the impure, afterward applying special methods to the impure samples to ascertain the nature and extent of the adulteration.

No attempt is made in what follows to deal with the processes of analyzing foods for their nutritive values, but simply briefly to outline methods of detecting, and in some instances estimating adulterants in such classes of food products as experience has shown to be most liable to fraudulent adulteration. Wherever possible, methods are selected involving the simplest possible apparatus. The usual laboratory reagents are used, mainly solutions of simple salts, and for their preparation the reader is referred to any text book in qualitative analysis.

BAKING POWDER.—The adulterants of cream of tartar are, of course, to be looked for in baking powder, and are tested for as indicated under "Cream of Tartar."

Alum is tested for by burning a small quantity of the sample to an ash, which is then treated with boiling water and filtered. If, on the addition of ammonium chloride to the filtrate, a flocculent precipitate is formed, this will indicate the presence of alum in the sample. The test is applicable in presence of phosphates.

BUTTER.—If accustomed to the odor and taste of oleomargarine, one can usually distinguish by these senses alone between it and pure butter. The odor of the melted fat is very distinctive, the melted oleomargarine lacking the butyric odor so characteristic of the butter and possessing a distinct "meaty" smell that generally betrays its nature. Certain quick physical tests are sometimes employed to distinguish pure from adulterated butter.

The Spoon Test.—If about a gram of the sample be placed on a spoon, held over the free gas flame and brought to the boiling point, the mass will assume a "foamy" appearance if the butter is pure. If the sample is oleomargarine or "process butter" (old butter reworked), the mass will bump and spatter like hot grease containing water, but does not foam.

The Milk Test.—Five to 10 c.c. of the sample are added to 50 c.c. of sweet milk heated nearly to boiling. The contents are stirred with a rod till the fat is melted, after which the container is placed in cold water and the stirring is continued till the fat congeals. If oleomargarine, the fat can readily be collected into one lump with the stirring rod, and if butter, it cannot be gathered together, but granulates.

Under the microscope pure butter should theoretically show no crystalline structure when viewed by polarized light, being uniformly bright throughout and, if the selenite plate be used, showing an evenly colored field entirely devoid of fat crystals. With process butter or oleomargarine, both of which have been melted and sub-

sequently cooled, the crystalline structure should be marked, showing with polarized light a mottled appearance, and a play of colors with the selenite. These conditions are, however, not sufficiently sharp to be reliable in unskilled hands.

The Zeiss Butyro-Refractometer furnishes a ready means of distinguishing between butter fat and oleomargarine. This instrument is so constructed that the degree of refraction of a beam of light reflected from a mirror obliquely through a thin film of the melted fat is read on an arbitrary scale of sufficient extent to cover the widest limits of deviation possible for butter fat and oleomargarine under ordinary temperatures. The butter fat is kept at a constant temperature above the melting point by a circulation of heated water maintained through a jacket that encloses it, the temperature being read on a thermometer. Each fat has fixed limits of reading at a given temperature, the scale reading of oleomargarine being from six to twelve degrees higher than that of butter.

The Volatile Fat Acids.—The presence of a considerable percentage of volatile fatty acids in genuine butter and the lack of them in oleomargarine furnishes the most ready chemical means of distinguishing between the two. The result is usually expressed by the number of cubic centimetres of decinormal alkali necessary to neutralize the volatile fatty acids in 5 gm. of the fat, being known as the "Reichert number." The method of obtaining this is fully described in Bulletin 46, United States Department of Agriculture, Division of Chemistry.

CHEESE.—**The Fat Content** of cheese is the most important factor in determining whether whole or skimmed milk has been used in its manufacture, and the Babcock milk tester is used with advantage in estimating the fat.

Weigh 5 gm. of the finely divided sample into a tared Babcock milk testing bottle. About 15 c.c. of hot water are then added, and the mixture is shaken until an emulsion is formed. A few drops of ammonia aids in softening the cheese. The mixture is kept warm by immersing the test bottle in hot water. When a complete emulsion is formed, the bottle is cooled, 17.5 c.c. of concentrated sulphuric acid are added and the test is completed in the usual manner for carrying out the Babcock test (see Milk Fat). The reading of the fat in the bottle is multiplied by 18 and this result divided by the number of grams of the sample taken gives the percentage of fat in the cheese, which in case of a whole-milk cheese should be at least thirty per cent.

Detection of Foreign Fat.—The presence of foreign fat in cheese is best detected by submitting the separated cheese fat to the same examination as is given to butter fat (*q. v.*), the fat for chemical examination being best removed by extraction of the cheese with ether.

COCOA.—The purity of cocoa is best determined by means of the microscope. See "Spices" for brief directions as to mounting, etc. Samples of known purity should be studied for comparison with doubtful specimens. Under the microscope pure cocoa shows a loose mass of yellowish-brown matter, with small starch granules and oil globules.

COFFEE.—This, like cocoa, is best examined microscopically, being first ground to a fine powder in a mortar. Figs. 6, 7, 8, Plate XXVI., show the characteristic appearance under the microscope of both pure and adulterated samples. Pure coffee appears as a mesh-work of irregular hexagonal thick-walled cells enclosing oil droplets and amorphous material.

CONDENSED MILK.—Forty grams of the thoroughly mixed sample are weighed out and made up to 100 c.c. with water.

Total Solids.—An aliquot part of the above solution is further diluted with an equal amount of water, and 5 c.c. of the diluted mixture is evaporated over the live steam of a boiling water bath for three hours in a platinum dish and the residue weighed.

Ash.—The residue from the total solids is burnt to a white ash and weighed.

Fat.—This is the most important factor in determining

EXPLANATION OF
PLATE XXVI.