

## Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.



U. S. DEPARTMENT OF AGRICULTURE.

---

REPORT  
OF  
**THE CHEMIST**

FOR  
1910.

BY

H. W. WILEY.

---

[FROM ANNUAL REPORTS OF THE DEPARTMENT OF AGRICULTURE.]



WASHINGTON:  
GOVERNMENT PRINTING OFFICE.

1910.



# CONTENTS.

---

	Page.
Important food investigations.....	5
Deterioration of poultry and eggs.....	5
Shipping experiments.....	5
Drawn and undrawn poultry.....	6
Condition of poultry on entering storage.....	6
Handling of eggs.....	7
Field laboratories.....	7
Analytical work.....	7
Sugars and sugar products.....	8
Maple products.....	8
Effect of environment on sugar content of corn, etc.....	8
Sugar beets.....	8
Miscellaneous investigations.....	8
Bacteriological work.....	9
Special investigations of the Division of Foods.....	10
Determination of colors in foods.....	10
Codfish.....	11
Ketchup.....	12
Fruit and fruit products.....	12
Citrus oils and citrus by-products.....	13
Distilled spirits.....	14
Cider vinegar.....	14
Occurrence of arsenic in food products.....	14
Oysters.....	14
Influence of tin receptacles on the character and composition of foods..	14
Edible oils.....	15
Analytical methods.....	15
Miscellaneous.....	15
Drug investigations.....	15
Essential oils.....	16
Synthetic products.....	17
Cooperation with Post-Office Department.....	18
Medicated soft drinks.....	20
So-called drug-addiction cures.....	20
Prescription remedies.....	21
Pharmacological investigations.....	21
Studies on flour and nitrites.....	21
Studies on the pharmacology of caffeine.....	22
Toxicity of the alcohols and of other compounds in the fatty-acid series.....	22
Chemical reagents.....	22
Special investigations.....	23
Vegetable physiological chemistry.....	23
Animal physiological chemistry.....	25
Microchemical investigations.....	26
Figs.....	26
Desiccated eggs.....	26
Miscellaneous.....	26
Enological chemical research.....	27
Grape and apple investigations at Sandusky, Ohio.....	27
Composition of commercial ciders and wines and of those of known history.....	28
Yeast races.....	29
Denatured-alcohol investigations.....	29

	Page.
Food and drug inspection.....	29
Work of the inspection force.....	30
Changes in the force.....	30
Collection of samples.....	30
Special investigations.....	31
Washington Food Inspection Laboratory.....	32
Examination of dairy products under the law.....	34
Washington Drug Inspection Laboratory.....	35
Domestic drugs.....	35
Imported drugs.....	36
Examination of foods and drugs at the branch laboratories.....	37
Boston laboratory.....	39
Buffalo laboratory.....	41
Chicago laboratory.....	41
Cincinnati laboratory.....	42
Denver laboratory.....	43
Detroit laboratory.....	43
Galveston laboratory.....	44
Kansas City laboratory.....	44
Nashville laboratory.....	45
New Orleans laboratory.....	45
New York laboratory.....	46
Inspection work.....	46
Investigations.....	47
Omaha laboratory.....	48
Philadelphia laboratory.....	49
Pittsburg laboratory.....	50
Portland laboratory.....	51
St. Louis laboratory.....	51
St. Paul laboratory.....	51
San Francisco laboratory.....	52
Savannah laboratory.....	53
Seattle laboratory.....	53
Miscellaneous investigations.....	54
Work of the Miscellaneous Division.....	54
Examination of waters.....	55
Insecticides and fungicides.....	55
Cattle feeds and grains.....	56
Trade wastes in relation to agriculture.....	57
Investigations of the Leather and Paper Laboratory.....	57
Paper and paper-making materials.....	58
Turpentine and rosin.....	58
Leather.....	59
Miscellaneous work.....	59
Examination of contract supplies.....	59
Nitrogen determinations.....	60
Publications.....	61
General business operations.....	61
Work planned for the fiscal year 1910-11.....	62
Inspection work.....	62
General food investigations.....	63
Food Research Laboratory.....	64
Drug work.....	64
Miscellaneous Division.....	64
Sugar Laboratory.....	65
Dairy Laboratory.....	65
Leather and Paper Laboratory.....	66
Contracts Laboratory.....	66
Microchemical Laboratory.....	66
Special investigations.....	66
Enological chemistry.....	66
Plant and animal physiological chemistry.....	67
Bacteriological studies.....	67



## REPORT OF THE CHEMIST.

---

U. S. DEPARTMENT OF AGRICULTURE,  
BUREAU OF CHEMISTRY,  
*Washington, D. C., September 1, 1910.*

SIR: I have the honor to transmit herewith the annual report of the Bureau of Chemistry for the year ending June 30, 1910, together with plans of the work proposed for the year ending June 30, 1911.

Respectfully,

H. W. WILEY,  
*Chief of Bureau.*

HON. JAMES WILSON,  
*Secretary of Agriculture.*

---

### IMPORTANT FOOD INVESTIGATIONS.

#### DETERIORATION OF POULTRY AND EGGS.

The investigation of the deterioration of foods, especially of poultry and eggs, instituted primarily to afford data for the enforcement of the food and drugs act, has progressed under the direction of M. E. Pennington, along the lines indicated in last year's report of the Food Research Laboratory. As there stated, this work, which begun with the study of cold-stored poultry, has led to the investigation of the handling of poultry in every phase from the producer to the consumer. The industries concerned are bringing their problems for solution, and are offering the most hearty cooperation in furthering the work, believing that by the improved methods evolved not only will losses be prevented, but it will be possible to put a better product on the market. The cooperators include not only associations of poultry dressers and merchants, but also railways, refrigerator transportation companies, and cold-storage warehousemen.

The laboratory studies on the decomposition of flesh, especially as influenced by temperature, have progressed far enough to warrant their collation. The results include data on the changes occurring in flesh when kept at temperatures below zero for varying periods of time, as well as those which occur at atmospheric and ordinary ice-box temperatures.

SHIPPING EXPERIMENTS.—During the summer of 1909 the Food Research Laboratory conducted a series of shipping experiments with Chicago as the receiving center. Chemists, bacteriologists, and field men from this laboratory established temporary headquarters in the Chicago food and drug inspection laboratory and conducted there the necessary laboratory work. Large poultry packing houses from

southwestern Kansas to northern Iowa were visited; their methods of killing, picking, chilling, packing, and transportation were observed, and a shipment of poultry, of which an accurate record of every detail of manipulation had been kept, was sent to Chicago, where it went either into immediate consumption or into a cold-storage warehouse. In either event, the carload was met on its arrival, the conditions in the car after the railroad haul were noted, the boxes of poultry opened and examined, and typical specimens sent to the laboratory for immediate chemical and bacteriological examination. A number of these shipments have been traced after leaving their respective cold-storage warehouses in Chicago, and again examined after the second railroad haul and a short sojourn in a second warehouse before being placed on the market; some of them have been followed through the market as far as the retailer. At every step specimens were sent to the laboratory for examination. In this way it has been possible to study the practices of a number of packers over a large territory and to trace the results of methods, weather conditions, railroad facilities, etc., on the final condition of the product when it reaches the consumer. A study of the Chicago poultry market was also made, and is of especial interest, since this city, unlike most others, receives its poultry alive and kills and dresses within the city limits.

**DRAWN AND UNDRAWN POULTRY.**—Especial attention during the year has been given to the question of eviscerating poultry when killed or just before offering it for sale in the markets. Many shipments have been made from the large producing centers of the West to the consuming sections of the East of drawn and undrawn poultry, dressed by commercial and by experimental methods. The cooperation of the industry has permitted the examination and experimental use of much larger quantities of poultry than would have been possible otherwise, arrangements having been made whereby experimental packages, if not rendered unsalable, were turned back into stock and sold. Hence, this much debated question has been studied on a commercial scale, under existing as well as under experimental conditions, with every facility that the industry could offer to assist in solving the problem. To the visual examination of the fowls, at every stage of their preparation for the market and their journey through it, was added a chemical and bacteriological laboratory examination, that a standard record of changes in the flesh might be correlated with the history of the shipment, and thereby ultimately provide a scientific explanation for the undesirable fowls so often seen in the markets. Shipments were made during cold and during warm weather. Marketing included the handling of the goods by a commission man, and by a retailer who sold directly to the consumer. The results of this series of experiments are now being collected.

**CONDITION OF POULTRY ON ENTERING STORAGE.**—It is known that the successful cold storage of poultry depends very largely upon its condition when it enters the freezer. It has also been observed that the mode of dressing the birds influences the quality, especially after storage. This fact was brought out in several addresses to poultry men and warehousemen, the results of the experiments on scalded or dry-picked fowls, promptly stored or delayed before storage, etc., being illustrated by colored sketches of the birds so treated.



The relative stability of the flesh of poultry well drained of blood, as compared with that which holds any quantity of blood in the tissues, as well as the more sightly appearance of the former, has led to a careful study of the whole matter. Shipping experiments, including marketing and experiments in the packing house, are now under way in the hope of obtaining practical information on this subject. Part of the work includes an anatomical study of the blood vessels of the neck and head of the chicken, that the methods of bleeding may be improved by a knowledge of the location of the vessels and the most available place for the cutting of them. The results of this part of the work have already been published in the form of a circular (Circular 61 of the Bureau of Chemistry).

**HANDLING OF EGGS.**—A study of the changes occurring in eggs after long keeping at low temperatures and after shorter periods at ordinary or incubator temperatures is in progress. Eggs of known history, from those of the highest quality to those of a low commercial grade, have been analyzed from time to time after keeping under definite conditions, and have also been studied bacteriologically. This work forms the scientific basis for the study of the commercial handling of eggs along the same lines as are being followed in the investigation of poultry. The details of this investigation and the arrangements for the cooperation of the industry are now completed, and it is expected that it will go forward promptly during the egg season of 1911. This work involves the careful tracing of commercial practices in the handling of eggs, from the producer to the consumer, and includes the study of the holding of eggs at various points, either for gain in price or through ignorance or carelessness; sorting and packing in the collecting centers; shipping to distant points; marketing by the jobber and retailer; and storage, from the season of production until the season of shortage. These records of history and environment are to be accompanied by a laboratory analysis at every stage.

**FIELD LABORATORIES.**—The development of the investigation of the handling of poultry and eggs intended for food and the ultimate effect of such handling on their wholesomeness has necessitated the installation of small laboratories at the packing houses where experiments are being conducted. One such laboratory was established in Atchison, Kans., for the winter of 1909-10, and did most effective work in defining the condition of poultry when fresh killed and the differences caused by various methods of dressing as exhibited by chemical and bacteriological findings. So valuable was the work done in this field laboratory that the establishment of such is now looked upon as an indispensable part of the field equipment. A brief mention, at least, must be made of the interest taken in the field laboratories by the packers themselves and the encouraging understanding which they evidence of the practical value to them of bacteriological and chemical findings.

During the latter part of the year work has been inaugurated in cooperation with the Bureau of Statistics, in order to obtain reports from the industry concerning the production and sectional distribution of poultry and eggs throughout the country.

**ANALYTICAL WORK.**—The analytical work of the laboratory, which furnishes, as has been stated, the foundation for all the field and

market investigation and to which almost every problem must finally be referred for solution, necessitated the making of 3,006 determinations on 274 chicken samples and 43 egg samples. Three hundred bacteriological examinations of chicken and eggs were also made. The bacteriological work has included the study of growth conditions, especially as influenced by temperature, each culture or plating being grown at 0°, 20°, and 37° C. This has necessitated the making of a great number of plates, when quantitative results were desired, and has practically tripled the work done. A considerable number of organisms have also been isolated and identified. The histological examinations of the tissues have been made in connection with the bacteriological whenever it was desirable.

#### SUGARS AND SUGAR PRODUCTS.

**MAPLE PRODUCTS.**—The investigation on the maple products of the United States, begun a year ago, has been practically completed. The samples collected have all been analyzed, and the results on maple sirup have been compiled and are in press. An additional collection of maple sugars was made during the past season; these have been analyzed and the results are being compiled for publication as a companion report to that on maple sirups. It is thought that these data will be of material service to the food chemists of the country, as the large number of samples and their wide distribution will furnish a broad and reliable basis for the future valuation of this product.

Some experimental work on the manufacture of sirup and sugar from maple sap was done in order to obtain data on the chemical composition of the product as affected by the souring of sap and different methods of manufacture. While many valuable figures have been obtained, the investigation must be continued for several seasons in order to prove some of the points at issue.

**EFFECT OF ENVIRONMENT ON SUGAR CONTENT OF CORN, ETC.**—During this year Bulletin No. 127 on "The Influence of Environment on the Composition of Sweet Corn" has been published, which includes the results of a four years' investigation from 1905 to 1908. One additional season's work has been done on this subject, making a five years' study comparable to the similar one on sugar beets. The next products to be considered in this series of investigations on the influence of environment on the sugar content are cantaloupes and watermelons. As the quality of melons depends largely on their sugar content, and some sections produce much better melons than others, the work will be of great value in determining what features of the environment influence this content most. This work will be continued for five years in the same way as the two former investigations have been conducted. Stations have been selected in Florida, Arizona, Colorado, and some of the Northern States.

**SUGAR BEETS.**—The methods of analysis of sugar beets are under study to endeavor to adapt them more perfectly to commercial needs. As in previous years, a great many samples of beets have been analyzed for the Bureau of Plant Industry.

**MISCELLANEOUS INVESTIGATIONS.**—A large number of analyses of imported honeys have been made which, together with the results on

American honeys already published, will be of great value to the food chemist in determining the character and purity of honey.

Samples have been collected and analyses begun in an investigation of the composition of American glucose and starch sugars. At present only a few scattered analyses of these products are available, and this work will be of material value to the food chemist in his valuation of sirup mixtures containing varying percentages of commercial glucose.

The general methods of sugar analysis are constantly being studied in the Sugar Laboratory, under the direction of the chief, A. H. Bryan. New methods as they are published in scientific literature along this particular line are tested and their value for the work in hand is studied. This often requires much work, and may produce only negative results, which are, however, as valuable as positive ones, since it is necessary to know whether the proposed methods are more accurate than those in use.

During the year 721 samples were received for analysis by the Sugar Laboratory, and on over 95 per cent of them a complete report has been made. Besides this, about 250 samples of maple sugars, collected during the preceding year, were analyzed, and approximately 30 samples of imported honeys. Classifying these samples, the distribution of the work is seen to be as follows:

Sugar-bearing plants:	
Beets-----	244
Cane and sorghum-----	62
Official food samples:	
Maple and cane sirups, molasses, and honeys-----	62
Imported honeys-----	39
Maple sirup and sugar samples-----	399
Samples from other laboratories and departments:	
Bureau of Engraving and Printing-----	14
General Supply Committee-----	26
Drug Laboratory samples-----	70
Other laboratories of the Bureau-----	8
Starch products-----	32
Miscellaneous sirups and sugars-----	45

#### BACTERIOCHEMICAL WORK.

The principal bacteriochemical investigation conducted has been that of the conditions surrounding the oyster and clam industry. This was continued from last year, and a decided improvement was noted in the methods of handling and shipping these valuable food products. Inspection of oyster beds, floats, shucking houses, containers, and shipping and transportation conditions, and bacteriological examinations of water, oysters, and clams were made in the course of this work. The inspection of mineral springs and bottling establishments is being continued, with the attendant bacteriological examinations, and similar cooperation is being given in the Bureau's investigation of the desiccated and frozen egg industry. Consignments of this product have already been seized and condemned as being composed of badly decomposed and filthy material. Assistance was also given in the milk campaigns conducted in Cincinnati and at Boston and Springfield. The results indicate the necessity for further activity along the lines of sanitary milk production. The increased



use of milk ferments and kindred preparations is a subject now under consideration.

Much valuable information has been gained from the inspection of various factories in different sections of the country where foods are handled and prepared for human consumption. Conditions in milk depots, ice-cream factories, bakeries, candy kitchens, hotels, restaurants, boats, dining cars, etc., have been observed.

The number and nature of the samples examined is shown by the following tabulation of interstate samples and the statement as to research work:

Butter .....	12
Ketchup and ketchup material.....	65
Corn meals.....	18
Cream, raw and pasteurized .....	158
Cream puffs .....	18
Eggs:	
Desiccated.....	50
Frozen.....	50
Figs.....	10
Flour.....	34
Ice.....	21
Ice cream.....	42
Milk:	
Raw and pasteurized.....	756
Fermented-milk preparations.....	11
Miscellaneous.....	57
Oysters.....	69
Soft drinks.....	40
Water:	
Bottled.....	89
All others.....	22
Total.....	1,522

The research samples included 92 ciders, 209 samples of desiccated and frozen eggs, 145 samples of oysters, 287 samples of water from various sources, 115 samples of figs, and other miscellaneous materials aggregating 1,068, a total of 2,590 samples examined during the year.

#### SPECIAL INVESTIGATIONS OF THE DIVISION OF FOODS.

DETERMINATION OF COLORS IN FOODS.—Under the direction of Dr. B. C. Hesse, collaborating expert, New York City, a comprehensive study is in progress by A. M. Doyle, of the Washington Food Inspection Laboratory, looking to the classification of food colors and the construction of analytical trees for their identification. This investigation is extensive and intricate in the extreme and will require some time for its completion. The construction of the trees for greens, violets, and browns alone, which has been practically completed, involved the making of about 11,000 fundamental observations on 284 samples, in addition to which many hundred tests are made to assure the accuracy and reliability of the trees after their construction. These trees may be relied upon for concentrations ranging from 1 to 1,000 to 1 to 5,000; either side of this range their value has not been established. As far as the work has gone it does not appear that the impurities accompanying different makes of the same Green Table number interfere at all with the use of the trees; the only difficulty observed in this respect was in distinguishing a clean penta methyl

violet from a poor grade of the hexa methyl violet, and this may be overcome.

The actual result of the work so far accomplished is therefore briefly as follows: Given 1 c. c. of a solution of any straight green, brown, or violet dye, containing not more than 1 milligram and not less than one-fifth milligram of such dye, the trees constructed enable one to designate with absolute certainty the exact Green Table number of said dye, with the following exceptions: (1) All browns from G. T. No. 137 to 139, but not between 137 and 139, one against the other; (2) all violets from G. T. No. 451 and 452, but not between the two, one against the other.

Similar trees will be worked out for the remaining colors—blue, orange, yellow, and red—and the influence of mixed dyes tested, for which work the fundamental material has already been collected. It will also be necessary to determine what effect, if any, the food material in which the dye is placed has upon the sensitiveness or reliability of the trees as constructed. If this influence is disturbing, then means of obtaining clean color solutions of the necessary strength must be devised.

The importance of this work in the enforcement of the food law is apparent. Notwithstanding the number and variety of colors encountered the continuation of this systematic study will soon place the matter on a practical working basis, the analytical trees furnishing a rapid method of identifying the colors, further confirmatory tests to be applied when deemed necessary. These studies are supplemented by others at the New York and Seattle food-inspection laboratories.

**CODFISH.**—Codfish and other salt fish are subject to spoilage during the warm weather, particularly between the middle of June and October, and a careful study has been made by Inspector Bitting of the conditions surrounding the industry with a view to obviating or reducing the loss from this source. The first evidence of spoilage is a red discoloration, due to bacteria, and brown spots or "freckles," due to a mold. The specific organisms causing the spoilage have been determined and some of the conditions favorable to their growth established.

The preliminary work has been directed almost wholly toward finding the cause of the spoilage and the source of the infection. It has long been believed that the organisms causing the spoilage occur normally in the localities where the fish are packed and are abundant in the salt used for curing, possessing a tolerance for salt not common to most germs. The extensive bacteriological studies on the causes of reddening together with the inspection work present strong evidence that the difficulty is largely due to factory infection, use of contaminated water for washing the fish, and careless methods of handling, and that the influence of germs found in the lowlands, in the vicinity of the factory, and in the salt seems to have been overestimated. At first it was believed that the problem consisted in preventing spoilage in an infected product by stopping the growth of organisms necessarily present, but these investigations indicate strongly that it consists rather in the usual difficulty of preventing infection. Recommendations along these lines have been made in Bulletin No. 133, reporting the results of this investigation.



**KETCHUP.**—Experiments have been continued by Mr. Bitting in the making of tomato ketchup to increase the time of keeping after opening the container. The work showed that ketchup could be made without any other preservative than sterilization, and such preservative action as may be exerted by the vinegar and sugar present, and have it keep as long as it remains sealed, and also for a reasonable time after opening. The ketchup first made had a specific gravity of about 1.06, a total acidity of less than 0.9, estimated as acetic acid, and about 6 per cent of sugar. In the subsequent experiments the aim has been to give a heavier body and a higher total acidity in order to offer greater resistance to germs which might find entrance after the bottle has been opened. It was found that ketchups having a specific gravity of more than 1.12, a total acidity of 1.2 per cent or more, estimated as acetic acid, and 12 per cent or more of sugar would keep. All of these figures were greatly exceeded in the experiments, and good ketchup may be made in which all or only one or two of the factors are increased. It is possible that there may be a decrease in these proportions, though with some risk. The greater concentration and the increase in sugar and vinegar have been the chief factors in securing a product of superior keeping properties, cleanliness and sterilization being always essential.

Examinations were made of commercial ketchups for their specific gravity, total acidity, condition of the tissues, and the organisms present. A comparison made with the record of a similar examination two years previous shows a decided improvement in this time. The ketchups were also compared by dividing them into two classes, those preserved with benzoate of soda and those preserved by sterilization, together with the preservative action exerted by the increased vinegar and sugar present. The latter class has a heavier body and consequently a slightly higher acidity than the former. The ketchups depending mainly upon sterilization and also upon increased vinegar and sugar and concentration for their keeping properties are generally made of higher grade material, and a smaller number of organisms are present than in the benzoated products, but there are clean ketchups and dirty ketchups in both classes.

The condition of the ketchup is determined by the appearance of the cells, whether they are broken or separated by fermentation or decay, and by the number and kind of organisms present and their condition. The general appearance of the ketchup and its color, taste, and smell may be easily modified by a skilled manufacturer, but no amount of cooking or finishing can change the microscopic structure.

**FRUIT AND FRUIT PRODUCTS.**—The experimental work on fruit and fruit products has been continued in collaboration with the pomologist in charge of the field investigations of the Bureau of Plant Industry. The fruits studied were grapes, apples, pineapples, peaches, plums, strawberries, raspberries, blackberries, huckleberries, currants, oranges, and lemons.

Investigations on grape juice were made with the object of studying the yields obtained by different methods of pressing and of heating before pressing and the effect of these various procedures on the composition and flavor, working on a scale which could readily be extended to commercial proportions. The studies on juices prepared

from various other fruits have been continued, their nature being similar to those carried on with grapes. It is found, however, that each fruit presents peculiarities requiring slight modifications in treatment. These results were printed in the *Journal of Industrial and Engineering Chemistry* for July, 1909.

It has been found that freshly pressed apple juice, cooled immediately after preparation, can be kept for a period of from six weeks to three months at 32° F. before it begins to ferment, after which the fermentation is very slow and the flavor of the juice well maintained. Investigations made during the past season along this line have verified those previously made and show in addition that cider held at the freezing point on withdrawal from storage keeps well at refrigerator temperatures.

Another study on the value of peaches as vinegar stock was made, covering the composition of peach juices of different varieties, the fermentation of ground peaches, the composition of the resulting ciders, and the preparation and composition of peach vinegar. It appeared from this work that peaches contain sufficient fermentable sugar for use in this way and that they can be successfully handled by the machinery used for making apple vinegar.

Studies on the method of preparing dried, sugared pineapples have been continued and a very palatable product which keeps well has been produced. The samples held in cold storage retained to a great degree their original golden yellow color and the rich pineapple aroma and flavor. These three investigations have been recorded in Circulars 48, 51, and 57 of the Bureau of Chemistry.

Further investigations on Japanese persimmons have indicated that the Japanese process of ripening by using sake or dilute alcohol, as the liquid with which to saturate the walls of the vessel in which the fruit is stored, can be successfully applied commercially if the fruits are evenly ripened. Otherwise a considerable proportion of the fruit may soften unduly.

The study of the effect of low temperatures on the life processes of fruits has been continued and extended to several varieties of small fruit. In this study the rate of the evolution of carbon dioxide is used as a measure of physiological activity. In all cases thus far investigated cooling was found to cause marked retardations in the life processes.

In collaboration with the Bureau of Plant Industry a study is also being made of the composition of oranges at different stages of maturity with a view to elaborating, if possible, an analytical method by which data may be secured for the comparison and selection of types of oranges.

A study has been made of the practice of picking immature oranges and grape fruits and sweating them for the purpose of supplying the market in advance of the time of normal ripening. It appears that fruit so treated is so far inferior to that permitted to attain a reasonable degree of ripeness before picking that the continuance of the practice would be likely to work great injury to the industry. These fruit studies and the following food investigations are made under the direction of W. D. Bigelow.

CITRUS OILS AND CITRUS BY-PRODUCTS.—The examination of authentic samples of citrus oils obtained in Sicily will soon be com-

pleted, and the special investigation of the production of citrus by-products in California, begun last year, is being continued. The methods for the manufacture of citric acid have been studied in the laboratory and the investigation is now awaiting the completion of a device for extracting oil. Whether or not such a device can be successfully operated will soon be ascertained.

**DISTILLED SPIRITS.**—The investigation of the methods of handling distilled spirits and the study of the changes taking place in storage of same under varying conditions, which was commenced two years ago, is still being carried on, samples being taken at regular intervals and general conditions noted. The data so obtained are of value in judging of the authenticity of samples in the enforcement of the food law.

**CIDER VINEGAR.**—A special study has been made of the changes taking place in the composition of apple cider when converted into vinegar in the commercial types of generators. In order to determine what changes take place when manufacturing on a commercial scale, the cooperation of a large vinegar factory in Michigan was obtained, thus making it possible to exercise chemical control of all of the operations under commercial conditions. Twice during the year, once in the winter and once in the summer, a 20,000-gallon tank of cider was run through a series of generators, and a careful note made of the changes of composition which occurred, thus covering also the effect of the seasonal changes in temperature on the action of the generators. This work is still in progress, and already important information has been obtained as to the composition of pure cider vinegars made on a commercial scale. In addition to the study of changes taking place in the manufacture of cider into vinegar, an elaborate chemical study of the composition of cider to be used in the manufacture of cider vinegar has been made in cooperation with the New York laboratory.

**OCCURRENCE OF ARSENIC IN FOOD PRODUCTS.**—The investigations of the Bureau have shown that certain materials, used both as drugs and in the manufacture of foods, sometimes contain a considerable amount of arsenic. For example, a number of samples of various types of foods, in the manufacture of which commercial preparations of phosphates and phosphoric acid were used, were found to contain an excessive amount of arsenic. A study has been begun to determine the prevalence of the use in the manufacture of foods of arsenic-bearing raw materials.

**OYSTERS.**—A number of cove-oyster canneries have been visited and samples prepared in the presence of the inspector have been examined in the laboratory. The data secured are of value in judging of the legality of shipments of cove oysters in interstate commerce.

**INFLUENCE OF TIN RECEPTACLES ON THE CHARACTER AND COMPOSITION OF FOODS.**—A careful study has been made of a large variety of foods canned in different grades of tin and prepared in the presence of representatives of the Department. This food will be examined periodically to determine the amount of tin dissolved therein and the extent to which the coating of the receptacle has been corroded. During the past year the first examination of all of the samples was made. For the same purpose there were examined some old samples



of unknown origin. A study was also made under artificial conditions (imitating as closely as possible those obtaining in processing canned goods) of the solubility of tin plate in organic acids simulating the composition and acidity of vegetable and fruit juices.

**EDIBLE OILS.**—In collaboration with the Bureau of Plant Industry a study has been begun of the composition of a large number of varieties of soy beans and the character of their oil. Methods for the clarification of this oil and of peanut oil have also been studied.

**ANALYTICAL METHODS.**—Much progress has been made in the improvement of methods for the detection of food adulteration. New methods have been devised, improvements have been made in some of those formerly used, and by means of collaborative study the results of the various food laboratories of the Bureau have been brought in closer accord. The method for the quantitative determination of benzoic acid, which previously had been used especially with tomato ketchup, has been investigated in connection with other varieties of foods and found to be generally applicable.

The exact determination of the character and quantity of the various organic acids in different types of foods is of the utmost importance in the detection of food adulteration, since the organic acids of many foods are dissimilar from those of the products with which they are commonly adulterated. A careful study of methods for the detection and estimation of minute quantities of the common organic acids has been undertaken and marked progress has been made. This not only furnishes additional evidence of adulteration, but also valuable data respecting the soundness or decomposition of products from which certain types of food have been made.

The analytical methods used in foreign countries in testing American food products, especially those regarding fats and oils, have been under investigation, with the hope of bringing about some international agreement. The necessity for this work can not be overestimated, especially with regard to the great quantity of animal fats and oils exported to foreign countries, the acceptance of which is based on chemical analysis.

**MISCELLANEOUS.**—A considerable number of the samples examined was not included either in the ordinary investigations of the Bureau or in its work of inspection. Many materials were examined at the request of other departments for the purpose of determining their purity and quality. At the request of the General Supply Committee the division examined 235 samples of food submitted in connection with bids for government institutions.

#### DRUG INVESTIGATIONS.

Both the routine examinations and the special investigations conducted by the Division of Drugs, under the direction of L. F. Kebler, are chiefly concerned with the composition, adulteration, and misbranding of drugs and chemicals imported or found on the American market and shipped in interstate commerce or manufactured or produced in the United States territories or the District of Columbia. The chemical reagents used by the Bureau of Chemistry in its general analytical work are also examined by this division. These lines of work require a study of the methods of analysis, of the standards at

present official for certain products, and of normal products, with a view to establishing standards and supplying the necessary data on which to base action. The study of the keeping qualities of hydrogen peroxid was completed and that on the deterioration of certain plant products and preparations derived from the same is still in progress.

Much work has been done to establish qualitative and quantitative methods for demonstrating the presence and determining the amounts of several constituents (i. e., morphin,<sup>a</sup> cocain,<sup>a</sup> acetanilid, antipyrin, chloral hydrate, opium, heroin, diacetylmorphin, the eucains, etc.) found in various mixtures, such as the so-called drug-addiction cures, asthma cures, cancer cures, consumption cures, soothing sirups, etc. During the fiscal year ending June 30, 1910, there were examined in this division 2,051 samples; of this number 503 were chemical reagents, 228 imported drugs, 1,184 domestic drugs or dry products, and 136 miscellaneous materials. These include all samples whether collected under the food and drugs act, examined for other branches of the Government, for information, or to be used as a basis for establishing the data on which to fix standards.

#### ESSENTIAL OILS.

Several years ago it was a common practice for various manufacturers to advertise the fact that their salicylic acid and sodium salicylate were made from oil of wintergreen. This representation was largely made because of the fact that the physician believed that the agents so obtained were more efficacious in the treatment of rheumatism than the synthetic products. Numerous complaints were received by doctors to the effect that the wintergreen salicylates they were employing did not give the results formerly obtained. An investigation soon showed that a comparatively small amount of actual oil of wintergreen was produced in the United States, but it was very difficult to prove that any given sample of salicylic acid or sodium salicylate was not made from oil of wintergreen. The results of the investigation soon manifested themselves in the trade, however, by the appearance of statements on labels as the following: "Salicylic acid natural," "Sodium salicylate natural," with nothing to indicate that these products had a common origin in oil of sweet birch, an oil analogous in many respects to oil of wintergreen, but not the same. In fact, no advertisements have appeared during the past year representing that these commodities were made from oil of wintergreen, but the natural products are still on the market. It is well known that such a representation would be looked upon as false, for the reason that the supply of oil of wintergreen is extremely small. A further investigation showed that a large proportion of the so-called oil of wintergreen consisted largely of mixtures of methyl salicylate and oil of sweet birch; for example, one of the manufacturers of so-called oil of wintergreen found it very difficult to explain certain circumstantial evidence, and finally admitted that the product he was selling as oil of wintergreen was in reality not that article. The investigation is still in progress, with the view to devising a method for detecting the various mixtures of the three commodities known as oil of wintergreen, oil of sweet birch, and methyl salicylate.

---

<sup>a</sup> The words "morphin" and "cocain" as used in this report refer to the salts of the respective alkaloids.



Peppermint oil undoubtedly constitutes one of the most important industries in essential oils in the United States. Investigations are in progress to determine whether or not one variety of plant grown under varying conditions would produce oils superior to those made from another variety grown under similar conditions, and whether or not the oils so produced comply with the standard set by the Pharmacopœia. Quite a number of authentic oils were gathered in southern Michigan, but no conclusions have been reached as yet. A sample of California peppermint oil was also procured and was found to contain an unduly large amount of menthol. Other oils under investigation are spearmint, tansy, and wormwood.

The quantitative methods for determining the chief odor-bearing constituents are being studied. These methods involve the determination of many of the ketones and aldehydes present in the various essential oils. A special study of the hydroxylamin titration method for estimating ketones and aldehydes is in progress in order to determine whether or not this method is more generally applicable and reliable than the alkaline sulphite or bisulphite solutions at present used. Many of the ketones do not react with the sulphite solutions. From the results obtained so far it is apparent that this method when carefully worked out will give closely concordant results in the hands of different workers, and in most cases the product of the reaction can be recovered and its chemical identity established. The method has already been compared with the other assay methods in conjunction with spearmint and dill oils. The method also promises well for determining the quality of such oils as tansy, wormwood, pennyroyal, and dill, for which at present there is no satisfactory method of assay. The official method for determining the presence of dimethyl sulphid in oil of peppermint as prescribed by the United States Pharmacopœia is also under investigation.

The analysis of certain brands of root-beer extracts on the market having revealed the presence of a considerable quantity of free salicylic acid, the question of the hydrolysis of methyl salicylate under the conditions obtaining in the manufacture was raised and it became necessary to establish whether the salicylic acid found is added as a preservative or whether it is the result of hydrolysis of methyl salicylate. The indications point to the latter hypothesis as the correct one, in which case salicylic acid may appear in the finished product without having been added as such.

The interstate samples of essential oils so far examined show that they are either pure or the variation from the standard prescribed by the Pharmacopœia is very slight. In many instances, however, the oils are evasively labeled with such phrases as "for technical use only" or "not for medicinal use."

#### SYNTHETIC PRODUCTS.

In former years it was customary for manufacturers of proprietary remedies, particularly those for headache, rheumatism, and la grippe, to represent them as containing drugs of exceptional curative powers, while, as a matter of fact, the active ingredients were usually acetanilid, antipyrin, some salicylate, with frequently caffein and quinin. A marked change has taken place under the operation of

the food and drugs act in that such common and active synthetics as acetanilid and acetphenetidin must be properly declared on the label, so that it becomes apparent at once to the consumer how much of these drugs he is taking at each dose. During the past fiscal year the Synthetic Products Laboratory has examined 252 interstate and 12 unofficial samples; 72 of the former were reported as illegal, and 15 notices of judgment dealing with such materials have been issued. The illegal samples included preparations for the treatment of headache, neuralgia, la grippe, rheumatism, and catarrh, and contained among other constituents various synthetics, such as acetanilid, acetphenetidin, antipyrin, salicylic acid, salol, heroin, codein, and novocain. Several products, such as soft drinks and Haarlem oil, were subjected to check analysis in this laboratory for the purpose of verifying the amounts of cocain, caffen, and methyl salicylate originally reported.

The investigations inaugurated in 1908 for the purpose of developing methods for estimating the constituents present in headache mixtures were continued during the past year. Very satisfactory results were obtained with the new method for separating acetanilid from acetphenetidin. Sophistication of the latter product with acetanilid can now be quite accurately determined, both volumetrically and gravimetrically, by means of the iodine addition product of acetphenetidin. A method has also been elaborated for the purpose of separating and estimating antipyrin and caffen in mixtures. The efficacy of these methods was clearly shown in the examination of various check and interstate samples. Further work has been accomplished in the recovery of caffen from certain animal tissues and secretions, particularly the bile.

#### COOPERATION WITH POST-OFFICE DEPARTMENT.

The Division of Drugs has continued to cooperate with the Post-Office Department in its efforts to obtain fraud orders against medicinal agents represented as cures for various maladies sent or prescribed through the mails in violation of the postal laws. To this end the analysis of the samples of medicines used is supplemented by a study of all of the claims and representations made for the treatments. The number of remedies in each treatment varied from one to ten. Twenty of these treatments were investigated, eight of which were so-called "cancer cures." One of these consisted essentially of cloth bags containing a mixture of about 98 per cent of sand and clay and 2 per cent of boneblack. It was represented that these "cancer absorbents" would cure cancer completely and permanently by withdrawing or absorbing the "cancer poison" from the system. "Cancer tablets," to "soften and dissolve the growth from the inside," and "cancer ointments" were also employed in conjunction with them. The tablets were found to consist of 98.4 per cent of sugar of milk, 1.4 per cent of moisture, and a trace of animal charcoal and an excipient; the ointment was composed of petroleum mixed with oil of tar and a trace of vegetable matter. Another, comprising seven remedies, consisted essentially of potassium iodid, and from the evidence presented at the hearing it was clear that, like many other "cures" of this class, it was in reality directed toward the

relief of syphilitic troubles erroneously believed to be of a cancerous nature. The Post-Office Department has issued fraud orders in nearly a dozen of these cases, and as a result the mail-order "cancer-cure" business has, to a very large extent, been suppressed in this country. Other treatments investigated included epilepsy and hernia "cures," lost-manhood restorers, "cures" for women's ills, etc. There are several other cancer "cure" treatments of lesser importance under investigation, besides tuberculosis and epilepsy "cures," eyesight and vitality restorers, and similar remedies, all plainly of a fraudulent character.

Most of the "epilepsy cures" are prescribed and sold through the mails though a few of them are sold in the open market. They rank second only to the cancer cures in the misleading and deceptive character of the claims made for them. Most of them are represented to cure epilepsy, irrespective of kind or cause, completely and permanently, and the claims to this effect generally appear in the correspondence and printed matter sent to the prospective purchaser through the mail; only a few, if any, appear on the label. The representations commonly made are to the effect that as a result of the use of the treatment the epileptic seizures are lessened in frequency and severity, any diseased condition of the brain is corrected, and brain tissue which has been damaged or destroyed is replaced; this change goes on steadily until the whole nervous system is restored to a sound and normal condition, and, the cause being removed, the convulsive seizures no longer make their appearance and the epilepsy is cured, never to return. Such claims are false and misleading in the highest degree. The medical profession knows of no substance or mixture of substances which is capable of creating new brain or nerve tissue in place of the old which has been removed or destroyed. Most of the epilepsy cures depend for their efficacy upon the presence of one or more of the bromids. While these agents appear in some instances to exert a palliative effect upon the epileptic seizures, their effect is temporary only, and according to the best authorities they can not in any sense be considered cures for the disease.

"Consumption cures" are also sold through the mails as well as in the shops. Analysis in the Division of Drugs has shown that they usually contain ordinary medicinal agents, some of which are occasionally useful in combating the distressing symptoms of the disease; but so far as has yet been learned, their effect is temporary only, and they can not in any sense be regarded as "cures" for tuberculosis. Some of these remedies are represented to be cures and absolute cures for all forms of tuberculosis. Symptom blanks are employed in connection with these treatments as well as in connection with those cancer and epilepsy cures which are prescribed or sold through the mails, but this method of making a diagnosis in the absence of the patient is in such cases virtually worthless. Millions of dollars are spent annually to retard the progress of consumption, but it is well known that there is at the present time no specific for its treatment. Anyone engaged in exploiting a so-called consumption cure is simply trafficking in the life and health of the people, since the time lost in such a way may result in the death of the victims by delaying the use of the proper hygienic measures.



## MEDICATED SOFT DRINKS.

In the summer of 1907 an investigation was begun with the view of determining the number of medicated soft drinks containing either cocain or caffenin or both. Since that time over 100 brands have been found containing smaller or greater quantities of caffenin, and approximately one-third were found to contain small quantities of cocain. During the past fiscal year 15 samples, representing mostly new brands, were examined, all of which contained caffenin and 6 contained small quantities of cocain. The amount of cocain, to be sure, was small in each case, but the presence of such a deleterious agent, sold without restraint to children as well as adults, must be considered a very undesirable practice which brings harm to all consumers. It is not uncommon to find persons addicted to the use of these drinks, especially factory employees, stenographers, typewriters, and others subjected to mental or nervous strain, many of whom, it is reported, spend a large part of their earnings for these drinks. Life insurance companies are considering the status of soft-drink habitués as future risks, and undoubtedly very small quantities of cocain affect the nervous system of many individuals, especially those who have been addicted to the drug habit. Even in the few instances in which the quantity of cocain present is declared upon the container, this information does not come to the attention of the public. During the year a farmers' bulletin (No. 393) on habit-forming agents has been published for the purpose of warning people in general against all beverages and remedies containing such materials, and explaining the menace that they bear to the public health.

## SO-CALLED DRUG-ADDICTION CURES.

At the beginning of the last fiscal year the division was in communication with 35 institutions, combinations, or individuals engaged in the practice of treating drug addiction, opium, morphin, and cocain addiction, by furnishing treatment with instructions. As a rule the preparations contain, in large quantities, the very drug for which the treatment is to be taken. They are sent indiscriminately into any home, without any warning whatever relative to their poisonous character. Some of the promoters themselves have little knowledge of the dangerous character of the mixtures they are handling. For example, one of these treatments was found to be handled by a groceryman who had neither medical nor pharmaceutical knowledge, but distributed several treatments to anyone asking for them. Physicians very well understand that there are at present no substances known to the medical profession which can be used successfully for the treatment of drug addiction without the careful supervision and restraining influence of the doctor himself and the constant attendance of a nurse. It is also well known that drug addicts are incapable of curing themselves. The chief object of these treatments appears to be to extract money from the unfortunate victims, as is indicated by the fact that in some instances the treatment is supplied to the same individual over a period of years. A number of cases against products of this character are pending, but these dangerous commodities continue to be sent through the mails and especially by express from one State to another.

## PRESCRIPTION REMEDIES.

These prescription remedies usually call for several well-known medicinal agents, together with a coined-name product in the exploitation of which the advertiser is interested. In order to fill this so-called prescription it is necessary to purchase the agent sold under the coined name. The number of these remedies has been materially increased during the past year. Analysis reveals the fact that they are composed of well-known simple medicinal agents, and the claims made for them are not in keeping with the facts. The introduction of these mixtures has led to another scheme that might be called "household prescription remedies." They are advertised and sold in the same manner as are those just described, except that the purchaser himself supplies the ingredients necessary to compound the prescription. For example, in the manufacture of a face lotion, the prospective patient is advised to purchase a cheap well-known product under a coined name, mix it at home with certain well-known household agents, among them water, and apply the resulting mixture. The same directions are given for so-called shampoos, obesity reducers, and other remedies. The mixtures sold under these trade names are usually among the cheapest available on the market. For example, a certain commodity represented as a face lotion consists essentially of magnesium sulphate colored and perfumed. The amount of magnesium sulphate present in the package is worth less than 1 cent, but the package costs 50 cents. A shampoo exploited under a trade name sells for 75 cents, but consists essentially of borax, the amount contained in the package costing less than 5 cents. These are representative of a large number of products of this type at present on the market. It is of interest to note that these mixtures are sometimes exploited through the "Beauty" departments of certain newspapers. Such commodities are plainly unmitigated frauds.

## PHARMACOLOGICAL INVESTIGATIONS.

**STUDIES ON FLOUR AND NITRITES.**—Additional experiments on blood pressure of cats and dogs were made with alcoholic and aqueous extracts of unbleached flour and of flour bleached by varying quantities of nitrogen peroxid. The results obtained indicate a fall of blood pressure in all cases, equal in degree, however, for the bleached and unbleached flours. In experiments with sodium and potassium nitrite, a fall of blood pressure was obtained in cats and dogs under ether anaesthesia when relatively small quantities were injected directly into the circulation. The effect of bleached flour on enzymes has been studied as follows: (1) Experiments on autolysis (self-digestion without foreign bacteria) of bleached and unbleached flour have been conducted, but no difference in the rate of autolysis has been observed; (2) artificial digestion experiments were made on gluten from unbleached flour and that bleached by different amounts of nitrogen peroxid. No conclusion could be reached as to difference in the digestibility of the wet glutes examined, but when the gluten was dried and powdered the digestion was somewhat retarded in some of the samples of bleached flour studied as compared with those obtained from unbleached flour; (3) the effect of nitrites on the salivary digestion of starch was studied, but, although moderately large amounts of sodium nitrite were used, no effect was noticed.



STUDIES ON THE PHARMACOLOGY OF CAFFEIN.—(1) The experiments on the comparative toxicity of caffein in different species of animals and by different modes of administration were continued. Chronic caffein intoxication in dogs and rabbits was also studied.

(2) Experiments on rabbits to determine the production of caffein glycosuria indicate that doses not large enough to induce nervous and muscular symptoms cause a temporary diabetes. After larger doses the amount of sugar in the urine is increased. Glycosuria was also produced in some, but not in all, of the cats under observation. The amount of sugar in the urine of cats was much larger, however, than in that of rabbits similarly treated. It was also found that calcium chlorid stimulates caffein glycosuria in rabbits.

(3) Caffein added to liver tissue and allowed to stand in the presence of antiseptics for several days may be almost completely recovered, thus showing that the liver does not contain any specific enzym which destroys caffein.

(4) The elimination of caffein in the bile was studied in dogs, rabbits, and cats, results showing that caffein is eliminated through this channel.

(5) The effect of caffein on protein metabolism in dogs has been studied with especial care during the past year. Valuable and interesting data have already been obtained, and the work will be continued.

(6) A study of the effect of caffein on the circulation of cats and dogs is in progress.

(7) The elimination of kreatin and kreatinin after the administration of caffein has been continued. The results indicate increasing elimination of kreatin, but the evidence is not yet conclusive.

TOXICITY OF THE ALCOHOLS AND OF OTHER COMPOUNDS IN THE FATTY ACID SERIES.—Experiments on the comparative toxicity of ethyl and amyl alcohol were conducted, considerable work being done on the effect of ethyl alcohol on the protein metabolism in dogs. Because of its use in the arts and in flavoring essences for food, the pharmacology of amyl acetate was made the subject of a special investigation. It was found that from 4 to 6 cc injected subcutaneously caused paralysis and coma in frogs.

Some work has been done on the improvement of methods of analysis employed in metabolism experiments. The preparation of the sample for the determination of total nitrogen in feces and the determination of allantoin in the urine of animals have been especially studied and improvements made in the usual procedures.

#### CHEMICAL REAGENTS.

Five hundred and three chemicals were examined to check the quality of the reagents supplied to the Bureau of Chemistry and the branch laboratories on contract, as well as to other laboratories of the Department. Some improvements have been made in the general quality of the chemicals during the past year, and in many instances the manufacturers have improved on the style of container and the method of labeling. The rejections from the various lots of chemicals has been about 5 per cent. Some of the rejections and the reasons for same are as follows: Absolute ether, containing peroxids; absolute alcohol, containing foreign organic matter and aldehydes; citric acid,

containing sulphates; hydrogen peroxid, U. S. P., found to contain acetanilid; lead peroxid, labeled c. p., found to contain 5 per cent of lead sulphate.

Manufacturers have expressed not only in words, but in action, a marked degree of willingness to supply the character of chemicals needed for the analytical work of the Bureau. Difficulties relative to procuring acetic acid complying with the sulphuric acid-bichromate test have been experienced during this year, as in the past. This is largely because of the fact that the awards are made to different dealers from year to year, and each one in turn has the task of providing an acid of suitable quality or enlisting some manufacturer to produce a reagent of proper quality.

The investigation relative to the quality of the various glacial phosphoric acids on the market has been completed and the results compiled. They clearly show that the various brands of this product are variable mixtures of meta-phosphoric, pyro-phosphoric, and ortho-phosphoric acids, together with smaller or larger quantities of sodium phosphate. The latter is usually added for the purpose of causing solidification and thus enabling the manufacturer to supply an article of attractive appearance and which can be readily handled. It was also found that solutions of glacial phosphoric acid reverted from the lower hydrated acids continuously, and the rapidity of such reversions depend on temperature, concentration, and the nature of associated substances. It can therefore readily be seen that a mixture of such variable composition is an undesirable chemical reagent. It is further evident, in view of the fact that solutions of glacial phosphoric acid are never constant in composition, that such should not be used in the manufacture of medicines to be employed in the compounding of prescriptions. The reversion was proven to take place not only in the commercial brands, but also in meta-phosphoric acid made in the laboratory and of known purity.

#### SPECIAL INVESTIGATIONS.

##### VEGETABLE PHYSIOLOGICAL CHEMISTRY.

As in former years, the investigations in plant physiological chemistry, under the direction of J. A. Le Clerc, have been performed to a large extent in collaboration with the various offices of the Bureau of Plant Industry. For example—

(a) Studies of cereals for the Office of Grain Investigation and the Office of Grain Standardization, to determine their nutritive value when grown under different conditions and to determine the localities best adapted for the production of the particular cereals in question.

(b) Baking studies for the Office of Grain Investigation, in testing the value of Maryland flours, which for a number of years had been selected, crossed, and grown at College Park. This series of tests was for the purpose of eliminating the least desirable varieties of wheat under experimentation.

(c) The analyses of wheat to test the effect of varying amounts of shade on the protein and starch content, in collaboration with the physicist of the Bureau of Plant Industry.

(d) Acidity studies of peat for the botanist in connection with the blueberry investigation. These results are of value in indicating

whether the peat in question is suitable for growing blueberries and how to adapt unsatisfactory peat to this purpose.

(e) Barley investigation in collaboration with the barley experts of the Bureau of Plant Industry. This experiment was started for the purpose of noting the changes in composition of many varieties of barley when grown at the same experiment farm for a series of years.

(f) The study of alkali extracts in collaboration with the Office of Alkali and Drought-Resisting Plants and the Office of Western Agriculture Extension to determine whether the solutions in question contained sufficient alkali to prevent the growth of crops in the localities affected.

(g) The study of the absorption of plant foods by plants grown in the Great Plains area, in collaboration with the Office of Dry Land Agriculture. This is only a small part of the work done in connection with a very extensive project begun by the Bureau of Plant Industry to determine the influence of crop rotation. The chemical work includes the determination of the plant food taken up by plants grown under the different conditions.

Besides these collaborative studies, this laboratory milled 323 samples of wheat, obtained through the ordinary commercial channels, in order to prepare them for the determination of the amount of nitrites naturally found in flours as a preliminary to the bleached-flour investigation.

Other studies have included:

(a) Baking experiments to determine the value of high-protein food materials as partial substitutes for flour in bread making. The results thus far obtained promise to afford a cheaper loaf of bread, which shall be both nutritious and palatable.

(b) The influence of environment on the composition of wheat. This study has shown that environment has a greater influence in affecting the composition than has variety and the results have been published as Bulletin No. 128.

(c) The composition of cereals at different stages of growth, in order to determine when the plant should be cut in order to yield the most nutriment. This experiment is being carried on in collaboration with the Office of Grain Investigation, and the work is mostly with barley and wheat.

(d) Changes in the composition of cereals during storage. The results thus far obtained show that corn changes in composition very much more rapidly than do the other cereals.

(e) The study of the composition of barley and malt. The object of this study is to note the changes which take place on malting and to study the best temperature at which malting and subsequent kilning should be conducted with a view to causing the least possible loss and of producing a malt with the highest diastatic power.

(f) The effect of soil exchange (between Kansas, California, and Maryland) on the composition of wheat. This is intended to supplement the tri-local experiments on environment in order to determine to what extent the differences in composition found are due to the variations in soil. The first year's results only are at hand and they would seem to indicate that somewhat better crops can be produced on the California and Kansas soils in all three localities than on the Maryland soil. The differences in composition are, however, not



nearly so great as that caused by the change due to environment even on the same soil.

(g) The study of the form in which phosphorus occurs in wheat and cotton-seed meal. As it was intended to use cotton-seed meal for bread-making purposes, it was thought desirable to determine the nature of the phosphorus compounds found therein.

(h) The study of the translocation of plant food and the elaboration of plant material during germination and during the early stages of plant growth. Such studies have been carried on in the past with respect to maturing plants. This study takes up the first two weeks of the plant's life, and the results obtained are expected to be of considerable interest to scientific and practical agriculture.

In the conduct of this work, approximately 11,000 chemical determinations were made, and over 3,000 other examinations, including milling and baking tests, fermentation tests, physical tests of cereals, and granulation tests on flour.

#### ANIMAL PHYSIOLOGICAL CHEMISTRY.

A preliminary feeding experiment on animals to compare the relative nutritive values of glucose and cane sugar was completed. This study has not extended over a sufficient length of time, however, to be conclusive, though the results so far obtained indicate that the animals did not thrive so well on glucose as on cane sugar.

Analyses of yeast and beef extracts of known origin and a study on the determination of glycerin in medicinal meat preparations were made.

The work on the deterioration of meats and fish has been continued and is nearing completion. So far the results show that incipient deterioration of meats and fish when kept at low temperatures for periods of six to eight months can be detected by chemical means. The scope of the study has been enlarged in order to determine how long such products should be held in storage, especially with reference to their fitness for food under the food law.

Progress has been made during the past year in a study of the enzymes which accomplish the digestion of sugars in plants and animals. The laws of the action of one of the most important enzymes, invertase, have been reduced to exact knowledge by accurate quantitative study, and from this investigation there has resulted a useful method for estimating cane sugar in agricultural products. By the use of this new method it has been found that a wild plant, which occurs abundantly in Texas and New Mexico, called soto (*Dasylirion texanum*), contains 13 per cent of the important sugar fructose. It is planned to examine other related plants by this method. The results of these researches have been published in circular form. There is in progress a study of the enzymes maltose and emulsin, which has for its purpose the development of a method of analysis for the sugars maltose and raffinose. As these enzymes can not in general be employed with certainty in chemical analysis until the laws of their action are fully known, it is necessary to make first a careful scientific study of their properties.

An important investigation arising under the food law was made to determine the value of a so-called "diabetic flour." The excretion of sugar was doubled on feeding a diabetic with a limited quantity of

bread made from this flour, showing that the claim made for it was entirely without foundation.

Approximately 300 samples were analyzed in the prosecution of these studies, from three to five determinations being made on each one. This work is done under the direction of F. C. Weber.

#### MICROCHEMICAL INVESTIGATIONS.

Micro-analysis is of increasing importance both in the routine examination of food and drug samples under the law and in making researches for the solution of problems in connection therewith. Much collaborative work with other laboratories of the Bureau and Department, and some for other branches of the Government service, is done to supplement other examinations. During the year the following investigations under the direction of B. J. Howard have been carried on and are at present in varying stages of completion, the fig and egg investigations being made in collaboration with the Bacteriologist.

FIGS.—The condition of figs imported into this country has required an extensive and thorough study to determine the actual condition of the output as a whole, as well as to perform the routine work in the examination of individual samples. An extended inspection was made at the port of New York at the time of the fall importations to ascertain the condition of the new crop as unloaded at the docks and to collect numerous representative samples of the different grades for more careful laboratory inspection. This examination consisted in sorting each sample according to the percentage of figs containing (1) live or dead worms, (2) worm excreta, (3) sugar mites, and (4) molds. In order to identify these it was necessary to study the life history of the so-called worms (*larvæ*) which were allowed to develop in sterile figs, the resulting moth laying her eggs, and the whole cycle was thus followed.

DESICCATED EGGS.—The egg investigations, begun three or four years ago, have been continued, especially concerning frozen and desiccated products, with a view to detecting inferior materials when used in these goods. Experiments have been conducted on perfectly sound eggs, also on various grades of spoiled eggs, studying the products under different conditions and thereby determining what changes may legitimately be expected to take place in these products. This work was supplemented by a thorough inspection of Eastern factories during 1909, which inspection has been extended to about 25 factories of the Middle West during the present year. The kind of material used and the conditions of sanitation under which they were handled were the primary considerations, though every step of the process from candling to the finishing of the product was followed and samples taken for bacteriological and microscopical examination. As frozen and desiccated eggs are extensively used by the bakers of this country and are said to be an important channel for the utilization of the surplus material available in the spring and summer, it is apparent that the product should be carefully prepared from fresh material.

MISCELLANEOUS.—New studies have also been made concerning the conditions of manufacture of ketchup and the causes of certain



forms of spoilage. This work was especially needed to furnish data for passing on samples submitted for examination under the law, the microscope furnishing evidence as to the condition of the raw material which chemistry unaided could not supply.

The work on mustards has been continued and that on charlock is nearly completed. The importance of this weed as a substitute for mustard has led to the examination of a considerable number of commercial samples to determine the prevalence of this product on the market.

The condition of olives imported into this country was also investigated, the examinations showing that certain grades are very liable to be in a wormy condition, the worms having developed in the fruit previous to packing; apparently this fruit was sorted out as a low-grade product.

Much preliminary work has also been done on the application of microscopical methods to quantitative determinations. The work on alkaloids embraces now the study of 66 different kinds, and has yielded very gratifying results in its application to the identification of some of these products.

Paper samples have been examined during the past year for the Government Printing Office, General Supply Committee, Post-Office Department, and Bureau of Engraving and Printing, and floor coverings also for the General Supply Committee. Among the miscellaneous samples examined should also be mentioned paint pigments, carpet samples for a determination of the kind of fiber used, and samples of bone ash and cream thickeners.

The samples examined in connection with the food and drugs act include nearly 1,300 specimens, and among these are included ketch-ups, eggs, fruit products, olives, cattle foods, cotton-seed meal. Most of the drugs examined have been imported samples. A classified list of the various samples reported during the year is as follows:

General samples:

Papers .....	2, 735
General food samples .....	602
Stock foods .....	85
Pigments .....	32
Drugs .....	107
Unclassified .....	371
Total .....	<u>3, 932</u>

Interstate samples:

Foods .....	764
Stock foods .....	332
Drugs .....	164
Total .....	<u>1, 260</u>
Sum total .....	<u>5, 192</u>

ENOLOGICAL CHEMICAL RESEARCH.

GRAPE AND APPLE INVESTIGATIONS AT SANDUSKY, OHIO.—The enological chemical research, conducted by William B. Alwood at Charlottesville, Va., has followed in general the plan of previous years, but the amount of field work done has been greatly increased. It was found necessary in order to study thoroughly the grape crop used

in the manufacture of fruit juices and fermented by-products to establish a temporary laboratory in the northern grape belt. This laboratory, for convenience of access to the crop, as well as to the large manufactories, was placed at Sandusky, Ohio, and has been in operation practically throughout the fiscal year. The greater part of the work consisted in the chemical examination of the grape crop and by-products to determine the sugars, acids, and other important elements, 624 samples being analyzed. Four hundred and fifty-three samples of apples and their by-products were also examined, a total of 1,077 samples of fruits and fruit products analyzed at the Sandusky laboratory and involving above 8,000 determinations. This work has furnished a large amount of important data, which will have much value for reference and eventually aid in establishing the facts as to the proper composition of these products.

In connection with the study of the fruits, both grapes and apples, as presented for the manufacture of by-products, a number of fermented products were made in the laboratory in sufficient quantities to furnish full chemical data on all stages of the entire process of manufacture and on the finished article. As this work is especially designed to supply data for use in the administration of the food law, various methods of sophisticating fruit products were applied, and the chemical history of the product was carefully determined.

This investigation is now well under way, but several years will be required to complete the work so as to give reliable data, which shall cover the variations in the composition of the fruit from year to year.

COMPOSITION OF COMMERCIAL CIDERS AND WINES AND OF THOSE OF KNOWN HISTORY.—At the main laboratory at Charlottesville the chemical investigation of the composition of pure wines and ciders of known history has gone steadily forward. There are now under observation 62 wines made under strict control, including samples from most of the important varieties of grapes used for this purpose in the eastern United States. Ten samples of ciders are under observation, especially as to the effect on quality of different methods of storage. These have been so made and handled that both the manufacturing data and the chemical history are on record, and will furnish indisputable testimony as to what can be made from the fruits used.

The systematic collection and examination of the commercial wines and ciders of the eastern United States has been carried forward as rapidly as the conditions would permit. This work must of necessity give place to the investigations on the fruit crop and the manufacture of samples therefrom in season, but it is now approaching a state of completion when a large amount of data will be available. The past year 133 samples of these beverages have been examined, and a considerable stock is still awaiting attention. Previous work on commercial wines included 183 samples; thus data on 316 samples have been accumulated.

The total number of samples examined at the Charlottesville laboratory during the fiscal year was 597, or about 5,000 determinations, on fruit samples and by-products. Thus the total number of samples handled in the two laboratories reached 1,674, and the determinations made during the fiscal year exceeded 13,000.

YEAST RACES.—The attention required by the field work has rendered it necessary to defer, in a large measure, the critical studies on yeast races, which has been under way for several years, but this work is in hand and will be carried to completion. The demands for cultures of the yeast races already determined as having superior value continues, and small cultures for use as starters are furnished to manufacturers on request, and also to other laboratories. This distribution of cultures with instructions for their use is materially aiding in the improvement of the technic in the fermentation industries. The chemical and biological work of this section is now housed in the new laboratory at Stonehenge, Charlottesville, which furnishes an opportunity to increase the volume of work and improve the technic as well.

#### DENATURED-ALCOHOL INVESTIGATIONS.

During the past year the course of instruction in practical distillery work and lectures on the different phases of the manufacture of denatured alcohol, begun in 1909, were repeated, especial attention being given to the practical side of distillery operation. Besides the general educational work, experiments were conducted to determine the best methods of handling potatoes, using the American types of mashing and distilling machinery. The results obtained were eminently satisfactory, it being shown that potatoes could be satisfactorily handled in the American type of cooker and with good results.

Experiments were made also in the preparation of cheap malt, as this is one of the most expensive distillery materials that would ordinarily be purchased by the small distiller. It was found that a very satisfactory and cheap malt could readily be prepared on a small scale which would result in a very appreciable saving in the cost of operation. Even in so small a distillery as the experimental one used by the Department from \$2 to \$3 per day were saved by the use of green malt prepared at the distillery instead of the dried distiller's malt of commerce. Extensive analyses of the various products of the distillery were made, and all the results of the investigation were incorporated in Farmers' Bulletin 410, entitled "Potato Culls as a Source of Industrial Alcohol," with a general discussion of the availability of other wastes.

#### FOOD AND DRUG INSPECTION.

While nearly every division of the Bureau cooperates to some extent in either the food or drug work, the collection and examination of official samples of foods and drugs is assigned primarily to the inspection force of forty men under the chief inspector, with headquarters at Washington; to twenty-one branch laboratories, located throughout the country, and including one at Honolulu; and two inspection laboratories at Washington which check the analytical work of the branch laboratories on foods and drugs, respectively, and make original examinations of the samples collected in the vicinity of Washington. The official samples on flavoring extracts, dairy products, stock feeds, grains, and waters, however, are referred to the specific laboratories charged with the analysis of such materials, namely, the Food Technology Laboratory, the Dairy Laboratory, and the appropriate laboratories of the Miscellaneous Division. All of



the analytical reports of the branch food and drug inspection laboratories on official samples are referred to the specified laboratories for checking, and the preliminary selection of cases is made, the same being then prepared for the consideration of the Chief of the Bureau. In addition to their work in the examination of samples and the preparation of cases, these laboratories are conducting many special investigations to secure information necessary to the enforcement of the food and drugs act.

Several classes of food products are referred to other laboratories in the Bureau of Chemistry for the expert opinion of specialists on the questions involved. Among these may be especially mentioned the Sugar Laboratory, which examines all samples of sugar and saccharine foods; the Oil, Fat, and Wax Laboratory, which devotes its attention especially to the examination of those products; the Microchemical and the Bacteriological laboratories, in which all examinations are made of this nature; and the Leather and Paper Laboratory, to which samples of turpentine are referred. Such special reports are made to the laboratory which has charge of the preparation of the case, as just defined.

#### WORK OF THE INSPECTION FORCE.

**CHANGES IN THE FORCE.**—The general operations of the inspection corps along the lines laid down at the conclusion of the last fiscal year were seriously interrupted by the development of important special investigations and the amount of time spent by inspectors as witnesses in cases which had been referred for prosecution. There has been no increase in the number of inspectors, but a few changes have been made in the personnel of the force, due to four resignations and one death during the past year. Necessary appointments have been made, however, to fill these vacancies, and the quota of forty inspectors is now complete. Two inspectors are stationed at St. Louis and Philadelphia in order to handle to better advantage the volume of work which has constantly demanded attention at these trade centers. New stations have also been established at Cleveland, Ohio, and Springfield, Mass., necessitating the withdrawal of one inspector from Cincinnati and the abandonment of the station at Albany, N. Y. This work is in charge of W. G. Campbell, chief inspector.

**COLLECTION OF SAMPLES.**—The experience gained during the two years since the inception of the inspection work has shown that the most effective way of maintaining supervision over the interstate traffic in food and drug products is to visit the establishments where such commodities are prepared, to note the conveyance of the several classes of goods by the different carrier lines engaged in interstate commerce, and to collect specimens of both manufactured and crude products for analysis. A résumé of the routine work performed shows that a total of over 11,500 samples were thus obtained. This includes official samples, which may serve as the basis for prosecution of manufacturers or shippers, provided there is indicated any violation of the law, and also such samples as were collected for information or research which do not meet the legal requirements of official samples, but, nevertheless, serve the useful purpose of disclosing the nature of goods and the tendencies of their producers to meet or

evade the requirements of the law. The number of factories inspected is somewhat over 1,600. This, however, does not include the special inspection of manufacturing establishments which may have been perfunctory in their nature and yet thorough enough to yield the information desired.

**SPECIAL INVESTIGATIONS.**—Of the special investigations undertaken the last year, either by the inspection force alone or in conjunction with the chemical force, probably the most important, and the one which required the efforts of the largest number of inspectors over protracted periods, was the bleached flour campaign inaugurated to restrict interstate traffic in flour which had been bleached with nitrogen peroxid. The work was divided into two periods and carried on during the summer and autumn of 1909 and the spring of 1910. It was found impracticable to collect and deliver samples of all the interstate shipments located to the laboratories for examination, therefore the inspectors were provided with reagents to make preliminary examinations of samples of such flour, and if it appeared that the product had been bleached, a sample was forwarded to the laboratory and a check analysis made. A number of seizures were made in various sections of the country, and the preparation of the evidence necessary for the prosecution of these cases required an inspection of practically all of the mills in the Middle West and Northwest engaged in bleaching their output. Two cases have been tried, one at New Orleans, La., and the other at Kansas City, Mo., the former before a commissioner and court and the latter before a jury. In both instances decisions were rendered in favor of the Government.

Another important investigation related to interstate traffic in desiccated and frozen liquid egg products. This class of material is used exclusively in foodstuffs produced in wholesale quantities, and the consumer is thereby deprived of the opportunity to judge of its actual character before it is mixed with other substances and subjected to the process of baking and cooking. Necessary factory inspections and vigilant supervision of interstate shipments led to the institution of a number of criminal prosecutions and the confiscation of shipments on the charge of adulteration due to the contaminated or filthy character of the product. Several tons of eggs in both liquid and dry form have been confiscated and, under order of the courts, destroyed.

Another matter which has received considerable attention is the investigation conducted in connection with the Food Division as to the manufacture of cider vinegar. This was very comprehensive, involving a great many inspections and the collection of authentic samples in the States of Massachusetts, New York, New Jersey, Ohio, Michigan, Illinois, Iowa, Missouri, and Arkansas.

The inspection begun last year of the shipment of citrus fruit from certain districts in Florida has been continued, with special reference to the practices of some growers in shipping their crops to northern and eastern markets in an immature condition, where the fruit is subsequently treated by artificial means to bring about the appearance of a well ripened and mature product.

In collaboration with the Enological Laboratory, some work has been done in regard to the wine industry in northern Ohio, not only for the purpose of detecting instances of violations, but also to secure



the necessary data as to the grades of wine that may be produced in that section and to verify or disprove claims made by the manufacturers. Reports have also been made by inspectors, as the result of extensive inquiry, concerning the conditions under which food products are kept in cold storage in the principal trade centers.

The work begun the previous fiscal year in connection with the Sugar Laboratory was continued, samples of maple sugars and of maple sirups being procured at the source of production in the maple camps throughout Ohio, West Virginia, New York, and Vermont.

Another inspection which was continued was that of the conditions surrounding the soaking and floating of oysters and clams, and wherever instances of violations of the law were discovered samples were collected and shipments reported for seizure.

The investigation of the bleaching of oats and barley with sulphur fumes to improve the appearance of these cereals and the general practice of adulteration of cattle foods, supplemented by the collection of a great many official samples in various States, was continued.

The inspectors also cooperated in the concerted campaigns instituted to ascertain the character and quality of milk delivered in interstate shipments at Boston and Springfield, Mass., and at Cincinnati, Ohio.

At the request of certain packers of sardines along the Maine coast, an investigation was undertaken for the purpose of ascertaining the conditions under which these fish were canned, especially with regard to the sanitary features. One of the results of the investigation thus far has been to report shipments of old goods which were seized and destroyed because of adulteration with tin salts.

The varied character of the work performed by the inspectors is illustrated by enumerating other investigations in which they cooperated: The investigation of methods of manufacture and the collection of authentic samples of essential oils; an inquiry in collaboration with the Dairy Division of the Bureau of Animal Industry of the condensed-milk industry; an investigation to determine whether apples grown and shipped from the States of Oregon and Washington were misbranded in being labeled as the products of the Hood River districts; an inquiry into the practice of the firms engaged in producing salt in California and Utah and marketing it in imitation of well-known brands of English salt; and in numerous other special investigations which have been pursued at the request of state officials.

#### WASHINGTON FOOD INSPECTION LABORATORY.

The total number of samples examined in the Washington Food Inspection Laboratory during the year was 2,431, of which 790 were check samples of import foods taken at the various branch laboratories, 205 were import food samples taken in connection with the nonlaboratory port inspection in the Washington district, and 1,436 were samples of food of domestic origin. The preparation of the cases arising from these examinations forms a large part of the work of this laboratory, 1,600 cases having been prepared and submitted to the board for consideration.

The volume of work, both analytical and executive, handled in this laboratory restricts the researches, but several important studies have been made or supervised, notably the denatured alcohol investi-



gation and the study of methods for the identification of colors used in food products.

Some specially interesting features of the imported food work during the year were as follows:

In order that import cases may be handled in as short a time as possible arrangements have been made with the Treasury Department to establish certain precedents, and when the adulteration or misbranding of imported foods fall under one of these the port laboratory is empowered to report its conclusions direct to the customs officials in charge at that port. A gradual extension of this list of established precedents has taken place, so that during the past year practically all of the cases were handled at the ports directly with the customs officials, only special cases or appeals from the action of the laboratory being referred to Washington for check examination and final action. It is the handling of these special cases and appeals which often requires special investigation and constitutes the greater part of the import work of the Washington Food Inspection Laboratory, where all recommendations to the Board of Food and Drug Inspection on imported foods are prepared.

The inspection of meat and meat food products, through the cooperation of the customs officials, has been extended to the ports where no laboratories or inspectors of this Bureau are stationed, so that now all of these products must be accompanied by proper meat-inspection certificates, showing that they have been examined before and after slaughter by an official veterinarian. In addition, through cooperation with the Bureau of Animal Industry, an actual inspection will be made of imported meats when it is necessary to determine whether they are in proper condition at the time of arrival.

The insanitary conditions surrounding the packing of imported figs having been brought to the attention of the Department, and a great many shipments of dried figs being refused entry at the various ports on this score, every manufacturer of figs was required to submit a sanitary certificate from the American consul showing that his factory was in a satisfactory condition before his goods were allowed entry. As a result, a very rapid betterment of conditions and methods of packing took place. It also developed that these figs were very largely wormy or worm-eaten or infested with sugar mites. As a result of this work foreign countries interested in the production of figs have been making strong efforts to better the conditions at home so as to meet the requirements of this country, and undoubtedly a much better grade of figs, packed in more sanitary surroundings, will be brought into the country in the future. The imported ripe olives were also found to be wormy or worm-eaten, many shipments consisting almost entirely of such imperfect fruit, necessitating re-shipment.

The French Government limited the area in which Cognac brandy could be produced, and prohibited the labeling of any brandy produced in other parts of France as Cognac. The value of the word "Cognac" was so great, however, that practically all French brandies were labeled in such a manner as to convey the impression that they were made in that locality, the word "Cognac" appearing in very large type and other words restricting its application in very much smaller letters. Quite a number of shipments of brandy

labeled in this manner were detained and required to be relabeled before entry. As a result, the labeling of these products has been changed, so that they no longer convey the impression that the product is made in Cognac when such is not the case.

It was also noted during the past year that certain kinds of canned fish contained excessive amounts of tin. Especially was this true of the kippered herring, smoked sardines in bouillon or tomato sauce, fish in mustard sauce, etc. In some cases nearly all the tin on the inside of the can would be dissolved and the product would contain from 5 to 8 grains of tin per pound. The corroded appearance of the inside of the can in such cases is readily noted. Many shipments of this class of products were refused entry, and it seems probable that the method of packing these goods must be changed. The examination of fish, sardines, etc., put up in oil shows that, as a rule, they do not contain tin to any extent, the oil acting as a protecting coating to the tin.

A survey of the work of the year shows that certain forms of adulteration common at the beginning of the inspection work are now exceedingly rare, such as the mixture of olive oil with other oils, for instance, only one sample being found thus adulterated. Cheeses made from skim milk are now generally properly labeled, and the use of boric and salicylic acids as preservatives has been practically eliminated, only one case being reported.

#### EXAMINATION OF DAIRY PRODUCTS UNDER THE LAW.

Of the dairy products entering into interstate commerce, special attention has been given to various brands of cheese of domestic origin labeled as a foreign article. Many instances of this form of misbranding have been brought to the attention of the manufacturer, and the necessary changes made in the labels. In one case where the label of an Austrian variety of cheese was made use of on a domestic product, the foreign label has been discarded entirely, while others have only modified the wording of their labels, substituting English for foreign words.

Consideration has also been given to the subject of short weights in the case of the American Cheddar variety of cheese. It appears to be the universal custom of the trade to pay for cheese on the basis of the marks of boxes, which represent the weights at the time of shipment from the factory; unless the consignee uses the precaution to reweigh or check these weights a considerable shortage is often shown, due to shrinkage while in storage. Improvement has been made in this form of misbranding, in that most consignments of cheese are reweighed at the time they enter interstate commerce. Considerable deception is still practiced in labeling whole milk cheese as "cream cheese." One company making a well-known variety has removed the word cream from their labels.

The examination of fresh marketed milk entering interstate commerce has been continued during the year. Milks marketed in Boston and Cincinnati were examined in collaboration with the inspection laboratories in the cities named. The adulteration of milk by watering for city consumption is found to be still prevalent, though a marked improvement from a chemical standpoint is noted in the

case of Cincinnati milks, as compared with the previous investigation at this point.

An extensive investigation is in progress by the chief of the Dairy Laboratory, G. E. Patrick, of the manufacture of evaporated or condensed milk, for the purpose of determining reasonable limits of composition for this product. The investigation was ordered in consequence of numerous complaints from manufacturers, claiming that a total solids content of 28 per cent as at present required is unreasonably high, it being alleged to be impossible to attain such a standard at all seasons of the year and still produce a smooth, homogeneous, marketable product. This investigation necessitates a critical study of the manufacturing methods employed and results obtained in different parts of the United States.

A classified list of samples examined is as follows: Evaporated milks 159, cheese 112, fresh milks 54, butters 131, oleos 8, creams 15, condensed milks 33, milk powders 27, miscellaneous (malted milks, butter colors, ice-cream thickeners, etc.) 52; total 591. Of this total 357 were inspectors' samples, 49 were received from branch laboratories, 61 were examined in connection with the evaporated-milk investigation, and 97 were renovated butters examined for the Dairy Division, Bureau of Animal Industry. Cases recommended to the Board of Food and Drug Inspection for prosecution were as follows: Milks 83, cheese 66, evaporated milks 12, milk powders 7, butters 4, condensed milk 1, ice-cream thickeners 1; total 174.

#### WASHINGTON DRUG INSPECTION LABORATORY.

DOMESTIC DRUGS.—During the past year 994 samples of domestic drug products have been examined in the Washington Drug Inspection Laboratory, and 323 were found to be in violation of the law. In addition seizures of a number of consignments of drugs were recommended on the ground that they were either adulterated or misbranded under the law. Some of the analysts have devoted much time as witnesses at the trial of the cases.

The chief violations found were misrepresentations on the labels of bottle or carton and in the advertising literature accompanying the packages, and further incorrect statements, or the absence of any statement regarding the declaration of alcohol, opium, morphin, cocain, acetanilid, chloroform, etc. A considerable number of powdered drugs have been found adulterated, among which are belladonna leaves, containing an excessive amount of sand and foreign plant material; powdered colocynt, containing large amounts of seed; pilocarpus leaves, spurious or musty and worthless; spigelia, spurious or containing foreign plant and sand; stramonium leaves adulterated with foreign leaves, seed, and dirt. On the whole, however, the quality of powdered drugs was found to be better than in the preceding year, those from the Pacific Coast States being inferior to those collected in the East.

Examination of a number of so-called cancer and drug addiction cures have disclosed them to be of the same fraudulent character as previously, but a goodly number of these products have been taken off the market within the last year, or the labels and literature have been made to comply with the law.



IMPORTED DRUGS.—Of the 228 samples of imported drugs analyzed in this laboratory, 201 were found to be illegal. But few shipments of crude drugs were included among these, however, the illegal samples consisting chiefly of proprietary remedies.

A large percentage of the imported drug products detained are disposed of by the port laboratories under precedents which have been established, but all cases for which there are no precedents are regularly referred to the Washington Drug Inspection Laboratory, together with the appeals from importers, shippers, or manufacturers for investigation and recommendation. The character of violations is very similar to those encountered in domestic drugs, namely, misrepresentations upon the label, carton, and in the accompanying literature, regarding the medicinal claims, names, place of manufacture, etc., and the absence of or the incorrect declaration of the prescribed ingredients, as alcohol, ether, chloroform, opium, morphin, codein, acetanilid, etc.

The quality of the crude drugs imported has materially improved, as is noted also in the report on the New York laboratory where the greater number of imported drugs is received. Official crude drugs, for which the United States Pharmacopœia prescribed definite standards, are less frequently found to be below the specified strength in alkaloidal material, resin content, etc. A number of importations of official drugs for which no specific standard exists, however, were found to be of inferior quality. These included digitalis, senna leaves, uva ursi leaves, buchu leaves, and cubeb berries. Such goods were found to be either improperly cured or contaminated with foreign material, such as sticks, stems, and leaves, indicating that the inferior quality is due to improper or careless collecting and curing rather than to gross adulteration. During the fiscal year henbane leaves offered for entry showed a great improvement, but some consignments were still found below the minimum alkaloidal requirement. The practice previously in vogue of importing *Hyoscyamus muticus*, a spurious henbane, under the name "henbane," has virtually ceased. During the early part of the year many importations of saffron were found to contain an excessive quantity of yellow styles, and it was said to be impossible to procure this product without a large amount of this foreign material. Importations received during the last six months, however, indicate that this statement is not well founded and that there is no difficulty in obtaining these goods reasonably free from the objectionable material. The substitution of calendula florets colored with coal-tar dye for saffron, and the weighting of saffron with inorganic material, which frequently occurred when the law first went into effect, have virtually ceased.

Considerable difficulty has been experienced in regard to the importation of Haarlem oil. After purging the printed matter of the false and misleading claims and representations regarding the medicinal virtues of the article, the question arose as to the composition of genuine Haarlem oil, and the place of manufacture. A mass of information has been accumulated through the aid of the State Department and the trade regarding the status, merits, and composition of the various brands. The questions regarding the true place of manufacture have been very largely answered and the indications are that the whole matter will soon be adjusted satisfactorily.

During the early part of the fiscal year a number of importations of so-called "synthetic balsam Peru" were offered for entry, invoiced under some such names as "balsam Peru" or "synthetic balsam Peru." Examination showed that they were artificial mixtures, pure and simple. Such goods are intended to be employed instead of natural balsam Peru recognized in the United States Pharmacopœia, Analysis of this product showed that it did not comply with the pharmacopœial standards for the official product, and, from analytical data and other information available, it is evident that the article in question is purely an imitation of the genuine product.

Importations from oriental countries offered for entry under the guise of medicinal preparations were found to contain opium or morphin. These products are put up in various forms, such as small red pills coated with cinnabar, contained in bottles or wrapped in paper and inclosed in paraffin or in wax globules. Others are in the form of tablets. Such goods have been invoiced under various names, as "tonic pills," "stimulant pills," "tea cake," etc. The products are recommended, in the English or in the Chinese language, or both, for those who have been addicted to the opium or morphin habit, and also for coughs, colds, consumption, etc. Such products are obviously used to supply drug addicts and to promote drug enslavement. In some instances the statement is made in the Chinese language that the goods do not contain morphin, and that they are beneficial for "women and children, male and female." Other importations of products have been offered for entry containing habit-forming drugs, as opium, morphin, cocain, codein, chloroform, and ether, recommended for certain children's diseases, coughs, colds, etc.; for example, the products "pastiglie dower," containing opium, and "pastils of codein," containing morphin and codein. These goods are in the form of a confection, sweet and attractively flavored. In the hands of mothers, children, and those who are not familiar with the properties of such constituents, the great danger of their indiscriminate use is apparent.

Interesting facts have developed regarding the importation of certain linseed, licorice, and chlorodyne cough lozenges. This preparation is in the form of a lozenge, is not unpleasant to the taste, and contains, among other ingredients, chloroform and ether. When a consignment was detained it was represented to be sold only as a medicinal agent for coughs, colds, etc.; but an investigation showed conclusively that in certain localities the product was sold indiscriminately and extensively to school children and others as a confection, without any warning whatever regarding its dangerous character. All such products as the above are detained and prohibited entry under section 11 of the law, as being dangerous to the health of the people of the United States.

#### EXAMINATION OF FOODS AND DRUGS AT THE BRANCH LABORATORIES.

Heretofore the inspection of imported food and drugs has been largely confined to the ports at which inspection laboratories were established. Invoices of all shipments of foods to all ports in the United States were received at the Bureau of Chemistry, and from time to time shipments to nonlaboratory ports were sampled and ex-

amined, but the number of shipments so inspected was not large. During the last year the inspection at important nonlaboratory ports has been systematized and placed within the jurisdiction of the respective laboratory ports convenient thereto, as shown by the following assignments. This change will undoubtedly greatly increase the efficiency of the inspection in the territory covered.<sup>a</sup>

Boston food-inspection laboratory, United States Appraiser's Stores, Boston, Mass.: Bangor, Me.; Burlington, Vt. (Calais, Me.); Eastport Me.; Fall River, Mass.; New Bedford, Mass.; Newport, R. I.; Newport, Vt.; Portland, Me.; Providence, R. I.; Springfield, Mass.

Buffalo food-inspection laboratory, Federal Building, Buffalo, N. Y.: Cape Vincent, N. Y. (Malone, N. Y.); Niagara Falls, N. Y.; Ogdensburg, N. Y.; Oswego, N. Y.; Plattsburg, N. Y.; Rochester, N. Y. (Rouse Point, N. Y.); Syracuse, N. Y.

Chicago food-inspection laboratory, Manhattan Building, Chicago, Ill.: Dubuque, Iowa; Marquette, Mich.; Milwaukee, Wis.; Peoria, Ill.

Cincinnati food-inspection laboratory, First National Bank Building, Cincinnati, Ohio: Columbus, Ohio; Dayton, Ohio; Indianapolis, Ind.; Louisville, Ky.

Denver food-inspection laboratory, Tabor Opera House Building, Denver, Colo.: Nogales, Ariz.; Salt Lake City, Utah.

Detroit food-inspection laboratory, Telegraph Building, Detroit, Mich.: Grand Haven, Mich.; Grand Rapids, Mich. (Petoskey, Mich.); Port Huron, Mich.; Sandusky, Ohio; Toledo, Ohio.

Galveston food-inspection laboratory, Old Custom-House, Galveston, Tex.: Brownsville, Tex.; Corpus Christi, Tex.; Eagle Pass, Tex.; El Paso, Tex.; Galveston, Tex.; Houston, Tex. (Texas City, Tex.); (Velasco, Tex.).

Kansas City food-inspection laboratory, Government Building, Kansas City, Mo.: St. Joseph, Mo.

Nashville food-inspection laboratory, Custom-House, Nashville, Tenn.: Memphis, Tenn.

New Orleans food-inspection laboratory, Custom-House, New Orleans, La.: Mobile, Ala.

New York food-inspection laboratory, United States Appraiser's Stores, New York, N. Y.: Albany, N. Y.; Bridgeport, Conn.; Hartford, Conn.; Jersey City, N. J.; Newark, N. J.; New Haven, Conn. (Norwalk, Conn.); Perth Amboy, N. J. (Stamford, Conn.).

Omaha food-inspection laboratory, Post-Office Building, Omaha, Nebr.: Council Bluffs, Iowa; Des Moines, Iowa; Lincoln, Nebr.; Sioux City, Iowa.

Philadelphia food-inspection laboratory, United States Appraiser's Stores, Philadelphia, Pa.: (Chester, Pa.); Somers Point, N. J.; Wilmington, Del.

Pittsburg food-inspection laboratory, Park Building, Pittsburg, Pa.: Cleveland, Ohio; Erie, Pa.

St. Paul food-inspection laboratory, Old Capitol Building, St. Paul, Minn.: Duluth, Minn. (Minneapolis, Minn.); Pembina, N. Dak.

San Francisco food-inspection laboratory, United States Appraiser's Stores, San Francisco, Cal.: Los Angeles, Cal. (Oakland, Cal.); San Diego, Cal.

Savannah food-inspection laboratory, Custom-House, Savannah, Ga.: Atlanta, Ga.; Charleston, S. C.; Jacksonville, Fla.; Key West, Fla. (Miami, Fla.); (Palm Beach, Fla.); (Punta Gorda, Fla.); Tampa, Fla.

Seattle food-inspection laboratory, Arcade Annex Building, Seattle, Wash.: Great Falls, Mont.; Port Townsend, Wash. (Spokane, Wash.); (Tacoma, Wash.).

Washington food-inspection laboratory, Bureau of Chemistry, Washington, D. C.: Baltimore, Md.; Georgetown, D. C.; Newbern, N. C.; Newport News, Va.; Norfolk, Va.; Petersburg, Va.; Richmond, Va.

The following tabulated statement of the activities of the twenty-one branch laboratories is of interest as indicating in a general way the extent of the work done, the accompanying text showing the character of the examinations made, the classes of foods examined, and the nature of the research work done in connection with the execution of the law.

<sup>a</sup>An amendment to the Treasury decision inaugurating this inspection has been requested to cover specifically the inspection of imported drugs at these non-laboratory ports.



In the reports of the various food-inspection laboratories it will appear that a relatively large percentage of the foods and drugs examined were found to be in violation of the food and drugs act. From this no inference can be made regarding the prevalence of adulteration and misbranding. As the work of the Bureau increases the inspectors become more and more experienced in the collection of samples and are more and more conversant with various brands and types of food. The samples taken by them do not represent the average foods and drugs on sale on the markets, but those which the inspectors suspect of adulteration.

*Food and drug samples examined in the various branch laboratories during the fiscal year ended June 30, 1910.*

Laboratory.	Imported samples.			Hearings conducted.	Interstate samples.		Miscellaneous samples.	Total samples analyzed.
	Legal.	Illegal.	Floor-inspection samples.		Legal.	Illegal.		
Boston.....	460	295	12,404	674	744	270	140	1,909
Buffalo.....	76	29	33	159	146	231	41	523
Chicago.....	173	125	2,572	365	658	686	42	1,684
Cincinnati.....	19	4	28	239	1,157	228	1	1,409
Denver.....	11	.....	11	160	395	175	44	625
Detroit.....	52	4	92	359	151	144	31	382
Galveston.....	59	22	365	116	192	144	44	461
Honolulu <sup>a</sup> .....	272	144	677	131	.....	.....	8	424
Kansas City.....	.....	.....	.....	103	125	127	.....	252
Nashville.....	.....	.....	.....	157	191	65	.....	256
New Orleans.....	95	84	2,891	197	148	108	76	511
New York.....	2,382	1,632	47,821	1,779	124	297	504	4,939
Omaha.....	.....	.....	3	69	239	110	100	449
Philadelphia.....	569	183	5,250	293	41	114	48	955
Pittsburg.....	47	54	227	197	162	216	55	534
Portland.....	248	106	4,636	137	112	143	46	655
St. Louis.....	14	6	239	295	365	281	99	765
St. Paul.....	74	13	233	85	136	55	4	282
San Francisco.....	237	209	8,100	491	469	375	153	1,443
Savannah.....	65	40	26	159	105	51	19	280
Seattle.....	277	137	1,657	113	50	41	168	673
Total.....	5,130	3,087	87,265	6,278	5,710	3,861	1,623	19,411

<sup>a</sup> Owing to death of its chief, this laboratory was closed during the month of June; report is total for eleven months.

The wide variation in the figures reported from the different branches is due to the different conditions existing, details from one station to another and for court work, the varying amounts of executive and routine work necessitated at different points, etc. In some cases the hearings are conducted almost entirely by correspondence and again those cited appear in person.

#### BOSTON LABORATORY.

Of the 1,909 samples analyzed at the Boston laboratory over one-third were imported and included a wide variety of products. Approximately 39 per cent of these were classed as illegal. Of the 1,014 interstate samples, 737 were milk samples, a larger part of which were obtained during the milk campaign of November, 1909, undertaken because there had been much complaint concerning the quality of milk shipped to Boston and Springfield, Mass., from outside the State; approximately 13 per cent of these samples were classed as illegal, quite a number being watered milks from New

Hampshire and Connecticut. The source of all samples showing added water, excessive filth, or an abnormally high bacterial count was inspected and the conditions in general were such as to account for the insanitary samples, while in several instances deplorable conditions were found. In general, the milk supply of Boston was superior to that of any city so far inspected, but the supply of Springfield was inferior. As a result of the warnings, hearings, and prosecutions which have followed this milk investigation it is believed that the milk shipped in interstate commerce in New England has been appreciably improved. A large proportion of the miscellaneous samples examined during the year were analyzed for the purchasing commissary office of the War Department at Boston. Of the 674 hearings held, 401 were on domestic products, approximately 500 being held in person and the remainder by correspondence.

The following original investigations have been given attention during the year as opportunity has offered:

**VANILLA EXTRACT.**—The study of the effect of various methods of manufacturing vanilla extract from different kinds of vanilla beans has been continued, including detailed analyses of the extracts examined.

**FISH.**—The work of the laboratory on fish has been extended to include the detection of the deterioration of canned fish due to decomposition before canning. If this has not gone too far, the appearance of the fish may be nearly normal after the container is sterilized. Fish of this character, however, appear to yield upon analysis an appreciable amount of free ammonia, as would be expected from Pennington's results in similar investigations. This is not true of fresh fish. All samples of fish examined that had been canned two or more years also gave appreciable amounts of free ammonia, and an experiment is under way in which fish packed under known conditions is being submitted to periodical examinations.

**CONTAMINATION OF FOOD PRODUCTS BY TIN.**—On opening canned fish which has been packed for a long period in tin cans in which the fish is unprotected from the tin, it is invariably noticed that the container is more or less discolored and often badly etched. This recently led to an investigation as to the tin content of canned fish imported through the port of Boston and it subsequently developed that a number of such shipments contained from 300 to 1,200 mg of tin per kilogram—amounts which may be injurious to health. As to the quantity of tin in solution, much depends on the quality of the tin plate, the kind or character of goods, and the length of time the latter have been put up. All fish in acid have been found to corrode the tin very badly, even in a short time; this applies particularly to fish in mustard sauce. Fish in tomato and various other sauces, in bouillon, and smoked fish of all kinds—except when packed in oil—have been found to be especially active in attacking the container. Lobsters, clams, and shrimp also attack cans badly if they are unprotected, while, as is generally known, many fruits and vegetables act in the same manner.

**CASHEW NUTS.**—Cashew nuts (*Anacardium occidentale*), grown in tropical countries, where they are highly regarded as an article of

food, are being brought into this country in constantly increasing amounts, particularly from Jamaica and India. During the past season over 45,000 pounds have been imported through Boston alone, but a comparatively small proportion of these nuts are used whole, the larger part being ground and mixed with other higher-priced nuts of more pronounced flavor, such as the almond. A chemical and microscopical study has been made of cashew nuts, from which their addition in appreciable amounts to other nut mixtures or pastes may be detected.

## BUFFALO LABORATORY.

Of the 105 import samples examined at the Buffalo laboratory 29 were found to be illegal, and were either relabeled under customs supervision or reshipped from the country. Port inspections were continued throughout the year at Buffalo, Niagara Falls, and Rochester. Of the 377 interstate samples 61 per cent were found to be illegal, the principal classes of foods inspected being grape juice and other unfermented beverages, fruit and saccharine products, flavoring extracts, spices, dairy products, cocoa, and chocolate. One hundred and fifty-nine hearings were held, of which 117 were reported in writing, 19 held orally, and at 15 the persons cited appeared and presented their statement in writing. Eight citations to hearing met with no response.

Investigations undertaken during the year included a completion of work, previously reported, on the composition of canned peas and beans, the results being published in Bureau of Chemistry Circular No. 54. Methods for the determination of sugars and fat in cocoa products and for the determination of added cocoa shells in such products were also studied and an extended investigation made to provide a satisfactory procedure for determining the alkalinity of ash for use in judging of alkali-treated cocoas. Some collaborative work has also been done on flavoring extracts and paprika.

## CHICAGO LABORATORY.

Owing to special work relating to bleached flour, the number of samples examined at the Chicago laboratory in the ordinary course of inspection was somewhat less than during the preceding year. Of the 1,344 official samples of domestic foods analyzed 686, or 51 per cent of the total number, were found to be illegal. The percentages of the samples found to be adulterated or misbranded, in the case of the principal classes of foods examined, were as follows: Cereal products, including flour, 62 per cent; coffee and cocoa, 23 per cent; flavoring extracts, 52 per cent; fruit products, 45 per cent; saccharine products, 55 per cent; spices and condiments, 34 per cent. Citations of hearings have been issued in 365 cases, in the majority of which evidence was presented in person by the party cited or his representative.

Inspection of 2,572 shipments of imported foods on the floors of the appraiser's stores led to the taking of 298 samples, of which number 125, representing 42 per cent of the total number of samples examined, were found to be illegal. The classes of products most commonly found adulterated were dairy products, and preserved meat and fish.



**BLEACHED FLOUR.**—The most important work of the year has been in connection with the enforcement of the law against bleached flour. This has involved the examination of numerous suspected samples, the investigation of special problems relating to bleaching, and the attendance of two of the chemists at the New Orleans and Kansas City trials.

About 300 samples of wheat from different sections of the country, representing a great number of varieties and grades, were secured through the Bureau of Plant Industry and ground in an experimental mill in the Laboratory of Vegetable Physiology at Washington. The flour thus obtained was examined at the Chicago laboratory with reference to nitrites. In no case was even a trace of nitrites detected.

A comparative study of the effects of bleaching and aging on the physical properties and chemical composition of flour has been carried out with patent and clear flours from 15 mills located in different sections of the country. This investigation may be regarded as preliminary to a more extensive one planned for the ensuing year.

In the course of the flour investigations a method has been developed for the determination of the "gasoline number," which is a measure of the amount of yellow coloring matter present in the flour associated with the oil. This method, at first designed merely for detecting bleaching, is believed to have a wide application for determining the color value of unbleached flour.

**VANILLA INVESTIGATIONS.**—A method of determining vanillin, coumarin, and the normal lead number in vanilla extracts, developed during the preceding year, was presented at the Denver convention of the Association of Official Agricultural Chemists, and has been used in the examination of 74 vanilla extracts prepared in the laboratory from as many samples of vanilla beans, representing not only the product of different places of production, but also the different lengths and commercial grades of each. Second extracts prepared in each case from the residue of the first extraction have also been analyzed. It is believed that the results thus obtained will be of value in interpreting the analyses of commercial extracts, and enable the analyst to distinguish genuine vanilla extract from imitations.

**COURT WORK.**—Chemists from this laboratory have been called on to present evidence in court cases both at Chicago and other points. The time spent in consultation with district attorneys and in court, including the bleached-flour cases, has been approximately equivalent to that of one person for the whole year.

#### CINCINNATI LABORATORY.

The total number of samples analyzed at the Cincinnati laboratory during the past fiscal year is 1,409, including interstate and import work. About one-sixth of the 1,385 interstate samples were adjudged illegal. Of the domestic samples 101 were milks, 145 fruit products, and 126 flavoring extracts. As the figures show, the milk supply in and around the city of Cincinnati during the past year has received special attention. At the time this work was first undertaken, less than two years ago, nearly 60 per cent of the milk samples were adulterated, but when the last milk campaign was conducted, during June, 1910, only from 6 to 7 per cent of the samples examined showed

adulteration by the chemical analysis. Bacteriological determinations are not included in this statement. Of the 239 hearings reported, about 100 were conducted by correspondence. The chief of the laboratory was detailed during the year to certain large eastern cities to assist in milk campaigns such as had been conducted at Cincinnati.

## DENVER LABORATORY.

The percentage of the 570 interstate samples examined that were found to violate the law was about 31, a slight but not significant decrease as compared with last year. The violations by shortage of weight or measure, which last year predominated, showed a decided diminution, and in most instances were due to lack of uniformity in the size of the containers rather than to any fault of the manufacturer. The form of illegality most frequently found consisted of exaggerated and misleading statements on the labels.

Research work has been continued on lemon extracts and oils, comparing various methods for the determination of citral in these substances. In connection with this work the possibility of determining citronellal in lemon oils has also been studied, using both fuchsin sulphurous acid and metaphenylene diamine hydrochlorid.

A simple and reliable method has been elaborated for making quick ether extract determinations on dry powdered substances, such as cocoa, coffee, spices, etc. Its usefulness lies in the amount of time saved, the process of extraction consuming only a few minutes for each sample as compared with twenty hours by the official method, and the results so far obtained by the two methods agree remarkably well. It is not intended that the proposed method should be substituted for the official one, but it offers a simple and rapid means by which the analyst may separate the genuine from the adulterated samples.

Forty-four samples were examined for the Treasury and War departments, consisting of a few samples of drugs for the Customs Service and a considerable number of spices, etc., for the commissary, Department of the Colorado, cooperative work on methods for the examination of sugars and flavoring extracts and on maple products and the detection of capsicum, etc., in ginger ales.

Nearly all of the 160 hearings held by the Denver laboratory during the year were conducted by correspondence. The territory from which samples are commonly purchased and sent to the Denver laboratory for analysis comprises Colorado, Utah, Wyoming, part of Nebraska, western Kansas, New Mexico, Arizona, and Nevada, a very large but rather sparsely populated area. Again, Denver is not in itself an extensive or important producer of foods as compared with eastern cities, but is a comparatively large distributor of foods through a district covering a considerable portion of the States named. These conditions materially affect the character of the hearings, the results being that few manufacturers are cited on samples examined in the Denver laboratory.

## DETROIT LABORATORY.

The work of the Detroit laboratory, as in previous years, has consisted principally in examinations of domestic samples. Of the 295 interstate samples about 50 per cent were found to be illegal. Notice-

able among these were 49 illegal samples of fruit products out of 56 examined, and 46 out of 125 flavoring extracts. The miscellaneous samples analyzed were chiefly those submitted by the Treasury Department and others used in cooperative work with the Bureau. Of the 56 samples of imported food and drug products only 4 were found to be in violation of the food and drugs act. Besides the imported samples taken from the Detroit appraiser's stores, samples were also received from Grand Rapids, Port Huron, and Toledo. Over 50 per cent of the 359 hearings were on flavoring extracts and fruit products, at which approximately 60 per cent of those cited appeared in person.

#### GALVESTON LABORATORY.

The examination of imported foods constitutes the less important part of the work of the Galveston laboratory. Wines, liquors, tinned fish, oils, and canned vegetables comprise the greater part of the entries at this port, and of the 81 samples examined, about three-fourths were adjudged misbranded or adulterated.

The 336 domestic samples examined were principally canned fruits, flavoring extracts, cocoa, chocolate, spices, condiments, fruit juices, fermented liquors, cereals, and sirups, of which about 43 per cent were adjudged illegal. The territory from which these samples were drawn is principally limited to Texas, with a few from Louisiana, Oklahoma, and adjacent States. Of course, the percentage of samples found illegal is no criterion of the average of food products brought into this territory, since these samples are selected by the inspector as being suspicious. Instances of products dangerous to health were rare, but cases of willful misrepresentation were not uncommon, particularly in the case of extracts artificially compounded to imitate the genuine, about 54 per cent of those examined being found illegal. About half of the fruit juices and 30 per cent of the fruit products were also adjudged illegal.

The hearings held at this laboratory on domestic cases have been largely those accorded to retail dealers and are conducted almost entirely by correspondence, owing to the distance involved.

There being no other government laboratory in this district, a number of miscellaneous examinations were made for the Treasury Department, from time to time, in connection with the customs work.

In addition to the regular inspection of samples, methods of analysis proposed for cocoa, the determination of citral in lemon oil, the determination of preservatives, and of color in whisky have been tested, and analyses of oysters and water from the local oyster reefs have been made in connection with the oyster investigations of the Division of Foods.

#### KANSAS CITY LABORATORY.

Almost half of the 252 samples examined were found to be illegal, the proportion varying from 90 per cent in the case of fruit juices and nonalcoholic beverages and of fermented beverages to 14 per cent for coffee and cocoa. Cereal, fruit, and saccharine products were the principal articles examined. Of cereal products 77 per cent were illegal, of dairy products 53 per cent, of flavoring extracts 50 per cent,



of fruit products 41 per cent, of oils and fats 33 per cent, of saccharine products 28 per cent, and of spices and condiments 25 per cent.

For nearly two months the regular activities of the laboratory were diverted to the preparation of the bleached flour case which was tried in Kansas City June 1, and which was decided in favor of the Government.

Some collaborative work on methods was done, chiefly dealing with the determination of citral in lemon extracts. An apparatus was perfected for the convenient and rapid photography of labels, these being necessary to show the "design and device" as well as the wording. The main feature of the apparatus is the use of focusing scales and the elimination of the dark room, the whole operation being so simple as to permit of its being turned over to an unskilled person.

#### NASHVILLE LABORATORY.

Of the 256 interstate samples examined 21 were check analyses, all reported as illegal, excluding which about 19 per cent of the samples were adjudged either misbranded or adulterated. Flavoring extracts, vinegars, and spices furnished the greater part of these. A vinegar investigation was made in connection with the New York laboratory, during which vinegar plants at Memphis, Tenn., Cairo, Ill., and Paducah, Ky., were visited and a special study made of the samples so obtained.

In connection with this work 157 hearings were conducted, in the majority of cases by correspondence.

#### NEW ORLEANS LABORATORY.

The work of the New Orleans laboratory has been closely confined to the routine examination of interstate and import samples, owing to the serious illness and absence of the chief.

Some of the 76 unofficial samples were examined for the purchasing commissary of the United States Army, and others for the United States Grain Standardization Laboratory, the remainder being analyzed in connection with the bleached-flour investigation. For about a month the entire resources of the laboratory were devoted to the preparation of the bleached-flour case which was tried in New Orleans February 10, 1910.

Work on a method for the detection of corn oil in mixtures, particularly with cotton-seed oil, was planned, pure samples of corn oil and cotton-seed oil being obtained and known mixtures made.

The inspection of bulk olives offered for entry into the port of New Orleans has shown over 90 per cent of them to be wormy and unfit for food. Nearly 3,000 floor inspections resulted in the examination of 179 import samples, about half of which were adjudged illegal, fruit products, meat and fish, and vegetables furnishing the greater part of these.

The more important classes of domestic products examined were coffees and cocoas, dairy products, fermented liquors, flavoring extracts, and fruit and saccharine products, of which over one-third were found to be illegal, about 42 per cent of all of the domestic samples proving to be either misbranded or adulterated.

## NEW YORK LABORATORY.

**INSPECTION WORK.**—The New York laboratory is chiefly concerned with the inspection and examination of imported food and drug products, as provided for by section 11 of the food and drugs act. During the past year 47,821 cases of foods and drugs were inspected on the examiners' floors, from which no samples were taken; 4,014 samples were analyzed in the laboratory, of which 1,632, or about 40 per cent, were found to be in violation of the law. One hundred and thirty-five shipments were reshipped or destroyed, and 1,245 shipments were permitted entry after being relabeled or sorted. The principal food products analyzed were fruit and fruit products, cheese, edible oils, liquors, essential oils, cereal products, and spices. Among the food products examined during the past year were a large number of shipments of beans from Italy, which were infested with a small fly, the bite of which produced a rash on the workmen on the docks. A large number of shipments of figs were found to be so badly infested with worms and worm excreta as to necessitate their reshipment.

With regard to the crude drugs presented for entry, a marked improvement in quality is noted, as is shown by the following review:

*Belladonna leaves.*—These have improved very much in quality. From about 60 shipments examined, less than 10 per cent have been deficient in assay. Of these about one-half contained scopolia leaves.

*Belladonna root.*—About 20 shipments were examined, 3 of which contained poke root, and were decidedly deficient in alkaloid. Some large shipments, however, averaging 50 bales, equaled or exceeded the pharmacopœial requirement as to alkaloid content.

*Asafœtida.*—This commodity, although there has been a considerable improvement, is still, as a rule, of poor quality. Of 45 shipments examined more than half did not come up to the U. S. P. standards.

*Cinchona.*—Of the 28 shipments entered all samples taken were above the U. S. P. standard.

*Benzoin.*—Of 21 shipments entered practically all complied with the 15 per cent insoluble standard. Several, however, were entered for "technical purposes only," and declared 25 per cent insoluble in alcohol.

*Jaborandi.*—With the exception of one sample, consisting of a false variety, all the jaborandi has been of excellent quality, assaying about 0.75 per cent, which exceeds the U. S. P. requirement.

*Copaiba.*—Of 105 shipments entered only 2 per cent contained foreign resins. Copaiba has improved to such an extent that the South American importations are practically pure. Five large shipments of African balsam were entered, consisting of about 200,000 pounds.

*Balsam Peru.*—Sixty-two shipments were entered. The San Salvador and Colombian varieties are up to the U. S. P. standard.

*Synthetic Peru.*—A very close imitation of the natural has been offered, but the majority is brought in for technical use only. Nine shipments of "peru-gene" were entered in the same way.

*Henbane.*—Of over 30 shipments entered, although many assay as high as 0.13 per cent, yet over 20 per cent are deficient in alkaloid, due to the excessive amount of sand mixed with the leaves.

*Stramonium.*—Thirteen shipments were entered, all of which were of good quality.

*Quince seed.*—Sixteen shipments were entered, of which over 75 per cent were detained because of excessive foreign material averaging 40 per cent.

*Jalap.*—Eighty-four shipments were entered, and of 11 samples analyzed but 1 was deficient in resin. The resin content averaged 10 per cent.

*Rhubarb, colchicum, chamomile, ipecac, coca, tolu, guarana.*—These continue to be of excellent quality. With one exception gentian roots were up to the standard. As before stated, adulteration has decreased to a large extent, resulting in the importation of drugs of superior quality.

Four hundred and twenty-one interstate samples taken by the inspectors in the regular way were examined at the laboratory during the past year, 297, or 70 per cent, of which were found to be in violation of the law. Of these samples 68 were coffee, of which 55, or 80 per cent, were illegal, a majority being falsely represented to be Mocha and Java mixtures. A marked improvement in the labeling of coffee in this respect has been noted since the inspection of this product was commenced.

One hundred and thirteen samples of vinegar were analyzed, 67 per cent of which were found to be adulterated, the chief form of sophistication being the substitution of mixtures of distilled vinegar and boiled cider for the true cider vinegar.

Aside from the imported and interstate samples analyzed, there have been received from the Panama Railroad Company, the Isthmian Canal Commission (medical supply depot), the War Department, the Navy Department, and the Department of Commerce and Labor about 250 samples of food products and medicines for examination as to purity and conformity with the specifications.

Twenty-four samples of food products were also received for analysis for certification for the export trade, certification being granted in all but 5 instances. The remaining 19 samples covered 56 lots, and 56 certificates were issued.

This laboratory has also passed upon 189 samples of denaturants for olive oil. By the provisions of the present tariff act and the regulations of the Treasury Department, olive oil intended for technical use only may be permitted into this country free of duty if denatured in such a manner as to be unfit for food purposes. The kind of denaturant and its fitness for the purpose intended is passed upon by the Department of Agriculture. Thus far the following denaturants have been permitted: Oil of rosemary, oleoresin of capsicum, oleic acid, wood turpentine, pyridin, creosote, and anilin oil. Application for denaturing is accompanied with the material it is proposed to use, which material is sampled by this laboratory and its suitability for the purpose determined.

**INVESTIGATIONS.**—An investigation of the subject of cider vinegar was begun, the principal factories of the eastern part of the country being visited and the processes of manufacture studied. Samples of raw materials and of the product at the various stages of manufacture were obtained and analyzed. A representative of the laboratory was stationed for some time in one of the factories to study the chemical changes that occur in the product during the daily operation. The work as far as completed promises to be of much value, and it is expected to continue the investigation during the coming season.

The routine and investigation work on the subject of coal-tar colors for use in food products has been continued during the past year, the entire time of one chemist and a portion of that of two others having been occupied with this work. Sixty samples have been examined, of which about 95 per cent were reported as complying with the Department's requirements for certification. The studies of methods for analysis of colors have been continued, and the following have been devised: (1) A method for estimation of iodine in inorganic compounds with special reference to mixtures containing halo-



gen derivatives of fluorescein and the inorganic halides; (2) the determination of minute amounts of arsenic in products like coal-tar colors; (3) the separation and identification of mixtures of colors permitted by Food Inspection Decision No. 76.

In connection with the drug work of this laboratory an interesting study has been made of a method for the determination of benzaldehyde, cinnamic aldehyde, and vanillin, based on the fact that these aldehydes form insoluble semicarbazones with semicarbazids. The advantages of this method are: (1) Ease of manipulation; (2) drying at 100° C., where the phenylhydrozone methods necessitate a lower temperature; (3) the resulting semicarbazone is crystalline in character, of a definite melting point, and affords a ready method of identification of the aldehyde under examination; (4) accuracy, the duplicates varying within 0.5 per cent.

Other drug investigations included a study of Haarlem oil and one of copaiba. From examinations of the Haarlem oils generally recognized as genuine, this product appears to be obtained by boiling together a fatty oil, sulphur, and turpentine for a considerable time (sixteen to twenty-four hours). The oil so obtained is viscous, brownish in color, and possesses the characteristic turpentine-sulphur odor. The volatile oil is yellow in color and leaves a residue of not more than 15 per cent insoluble in concentrated sulphuric acid.

Experiments made in this laboratory, in which linseed, olive, and castor oil were boiled with sulphur and turpentine for sixteen hours at the boiling point of turpentine, indicate that the nature of the fatty oil has little influence on the properties of the final product. In all cases the volatile oil was yellow in color, contained sulphur, and resembled that obtained from the imported oils in all particulars. No amber oil, tar oil, aloes, etc., were found in any of the imported oils, the yellow color of the volatile oil being due to the combination of sulphur with the turpentine.

A continuation of the study of copaiba shows that the South American products as a rule are dextro-rotatory. This is due to the resin present, which is dextro-rotatory, and since its specific rotation is about +78° in alcohol, while that of the oil is -7° to -35°, the balsam, due to the percentage of resin, is dextro. In the case of African balsam, the original balsam is lævo, the resin lævo, and the oil dextro. Gurjun balsam follows copaiba in its rotation.

The chemists of the laboratory have also done collaborative work on methods of analysis of paprika, preservatives, flavoring extracts, colors, chocolate and cocoa, coffee, sugar, drugs, and medicines.

#### OMAHA LABORATORY.

Three hundred and forty-nine interstate inspection samples were examined at the Omaha laboratory, about one-third of which were found to be adulterated or misbranded, and 100 miscellaneous samples were received, coming principally from the Treasury Department (internal revenue) and the War Department (office of purchasing commissary). As the chief of the laboratory was detailed to Chicago for over three months, the output of work was materially reduced. Coffees and cocoas, flavoring extracts, fruit and saccharine products, and spices and condiments constituted the largest classes of products examined. Nearly half of the spices and 10 out of 14 cereal products

were adjudged illegal. Approximately two-thirds of the 69 hearings held were conducted by correspondence.

Research work on methods of analysis has been conducted along the following lines: Determination of benzoic acid in catsup, separation and identification of capsicum and ginger in ginger ale, determination of sucrose, lactose, and fat in cocoa products, and determination of glycerin in wine. The method for the determination of glycerin in wine, with slight modifications, was applied to the determination of glycerin in vinegar. This study gave satisfactory results and new characteristic ratios which furnish additional means of judging the purity of cider vinegar.

PHILADELPHIA LABORATORY.

The inspection of imported products has constituted the principal work of the laboratory, as in previous years. Of the 752 import samples examined, 24 per cent were either adulterated or misbranded, this percentage being practically the same as in 1909. The principal products examined included drugs, spices, condiments, fruit products, and dairy and cereal products.

The total number of domestic samples examined was considerably less than that reported last year, due partly to the increase in the number of hearings and in court work, and also because the samples examined were of such a character that more time was required in making the analysis. The ratio of illegal (114) to the total number of interstate samples examined (155) gives a wrong impression of the character of the products examined, since a considerable proportion of the illegal samples reported were check analyses on samples found to be adulterated at other laboratories and forwarded for confirmatory examination.

For some time particular attention has been paid to the examination of imported cheese, with the result that almost all the foreign cheese now received is correctly labeled as to whether it is made from partly skimmed milk or not. When this work was first started a very large proportion of the Italian and Greek cheese, also Edam cheese from Holland, was made from milk which had been partially skimmed, the goods not being labeled to indicate their true character. At the present time only an occasional shipment is received not properly labeled, and the importers, after having their attention called to the matter, are very willing to cooperate with the Department. The investigations of the character of black and brown mustard seed used in the manufacture of ground mustard revealed the fact that large quantities of wild mustard, or charlock (the so-called Dakota mustard), are being used in the spice mills instead of mustard seed. To the eye this charlock seed resembles very closely the true black and brown mustard, but when examined with a hand lens the difference is very evident. As a result of this investigation some of the spice millers are now much more careful as to the character of the seed bought. A systematic examination has also been made of imported fish products which are packed with tomato sauce or fish bouillon, the examination showing that the tomato sauce and bouillon in many instances have a serious corrosive action on the tin, and that the contents of the cans as a result contain quantities of tin, which may be injurious to health.

This investigation is still under way, and it is possible that the serious corrosion in instances may prove to be due to the use of inferior tin, as some importations are received which show no corrosion whatever, the interior of the cans being bright and clean.

Collaborative work has been done on methods of analysis of various products, including maple sirup, cocoa products, vanilla extracts, citral in lemon extracts, detection of foreign oil in paprika, detection of fish oils in vegetable oils, determination of color in spirits, and estimation of benzoic acid in tomato ketchup.

The number of hearings (293) held during the fiscal year was approximately 50 per cent greater than in the previous year. From the evidence offered at the hearings, and other general sources of information, the manufacturers and others involved seemed in most instances to be in hearty sympathy with the authorities in the enforcement of the food and drugs act. Many products which formerly were badly adulterated or misbranded are now found to be in strict compliance with the law.

#### PITTSBURG LABORATORY.

Of the 101 import samples examined, over half were illegal, the greater part of these being cheeses, which are now correctly labeled in the majority of cases.

Three hundred and seventy-eight interstate samples were examined, of which 216, or considerably over half, were adjudged illegal, including 53 out of 76 flavoring extracts, 56 out of 94 fruit products, 14 out of 24 saccharine products, and 14 out of 23 vinegar samples. The greater part of the 55 miscellaneous samples were examined in connection with cases in preparation for prosecution; a few were analyzed for the Treasury Department. Twenty-two samples of Jamaica ginger were prepared and analyzed to serve as standards in a case for prosecution, and experimental work was done on 8 samples of coffee for the same purpose.

Collaborative work on methods of analysis was done on the following subjects: Detection of capsicum in ginger; determination of sucrose, lactose, and fat in cocoa products; determination of benzoic acid in ketchup; and the analysis of sirup. Two new methods of analysis were devised during the year: One, a rapid method for the determination of fat in cocoa and chocolate products, which greatly shortens the time of analysis; the other, a very rapid method for the detection of lemon and orange peel color in lemon and orange extracts, respectively. An improvement in the method for the detection of caramel in vanilla extracts is now being elaborated. Investigations of imported fish disclosed the fact that amines in these products on distillation will give formaldehyde reactions.

Twenty-two interstate samples were collected by this laboratory. One of these consisted of eggs in a very bad condition and a seizure was made, followed by criminal prosecution, the shippers being fined \$200. The dealer followed this by a civil suit and secured \$1,800 damages.

A considerable amount of imitation vinegar has been seized, but it is evident that vigorous measures will be necessary to break up this practice. Conditions affecting cleanliness in the preparation of food products have improved considerably during the year, and there



is a tendency among some manufacturers to put up more of the better grades of goods and less of the cheaper ones.

## PORTLAND LABORATORY.

In addition to the import and interstate work, 46 miscellaneous examinations have been made for the War, Treasury, and Post-Office departments and for the state dairy and food commissioner, and in the course of cooperative work in the study of methods for the analysis of extracts, cocoa products, ketchups, ginger ale, etc. Of the 354 import samples, 29 per cent were adjudged illegal, and of 255 interstate samples 56 per cent were illegal.

One hundred and thirty-seven hearings have been called, in which it appeared, especially in regard to import cases, that the misbranding and adulteration were more often due to carelessness and ignorance than to any willful intent to violate the law.

Vinegar factories at Salem and Portland, Oreg., have been visited and samples obtained for information and study, especially of the "second pressings" to determine to what extent it is permissible to use them in the manufacture of cider vinegar.

## ST. LOUIS LABORATORY.

Of the 646 interstate samples examined, 43 per cent were considered illegal. The total of 765 samples included 99 unofficial samples, quite a number of flavoring extracts, baking powders, and other goods having been analyzed for the purchasing commissary of the United States Army at this point.

The most important research was done on vinegars, 47 unofficial samples being examined in an effort to obtain information as to the composition of brown-sugar vinegar, molasses vinegar, and corn-sugar vinegar, and to determine as definitely as possible the change taking place in the composition of the material during the process of manufacture. This work, while as yet incomplete, has yielded a great deal of information which will be of valuable assistance in judging vinegars in the future.

Of the 295 hearings recorded, 5 pertained to imported food products, and these being misbranded, in all cases save one, they were released to the importer after relabeling.

## ST. PAUL LABORATORY.

Investigations on the bleaching of wheat flour were continued, special regard being given to the grade or quality of the flour treated. As a result it has been possible to produce evidence of misbranding of so-called "patent flour" in a number of instances where seizures have been made. Work on the composition of the known grades of flour is also continued from time to time with a view to the fixing of percentage limits of the several constituents of flour which have bearing upon its grade or quality.

Collaborative work has been done on methods for the analysis of cocoa products, sugar and molasses, ginger products, vinegar, vanilla flavoring, and citral in lemon extract, and on the examination of linseed oil. An investigation was also made of the chemical compo-

sition of sorghum sirups of known purity, and another to determine the amount of alum in pickles.

A somewhat extensive investigation of edible gelatins is now under way to establish methods for their analysis and examination as to origin, commercial purity, and wholesomeness.

Inspection of imported food and drug products is personally conducted at St. Paul and Minneapolis and extended to Duluth by correspondence. Of the 87 samples analyzed, 13 were found to be illegal. Two lots containing 39 cases of moldy and decomposed shelled walnuts were condemned and destroyed by fire. The remaining products were misbranded only and were permitted entry after being satisfactorily labeled. Miscellaneous examinations were made at the request of the local quartermaster of the War Department and the agents of the Treasury Department at St. Paul, Minneapolis, and Duluth.

The general interstate work has been somewhat irregular, owing to the absence of the chief from the station in attendance at court at St. Louis, Mo., New Orleans, La., and Kansas City, Mo., and assisting in the bleached-flour investigation.

Of the 191 interstate samples examined about 29 per cent were illegal, the greater number being cereal products, of which nearly one-third were either adulterated or misbranded.

#### SAN FRANCISCO LABORATORY.

The study of oriental drugs, begun last year, has been continued, and progress has been made in collecting data for their classification. A considerable amount of collaborative work has been done on methods of analysis of various food products, and some on methods for the detection of rice which has been polished with limestone. Experiments have also been made on special methods of analysis with a view to expediting inspection work.

Of the 1,443 samples of food and drug products examined, approximately 30 per cent were imported and 70 per cent were interstate samples. The actual number of import samples examined, however, is 54 per cent less than last year, while the domestic products have increased 95 per cent.

Of the import samples examined, 47 per cent were found illegal, while of the domestic products 44 per cent were in violation of the law. The most important classes of imported products are: Distilled liquors, 74 per cent illegal; fermented liquors, 53 per cent illegal; fruit juices, 66 per cent illegal; fruit products, 77 per cent illegal; and oils, 65 per cent illegal. Of the interstate samples, the principal items are: Fruit products, 31 per cent illegal; saccharine products, 63 per cent illegal; flavoring extracts, 56 per cent illegal; spices, 48 per cent illegal; cereal products, 50 per cent illegal; coffee and cocoa, 59 per cent illegal; fermented liquors, 72 per cent illegal; and drugs, 41 per cent illegal. Many of the illegal food cases were based on technical misbranding, only a small number of the total being due to adulteration. In the case of illegal drugs, however, practically all of the samples found to be illegal were adulterated either by substituting one substance for another or by adding some foreign and inert material.

The year has seen a considerable decrease in the number of adulterated and misbranded food products coming from abroad. This is

evidenced by the smaller number of samples that it was found necessary to analyze and a slight decrease in the percentage of illegal samples which were examined. A slight improvement in the quality of the interstate samples is also to be noted. The activity in the enforcement of the law has been greater, more samples have been examined, and the percentage of illegal samples is exactly the same as last year.

Of the 491 hearings conducted, 281 represent interstate samples, an increase of 75 per cent over last year. It is estimated that at least 600 personal appearances were made by importers and those interested in interstate violations in answer to citation issued from this laboratory during the year.

In the matter of relabeling of foreign products the enforcement of the law has been rigid, and a larger proportion of misbranded and adulterated goods has been exported by order of the customs authorities than ever before. If this rigid enforcement is continued, but little trouble will be experienced with imported foods.

#### SAVANNAH LABORATORY.

The assistant chemist was assigned to the New York laboratory for about four months, which, together with the increased amount of executive work in connection with the domestic and import samples, contributed to reduce the number of samples examined. Considerable time was devoted to the study of methods for the determination of sodium benzoate in different food products.

Of the 156 interstate samples examined, covering a wide range of foodstuffs, such as flavoring extracts, spices, sirups of various kinds, canned oysters, jellies, jams, preserves, olive oils, etc., 51, or about 33 per cent, were found to be illegal.

Of the 159 hearings, 119 were concerned with interstate samples and 40 with imported products.

#### SEATTLE LABORATORY.

At this laboratory the examination of imported food and drug products constituted the bulk of the work done, 414 samples being analyzed, of which about one-third were found to be adulterated. The largest classes of imports examined were fish and meat, medicinal preparations, and olive oils. Of the 83 samples of fish and meat examined, 18 were found adulterated or misbranded, 36 of the 62 samples of medicinal preparations, and 14 of the 37 samples of olive oil. Seventy-three samples of miscellaneous imported products have been examined for the customs officials of this district to aid them in their classifications, and 18 samples for the internal-revenue officials of the Treasury Department; other miscellaneous samples were also examined for the Navy Department and the purchasing commissary of the War Department. Of the 91 interstate samples about 45 per cent were found to be adulterated or misbranded, spices and condiments, fruit products, and fermenting liquors furnishing the greater number of illegal samples. About half of the 113 hearings reported were conducted by correspondence.

Special investigations were made along the following lines: A study was made of the salmon-canning industry on Puget Sound with special reference to the factory conditions and to the grade of canned



salmon known to the trade as "do-overs;" the chief of the dairy laboratory was assisted in the analytical work connected with the investigation of the condensed milk industry of the Northwest; analyses were made of authentic samples of cider vinegar; and co-operative work was done on existing methods for detecting colors and analyzing headache mixtures and flavoring extracts.

### MISCELLANEOUS INVESTIGATIONS.

#### WORK OF THE MISCELLANEOUS DIVISION.

In the Miscellaneous Division, under the direction of J. K. Haywood, chief, are conducted the examinations of waters, insecticides and fungicides, cattle foods and grain, trade wastes, hygienic and miscellaneous samples, and the research work along these lines.

The administrative work and correspondence of this division, especially that relating to the enforcement of the national food and drugs act in so far as it applies to waters, cattle foods and remedies, and grains; the preparation of cases under the food and drugs act on such materials, and travel in connection with expert work in court cases have occupied a large part of the time of the chief of the division. Field work on the effect of smelter fumes on agricultural products, forests, animals, and irrigation streams necessitating the study of methods of eradicating smelter fumes has also formed an important feature of the year's work.

The Miscellaneous Division analyzed approximately 1,629 samples, requiring about 9,060 determinations, in addition to the samples examined during the course of special investigations. Following is a tabulated statement of the materials analyzed, showing the scope and distribution of the work:

Imported mineral and table waters.....	50
Domestic mineral and table waters.....	225
Interstate shipments of ice.....	16
Miscellaneous waters.....	58
Imported cattle and poultry food and grains.....	13
Domestic cattle and poultry food and grains.....	497
Miscellaneous feeds and grains.....	233
Insecticides and fungicides.....	214
Trade wastes samples.....	240
Miscellaneous and hygienic samples.....	83
Total.....	1,629

Quite a number of these examinations were made for other departments of the National Government and other bureaus of the Department of Agriculture, as follows:

War Department.....	3
Department of Commerce and Labor.....	30
Interior Department.....	31
Isthmian Canal Commission.....	9
National Zoological Park.....	2
United States Senate.....	1
Department of Agriculture:	
Bureau of Plant Industry.....	229
Bureau of Entomology.....	193
Bureau of Forestry.....	8
Irrigation and Drainage Investigations.....	3
Unclassified samples examined for various other departments and bureaus.....	43
Total.....	552

The most important of the 83 unclassified samples examined were hops, food dyes, and macaronis analyzed to determine whether or not arsenic was present. The greater part of these miscellaneous samples were examined at the request of other departments or other bureaus of the Department of Agriculture.

**EXAMINATION OF WATERS.**—The Water Laboratory under the food and drugs act examines samples of mineral and table waters which enter into interstate commerce and also those which are imported into this country. It also analyzes public water supplies for the purpose of detecting pollution and suggesting remedies therefor, examines waters for irrigation and technical purposes and mineral springs of the United States from source, and studies improved methods of water analysis.

During the year 349 samples were examined, and out of the 50 foreign waters 18 were found to be mislabeled. Of the 241 interstate samples of bottled mineral and table waters and ice 37 were found to be illegal. Thirty complete analyses of samples of water from fish-hatchery stations in various sections of the country were made at the request of the Bureau of Fisheries of the Department of Commerce and Labor. Miscellaneous samples examined for other branches of the government service were as follows: War Department, 2; United States Senate, 1; Interior Department, 31; Bureau of Plant Industry, 10; Bureau of Forestry, 8; Drainage Investigations, 3.

The investigation of mineral springs at source has been continued, and data previously obtained collated.

Several other lines of original research previously begun have been continued. The investigation of a method for determining very small amounts of lithium has been completed, and has been of great value in determining lithium in samples of mineral waters collected under the food and drugs act. The investigation of the radioactivity of certain mineral waters has been continued, and the data obtained have been used in examining products claiming radio-active products. A study of sulphur waters and of the several forms of sulphur compounds existing in waters was begun. Some time has also been devoted to the perfecting of methods for the analysis of waters for sanitary, technical, and industrial purposes.

**INSECTICIDES AND FUNGICIDES.**—The composition and method of manufacture of insecticides and fungicides are studied, as well as the effects that they have on foliage, with the idea of increasing the efficiency of these products and suggesting methods of avoiding injury to vegetation. Investigations to discover new and improved insecticides are being constantly made and improved methods of examining various insecticides are being studied.

The greater number of the 214 samples examined were the products of cooperative work with the Bureau of Entomology and the Bureau of Plant Industry. In addition to the examination of samples submitted for analysis considerable time was given to the investigation of problems connected with the use and application of insecticides. Questions are always arising in their use which require the cooperation of the chemist in their solution. During the past year 8 investigations of this character, requiring more than 300 determinations, were made. One of the most important of these was in collaboration

with the Bureau of Entomology, to determine the efficiency of sodium cyanid as a substitute for potassium cyanid in fumigating operations; the proper proportion of cyanid, acid, and water to be used to obtain the greatest yield of hydrocyanic-acid gas, and the effect that impurities in the cyanid, principally chlorids, will have on the reaction. This work has been completed, and the results are of no small economic value.

The investigations of lead arsenate, begun in 1907 in cooperation with the same Bureau, have been published as Bulletin 131 of the Bureau of Chemistry. The examination of 50 samples of lead arsenates found upon the market are given, together with directions for preparing homemade lead arsenate, the chemical examination of the materials from which it is prepared, and the observed effects of different lead arsenates and the impurities they may contain on peach foliage. Results of importance were obtained, and the work is being further continued. Orchard tests are being conducted with numerous poisonous materials which have suggested themselves as of possible value as insecticides, with the hope of discovering some compound which may be used on peach and other tender foliage without causing injury thereto.

Another investigation, begun last year in cooperation with the entomologist, on the toxic effect on orchards of certain elements, notably copper and arsenic, which may accumulate in the soil as a result of spraying, is still under way. This will require the examination of many orchards before any definite conclusions can be drawn.

On account of the increasing interest in the subject of insecticides, more accurate and detailed methods for their examination are demanded, manufacturers in particular being especially interested at this time in this subject, owing to the recent passage of a national insecticide law in regard to the inspection of insecticides and fungicides. Much time has been devoted to this subject, particularly as concerns methods for the analysis of the comparatively new and important insecticides, lead arsenates. This work and that in connection with the orchard experiments have required during the year approximately 500 determinations which do not appear in the tabulation.

**CATTLE FEEDS AND GRAINS.**—The total number of samples examined in the laboratory studying these materials was 743, including samples of cattle and poultry food and remedies, both foreign and domestic, examined under the provisions of the food law, as well as samples examined in connection with the study of such economic problems as the feeding value of forage crops, the composition and value of various grains and cereals and of their milling quality, and of improved methods of examining such materials.

Some time was spent in the study of methods for the determination of starch and sugars in cattle foods, requiring approximately 1,000 determinations, a special study being made of the cause of varying results obtained in the starch determinations in cotton-seed meal. An improvement of the apparatus for fat extractions was also devised.

Of the 497 interstate samples of cattle foods and grains examined 125 were found to be illegal. The 233 miscellaneous samples analyzed were received principally from other bureaus of the Department.



TRADE WASTES IN RELATION TO AGRICULTURE.—These studies of the relation of the disposal of harmful wastes to agricultural operations and to the purity of streams are of great economical importance. Particular attention has in the past been given to a study of the effect of smelter wastes on agricultural products, forests, animals, and irrigation streams.

This work involved the examination of 240 samples during the year, about 600 determinations being made. A study of the effect of copper salts on certain grain crops was necessary to determine the effect of tailings from smelters on farm crops irrigated with water containing same. At the request of the Department of Justice the chief of the Miscellaneous Division visited Ducktown, Tenn., to inspect the improvements made in local conditions by the installation of sulphuric acid plants at the two Ducktown smelters, such acid plants being erected for the purpose of condensing the sulphur dioxide and trioxide fumes from the smelter operations. A study was also made of the process of sulphuric acid manufacture as conducted at these smelters. The results of the two investigations were transmitted to the Department of Justice.

An investigation of the effect of smelter fumes on forests and ranges in the vicinity of Anaconda, Mont., with special reference to the United States Government forest and ranges, was completed during the year, and the results, together with certain previous work on smelter fumes, were published as Bulletin 113, revised, of the Bureau of Chemistry.

#### INVESTIGATIONS OF THE LEATHER AND PAPER LABORATORY.

The routine work of testing government supplies, notably papers, for the several branches of the federal service has continued to increase; but more especially is this true of the researches concerning leather, paper, and turpentine. The following summary shows the number and kind of samples that have been examined:

Papers and paper-making materials:	
Washington .....	3,587
Dayton laboratory .....	2,177
Leather and leather-making materials.....	117
Turpentine, rosins, oils, and wood products.....	142
Miscellaneous.....	71
 Total.....	 6,094

Some indication of the usefulness of the laboratory to other branches of the service is afforded by the fact that, of the total number of samples examined, about 5,000 were for other departments.

Paper tests have been regularly made at Washington and at Dayton, Ohio, for the Post-Office Department, and also for the Government Printing Office, General Supply Committee, Bureau of Engraving and Printing, Isthmian Canal Commission, and other branches of the Government. Special investigations have been made of the postal-card paper at the request of the Post-Office Department, and of blueprint papers at the request of the Navy Department. Specifications for papers of maximum durability have been prepared at the request of the Census Office, and assistance has been rendered the American Chemical Society, as well as several of the departments, on

the same subject. Considerable attention has been devoted to the simplification of the methods for testing paper and to the study of methods. The facilities for the testing work have been so improved since moving into the new chemical laboratories as to render the equipment inferior to none in this country for this class of work.

**PAPER AND PAPER-MAKING MATERIALS.**—Cooperative studies on rarely used paper-making materials have been made with the office of the crop technologist, Bureau of Plant Industry. The yield and quality of fiber from different varieties of cornstalks, the proper way of cooking and bleaching the fiber, and the most feasible methods of utilizing the extract obtained in cooking the stalk have all been investigated. These experiments are not for the purpose of establishing the fact that paper can be made from cornstalks which has been proved long since, but to devise methods which will place the process on a profitable basis. Several other new raw materials have been examined as to their suitability for paper stock, but with negative results from the practical point of view. The problems involved in the utilization of new materials are, as has been previously pointed out, primarily those of cost of raw materials rather than of the actual making of paper. The work in progress has for its object the reduction of the cost of raw materials through methods for utilizing the enormous amount of waste which now occurs in paper making. The warning sounded in last year's report is repeated—that in the exploitation of materials not now in general use great care should be exercised in order that the losses incident to hastily considered and incompletely developed processes may be avoided.

**TURPENTINE AND ROSIN.**—Investigations on the production and nature of turpentine, both gum spirits and wood turpentine, have been continued and analytical methods for the differentiation of one from the other and for the detection of adulterants in either have been studied.

Samples of turpentine taken in connection with the administration of the food and drugs act, June 30, 1906, have been examined and a number found to be adulterated or misbranded. Samples of turpentine and rosin were also examined for the several departments. The waste in the production of these products is very large, both in the woods and at the still. These problems have all been studied during the year.

The question of the grading of rosin has for many years been a bone of contention between the consumers, middlemen or factors, and the producers, with the result that the farmer or producer has been the loser partly through unavoidable but also through avoidable errors in the methods of grading now in vogue. This has occurred, although several of the chief rosin-producing States have laws making it obligatory that each barrel of rosin be inspected by a sworn inspector. Under present conditions the producer does not know what grade of rosin he has made until he receives the report of the factor through whom it is sold. To the end that the producer may know the grade of each barrel of rosin he makes, and in this way have a check on the grading of his product on the market, an accurate but simple and inexpensive method for sampling and grading at the still, which it is believed will add thousands of dollars annually to the income of the turpentine farmer, has been devised. Investi-



gations looking to the improvement of the quality of rosin are being conducted, but are not sufficiently advanced to warrant conclusions.

The quality or grade of rosin is determined by its color and freedom from foreign materials, and is established by comparison with standard type samples. Much dissatisfaction now exists owing to the changes which occur in these types, and the laboratory is investigating the feasibility of preparing permanent rosin type standards with which the types used in the actual grading may be compared from time to time to assure their accuracy.

**LEATHER.**—The research work on sole leather had for its primary purpose the improvement of the quality of the product and the devising of tests for its examination. In this work the cooperation of several large manufacturers of shoes has been secured. Such manufacturers in general being much interested in preventing the adulteration of leather with materials which are useless or harmful. The work so far done indicates that much, if not the larger part, of the sole leather now on the market has been heavily loaded with glucose, Epsom salts, barium sulphate, etc., or with two or more of such materials. This practice from the point of view, both of the consumer and of the manufacturer of shoes, is utterly without excuse, as the quality and wear of the leather are certainly materially reduced thereby, while its cost is increased. In these days, when the quantity of tanning materials and hides available is barely sufficient to meet the demand, every effort should be made to conserve them through the manufacture of leather of the highest quality and greatest durability. The work on leather has progressed sufficiently to justify the conclusion that vigorous steps should be taken to prevent the adulteration or loading of leather in any way.

**MISCELLANEOUS WORK.**—Miscellaneous samples, including fertilizers, wastes, oils, and various industrial materials, have been examined at the request of other departments and of other bureaus of this Department, and the laboratory has cooperated with chemical associations in the study of methods for the examination of leather and tanning materials, in the preparation of specifications for suitable and permanent paper for scientific publications, and in the study of methods for the estimation of iron and alumina in phosphate rock. The work of the Leather and Paper Laboratory is in charge of F. P. Veitch.

#### EXAMINATION OF CONTRACT SUPPLIES.

The constant demand for the testing of current supplies by the various governmental branches, accompanied generally by the request that the work be rushed as rapidly as possible, leaves little or no time for systematic research. Considerable work has been done in the revision of existing specifications for miscellaneous supplies and the preparation of definite specifications where formerly none was used. A large number was prepared for the General Supply Committee and for the Commissioners of the District of Columbia, with the result that the number of samples tested was diminished very much as compared with preceding years by letting the contracts on the bases thus established and thus rendering sampling on competitive bids unnecessary in many cases. Some progress has been made also



on the study of the composition of rubber goods, with a view to drawing up specifications for this class of material, and an investigation of paint materials has been begun, including the preparation for some extensive paint tests.

As to the bulk of the work accomplished, the number of samples examined for the various government departments showed a very great increase over that of the preceding years, being the greatest ever examined in any one year since the establishment of the laboratory. The attached table shows the distribution of this work, according to the character of the material examined and the department for which the examinations were made. The character of the samples varies greatly, but the larger number was under the classes of colors, paints, and varnishes, and oils, fats, greases, and waxes. The greatest increase in any one class of samples examined was in typewriter ribbons, of which 595 were tested as compared with 73 in the previous year. The total number of samples examined during this year is 2,829, which does not include more than 3,600 pieces of apparatus tested for the Bureau of Chemistry. This work is done under the supervision of P. H. Walker.

*Number of samples of contract supplies analyzed.*

Departments requesting analysis.	Colors, paints, and varnishes.	Oils, fats, greases, and waxes.	Soaps and candles.	Inks.	Typewriter ribbons.	Rubber.	Glue.	Chemicals.	Metals and alloys.	Miscellaneous.	Total.
General Supply Committee.....	440	194	249	24	569		33			27	1,536
Isthmian Canal Commission.....	125	177	19			49		28	6	98	502
Treasury Department <sup>a</sup> .....	258	122	1		2		30	8		19	440
Department of Agriculture <sup>b</sup> .....	45	31	4		13	30			12	10	145
Post-Office Department.....	8				46						54
War Department.....	10	15								3	28
Commissioners, District of Columbia.....		7	12			2				1	22
Government Printing Office.....	1	13	7					1			22
Department of Commerce and Labor.....	3					11					14
Navy Department.....	7					3		1		3	14
Interior Department.....	3	3	2							1	9
National Zoological Park, Smithsonian Institution.....	3	3									6
Samples referred to other laboratories.....										37	37
Total.....	903	565	294	70	595	82	65	38	18	199	2,829

<sup>a</sup> Including Bureau of Engraving and Printing.

<sup>b</sup> Including Bureau of Chemistry.

#### NITROGEN DETERMINATIONS.

A section in charge of T. C. Trescot is devoted entirely to nitrogen work, which is especially important in the administration of the food law, since the value and quality of a product frequently depend largely on the nitrogen content, as in the case of dairy products and cattle foods. Another important application of these data occurs in the research work on cereals and the examination of the excreta of animals, referred by the Pharmacological Laboratory of the Drug Division in the course of experiments on metabolism. In all 10,500 such determinations were made on samples referred from the various laboratories of this Bureau and from the Bureau of Plant Industry.

During the past year this laboratory has collaborated with other nitrogen chemists in work looking to the improvement of the present methods, especially those relating to the determination of nitrates in fertilizers. An investigation has also been begun of methods for estimating free and combined ammoniacal nitrogen in foods, a difficult point which has given rise to considerable controversy.

#### PUBLICATIONS.

During the past fiscal year the following publications have been prepared: Fourteen bulletins, of which 9 are in print; 22 circulars, of which 20 have been issued; 7 unnumbered publications, including the Report of the Chemist and instructions to inspectors and to commissioned state officials concerning the execution of the food law; 3 farmers' bulletins; 16 food-inspection decisions; and 424 notices of judgment; aggregating about 2,580 pages of original matter. Of this, approximately 830 pages were notices of judgment received from the Office of the Solicitor. The food inspection decisions included Nos. 109 to 124 and covered rulings on wines, cordials, whisky, shellfish, rices, stock feed, cocoa, and certified colors. The bulletins covered a wide range of subjects; of special interest are the report on the manufacture of denatured alcohol, the results of experiments on the effect of environment on wheat and on sweet corn, an extensive investigation of the manufacture and composition of maple sirup, with inspection and analytical data, and the farmers' bulletin on preparations containing habit-forming agents, which was widely read and commented upon. More use was made of the circular form of publication this year, both for monographs on details of technical research, such as the enzym studies, and for practical applications of scientific data to commercial conditions, such as work on the cold storage of cider, the utilization of peaches as vinegar stock, and the preparation of sugared pineapples.

Even under the strict rulings governing the distribution of free publications it was necessary to reprint 7 bulletins, 4 circulars, 15 food-inspection decisions, 4 notices of judgment, 5 Yearbook articles, 5 separates, and 2 unnumbered circulars.

There were issued 346 requests for job printing, covering all stationery supplies, forms, circular letters, etc., and 241 requests on the photographic laboratory for drawings and photographs in connection with the illustration of bulletins or the construction of laboratory equipment.

#### GENERAL BUSINESS OPERATIONS.

There was appropriated for the Bureau of Chemistry for the fiscal year ending June 30, 1910, a total of \$930,560. Of this amount \$75,560 was for statutory salaries; \$112,540 for investigations relating to the application of chemistry to agriculture and for collaboration with other departments; \$5,000 for investigating the character of the chemical and physical tests which are applied to American food products in foreign countries and for inspecting the same before shipment; \$737,460 for the enforcement of the food and drugs act.

On June 30, 1910, there were 467 employees in the Bureau of Chemistry, of which number 228 were analysts, 89 clerks, and 41 inspectors. Half of the total number are employed outside of Washington.

During the year 120,000 letters were written to approximately 25,850 correspondents. In addition, 17,500 copies of mimeograph letters, covering 250 subjects, besides a large number of printed circular letters, were sent out, 3,024 requisitions for supplies were prepared, 7,500 vouchers checked and passed for payment, and 896 letters of authorization drawn up; 6,056 guaranties under the food and drugs act were received, examined, filed, and serial numbers assigned thereto. Complete purchase, property, and financial records were kept. Verbatim reports of all hearings before the Board of Food and Drug Inspection are made and complete records, involving a vast mass of detail, are kept, covering the collection and analysis of samples under the food and drugs act, as well as all data relating to each case thereunder.

#### WORK PLANNED FOR THE FISCAL YEAR 1910-11.

##### INSPECTION WORK.

The principal work of the inspectors for the fiscal year of 1911 will be, as usual, the collection of official samples of foods and drugs to be used as the basis for criminal prosecutions. This work involves the preparation of testimony to establish sale and interstate delivery, necessitating that the inspectors procure the affidavits requested by district attorneys from dealers and other persons concerned in the prosecution. The regular inspection of factories, for the purpose of observing the character of raw materials used and the sanitary conditions surrounding the manufacture of food and drug products, will be continued.

Attention will be given to interstate shipments of flour bleached with nitrogen peroxid, and instead of confining this work to a special investigation, as heretofore, involving the activities of a limited number of inspectors, it will be made general and include an examination of shipments received in every section of the country in interstate delivery. The investigation of the sardine industry on the northern Atlantic coast will be pursued until the inspector in charge is prepared to recommend what steps should be taken to suppress traffic in sardines shown to be adulterated by reason of the unsanitary character of the fish due to the methods of packing or the surrounding conditions. The milk supply of several cities, which, because of their situation, receive a large portion of milk from adjoining States, will be investigated. It is contemplated to make work of this character more general, necessitating the attention periodically of only a few inspectors at the principal cities, instead of undertaking the investigation by a short campaign, demanding the services of a number of chemists and inspectors simultaneously.

The inspection force will, for the most part, be wholly occupied with the routine work connected with the collection of samples and the prosecution of violations and the investigations made in conjunction with or at the request of the laboratories.



## GENERAL FOOD INVESTIGATIONS.

The work of the Division of Foods and the branch food inspection laboratories will consist largely, as in the past, of the inspection of foods imported into the United States and those sold in interstate commerce. For the purpose of increasing the efficiency of this work and promoting uniformity in the results obtained the collaborative study of analytical methods must be continued and new methods devised from time to time as conditions of manufacture and the character of adulterations change. Investigations regarding the methods of manufacture and the sanitation of foods will be made for the purpose in some cases of improving the methods of manufacture or of assisting the manufacturer to overcome difficulties by reason of which his products are in violation of the law, and on the other hand for the purpose of securing information that will enable the Department to determine whether or not certain products should be considered as illegal.

Among such studies which should be continued or inaugurated during the coming year may be mentioned the changes in composition that occur in the conversion of cider into vinegar; a study of the prevalence in foods of certain added injurious substances, such as arsenic; the solubility of lead solder in foods, especially in foods containing oil of various degrees of acidity; the manufacture of citrus by-products from waste fruits; the chemical composition of the soy bean with special reference to methods for the manufacture and clarification of the oil; clarification and preservation of fruit juices, giving attention to additional varieties of fruit and continuing the investigation of storing at low temperatures under commercial conditions; the effect of low temperatures on the life process of fruits; the composition of several varieties of oranges at different stages of their maturity with a view to securing data that may be used in the definition of types of oranges; a study of canned goods with a view to determining the relative suitability of different grades of tin and the action on tin plate of different varieties of food; a study of the organic acids in various types of foods for the purpose of improving methods of analysis and increasing the data on which judgment of the purity and soundness of foods may be based.

The extensive investigations under way in the Washington, New York, and Seattle inspection laboratories in collaboration with experts concerning the whole question of food colors, their identification, and the construction of analytical trees for this purpose, will be continued. Among the more important researches in progress at the branch laboratories the following should be noted: Vinegar investigations and researches as to the chemical composition of the various products and the same product at different stages of development; study of domestic and imported rices, especially of the Japanese types; work on apple butters to determine the nature of material used; studies on cocoa products, including additional determinations and constituents of the cocoa bean; the effects of aging on the composition, physical characters, and bread-making properties of flour; the amounts of phosphoric acid in jams and jellies of known origin and the detection of added phosphoric acid; the composition of vanilla extracts prepared by different methods, and the detection of caramel therein.

## FOOD RESEARCH LABORATORY.

The plans for the coming year extend and develop the lines of work already begun on the deterioration of poultry. The study of the handling of eggs along similar lines will be especially developed during the next fiscal year, since the question is one of great importance to the consumer and is a matter just now much in the public mind. These studies are of fundamental importance in settling questions raised under the food law. The poultry study, as planned, includes shipping and marketing experiments on fowls chilled in dry, cool air and also in water. The question of "wet" and "dry" packing is one concerning which the shippers do not agree, and it is expected that valuable information for the solution of this problem will be obtained. The study involves, also, some broad problems on the strictly scientific side, since it necessitates work on the relation of humidity, osmosis, temperature, etc., to bacterial growth and chemical change, both bacterial and enzymic.

## DRUG WORK.

The Drug Inspection Laboratory will continue to examine domestic drugs, check analyses of imported drugs not provided for by the special laboratories, and keep such systematic records of domestic and imported drugs required for the handling of cases as are necessary. Special investigation of certain drug products imported into the United States which may be dangerous to the health of the people will be made, such as preparations, sold indiscriminately, containing habit-forming drugs. Particular attention will be devoted to the improvement of methods of analysis, such as the detection and determination quantitatively of various alkaloids and other plant constituents contained in the complex mixtures upon the market. The time spent by analysts as witnesses in connection with cases under the food and drugs act will doubtless be increased. Plans have been made, now that some of the necessary preliminary work has been done in the drug field, to have a more vigorous part taken in the drug inspection work by the port laboratories than has hitherto been possible, which will greatly increase the efficiency and thoroughness of the control of such products. Especially is this true of the eastern drugs imported on the Pacific coast.

The pharmacological studies reported as under way will be continued, these being of a nature to require observation for an extended period before final conclusions can be drawn; other studies will be made as necessitated by the questions raised in the prosecution of the drug work.

The work on essential oils and synthetic products will continue along the line indicated in the report; a special study of methods for estimating salicylates will be begun. At the New York laboratory the study of crude drugs will be continued as a special feature of the work, particularly with reference to limits of ash, alkaloids, resin, and volatile and nonvolatile ether extracts.

## MISCELLANEOUS DIVISION.

The mineral-water survey of the United States begun in 1904 will be continued. Other important lines of water work under the food and drugs act will be continued. Improved methods of mineral-

water analysis will be studied and special attention devoted to the determination of the radio-activity of mineral waters, including an investigation of this important subject at the source of certain springs. Sulphur waters will be studied and improved methods devised for the determination of the several sulphur compounds present.

A study of the composition of cattle and poultry foods and remedies which enter interstate commerce, of range forage crops (the latter in cooperation with the Bureau of Plant Industry), and investigations regarding the feeding value, commercial importance, and adaptability of grains and other feeding stuffs will be made. Improved methods of determining the various constituents in cattle foods will be studied with special reference to the fat determination, which, as now made, extracts materials other than fat from certain feeding stuffs.

In addition to the examination of such insecticides and fungicides as may be called for by other bureaus of the Department and the continuation of the study of methods of analysis, the following investigations will be prosecuted: (1) The study of the cause of injury to foliage of fruit trees by lead arsenate and methods for preventing this injury. (2) The supposed injury to fruit trees from the accumulation of toxic salts in the soils, due to the use of insecticides, in cooperation with the Bureau of Entomology. (3) Orchard and laboratory tests of poisonous compounds not at present used as insecticides with the view to finding some substance which may be so used on peach and other tender foliage. (4) The arsenic content of fruits to which arsenicals have been applied in spraying operations.

The effect of toxic gases on different species of plants and the resistance of plants to copper and arsenic in the soil will be studied and field work done to determine the effects of smelter wastes in general on vegetable and animal life.

Studies of the amount of arsenic or other poisonous substances in household articles in general use and other sanitary studies.

#### SUGAR LABORATORY.

The completion of the extensive investigation under way in regard to the maple-sugar industry and the examination of commercial glucose will be made the most important work of the year 1911, together with the completion of the work on imported honey. The institution of investigations of equal thoroughness relating to cane sirup, sorghum sirup, etc., will follow the completion of the work in hand. The environment studies on the sugar content of watermelons and muskmelons will be steadily advanced.

#### DAIRY LABORATORY.

In addition to the regular routine work the following special studies will be made: (1) A completion of the study of the process of condensing milk to determine the practical limit of condensation consistent with good mechanical condition. (2) Continuation of the work on the perfecting of analytical methods and checking of analyses received from the branch laboratories. (3) Study of all the brands of malted milk in the United States.



## LEATHER AND PAPER LABORATORY.

The following lines of work will define the researches proposed for the coming year:

(1) The study of unusual paper-making materials and of methods for the utilization of waste from paper making with a view to increasing the availability of raw materials for this purpose.

(2) Investigations of the service qualities and suitability of leather for various purposes and experiments to improve its character with a view to conserving raw material. Also the study of native tanning materials, with particular attention to their conservation.

(3) Studies on the production, refining, nature, and uses of wood turpentine and products of wood distillation. Investigations looking to the improvement of the quality of rosin and methods of grading the same by the establishment of types. The testing of leather, turpentine, and rosin, and the preparation and improvement of specifications for these materials for other departments of the Government upon their request.

## CONTRACTS LABORATORY.

The examination of routine samples from the various departments will constitute the greater part of the work. The study of paint and paint materials will be given as much attention as possible and work on the testing of rubber, the revision of existing specifications, and the preparation of specifications for materials for which there are no satisfactory specifications obtainable will be continued. It is proposed also to investigate enamel ware used for cooking utensils, in order to ascertain the relative durability of the different makes and the presence or absence of poisonous metals in the enamel coat; also the relative solubility of such poisonous metals in water and in the dilute acid and salt solutions which would be used in cooking.

## MICROCHEMICAL LABORATORY.

The work for the coming year will be largely routine and cooperative as in the past, but in addition to this the following investigations will be elaborated: (1) Condition of eggs and egg products, in connection with which field work is contemplated. (2) The work on ketchups will also be supplemented by commercial investigations, especially with a view to obtaining more exact knowledge as to certain forms of spoilage which occur in this product. (3) The studies on alkaloids will be continued along much the same lines as in the previous two years, studying new forms as they may be obtained, and further studies will be made of the histological structure of drug plants for the purpose of identifying the ingredients in medicinal mixtures. The study of mustards will be completed and the information obtained applied in connection with the examination of this product under the food and drugs act.

## SPECIAL INVESTIGATIONS.

## ENOLOGICAL CHEMISTRY.

(1) The chemical examination of the grape and apple crops in the northeastern and central fruit sections of the United States.

(2) The preparation of samples of native wines and ciders from the fruit in these districts as supplemental to those already in hand.

(3) A study of the pomace and other wastes from the grapes and the apples as found at the manufactories.

(4) The collection and examination of native wines, ciders, and vinegars.

(5) The study of pure races of yeasts, with especial reference to their efficiency in producing chemical changes in pure juices at different temperatures and also in the presence of various preservatives.

(6) The further study of technical questions on the cellar practices with fermented fruit products and the economic handling and storing of the same.

#### PLANT AND ANIMAL PHYSIOLOGICAL CHEMISTRY.

Special emphasis will be given to plant studies during the early periods of growth, and milling and baking experiments to show the influence of environment on the composition of flour obtained from wheat grown under varying conditions. An exhaustive examination of the infants' and invalids' foods now on the market has been begun, and a study of the care, preparation, and modification of foods for infant feeding will be made.

#### BACTERIOLOGICAL STUDIES.

Special bacteriological work will be done in connection with the sustained investigations of oysters, eggs (including stored, frozen, and desiccated products), milk, ice cream, waters, and ketchups.



