

Historic, archived document

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

42
U. S. DEPARTMENT OF AGRICULTURE.

REPORT
OF
THE CHEMIST

FOR
1908.

BY
H. W. WILEY.

[FROM ANNUAL REPORTS OF THE DEPARTMENT OF AGRICULTURE.]



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1908.

LIBRARY
RECEIVED
DEC 13 1908
U. S. DEPARTMENT OF AGRICULTURE

CONTENTS.

	Page.
Introduction	5
Paper investigations	5
Tanning materials	7
Control of Government contracts	7
Post-Office fraud orders	8
Potable waters	9
Injury to agricultural interests by smelter fumes	10
Special features of the food and drug work	10
Drug investigations	11
Food colors	11
Administration of the food law	13
Food and drug inspection	14
Inception of the work	14
Statistical statement	14
Special investigations and inspections	15
Canning investigations	17
Tomato ketchup	17
Canned peas	18
Cooperative investigations	18
Food and drug inspection at branch laboratories	19
Boston laboratory	20
Chicago laboratory	22
New York laboratory	22
St. Paul laboratory	22
Important food investigations	23
Oysters	24
Lemon oil	24
Composition of fruits	24
Distilled spirits	25
Analytical methods and checking of inspection samples	25
Drug inspection and correlated studies	26
Chemical reagents	26
Domestic drugs—official and unofficial samples	27
Imported drugs	27
Medicated soft drinks	28
Tincture and essence of ginger	29
Glycerin	29
Hops	29
Hydrogen peroxid	30
"Loco" plants	30
Prescription schemes	30
Council of pharmacy and chemistry of the American Medical Association	31
Cooperation with Post-Office Department	31
Chemical studies of sugar-bearing plants	31
Dairy products	32
Work of the Miscellaneous Laboratory	33
Waters	33
Cattle food and grain investigations	33
Insecticides and fungicides	34
Trade wastes	34
Hygienic and miscellaneous work	35
Examination of contract supplies	35

	Page.
Investigations conducted by the Leather and Paper Laboratory	36
Tanning materials	36
Leathers	36
Papers	36
Turpentine	37
Miscellaneous work	37
Microchemical investigations	38
Nitrogen determinations	39
Special investigations	39
Animal Physiological Chemistry	39
Vegetable Physiological Chemistry	40
Bacteriological-Chemical Investigations	40
Washington laboratory	40
Philadelphia office, food research	41
Enological chemistry	43
Publications	44
The library	45
Clerical work	46
Work outlined for the fiscal year ending June 30, 1909	47

REPORT OF THE CHEMIST.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF CHEMISTRY,
Washington, D. C., September 14, 1908.

SIR: I have the honor to transmit herewith the annual report of the Bureau of Chemistry for the year ending June 30, 1908, together with plans for the work proposed for the year ending June 30, 1909.

Respectfully,

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

HON. JAMES WILSON,
Secretary of Agriculture.

INTRODUCTION.

The year ending June 30, 1908, marked the completion of the first fiscal year in the enforcement of the food and drugs act and was one of unprecedented activity in the Bureau of Chemistry. Every division and laboratory of the Bureau has felt the stimulus of the new and varied demands made on the force, and often several laboratories participate in one investigation. For this reason the details of the work, condensed as much as possible, are assembled according to the various divisions and laboratories in which they were performed, as showing most clearly and concisely the organization for the enforcement of the law and the way in which the different divisions collaborate in solving the varied and numerous problems presented. It seems further advisable to call special attention to the practical application and economic importance of some other very important investigations of the Bureau of Chemistry which are not so widely known and the value of which is not so generally appreciated as is the food work, the detail of the work involved in these studies being merely recorded under the appropriate caption. Conspicuous among these studies are the paper and tanning investigations, the inspection of supplies delivered to the Government on contract, and the protection of agricultural interests from the injury of smelter fumes.

PAPER INVESTIGATIONS.

One of the duties of the Bureau of Chemistry, as provided by law, is to conduct chemical investigations for other branches of the Government, as such aid may be requested of the Secretary of Agriculture. These studies not only involve research and investigation, but also a large amount of routine work. While the subjects particularly studied are those which relate directly to agriculture, the

provisions of the act establishing the Department of Agriculture make all investigations germane whose purposes relate to agriculture in the broadest interpretation of the term. It follows, therefore, that all investigations relating to the products of agriculture, their utilization, their chemical application, and their derivative products are legitimate sources of investigation in the Department. A case in point is one of the most prominent problems now submitted for solution, namely, that which relates to the paper supply of the country, closely connected as it is with the conservation of natural resources, especially the preservation of the forests, and the general economy of the public service. A vast increase in the use of paper for printing and other purposes, which has been attended with a corresponding decrease in the source of supply, has served to make the problem of paper production one of particular public importance. All of the paper-making materials heretofore utilized are agricultural products, especially those of the forest. The strength, chemical composition, and durability of the papers purchased are therefore problems which directly engage the attention of the Bureau of Chemistry because of their relations both to agricultural production and to Governmental supplies. For many years a study of the chemical composition of paper has been made a prominent feature of the work of the Bureau; associated with this, naturally, is the microscopical study of paper, without which it would sometimes be difficult, if not impossible, to ascertain the material from which the paper is made. Chemical reactions distinguish between the papers of different grades in many respects, but these reactions would not be sufficient in most cases to determine the source and character of the component fibers of the paper. Extensive advances in this field of investigation were made during the year. Not only were paper investigations made from the research point of view for the purpose of securing a more conservative use of paper-making materials and of establishing fundamental principles connected with the strength and durability of paper, but also the very large increase in the public paper supply and its control was made a feature of the year's work. The studies of samples of paper submitted for investigation by the Post-Office Department and by the Public Printer were made to this end, and a laboratory was established at Dayton, Ohio, for the purpose of inspecting paper manufactured for the use of the Post-Office Department. This was done in order to avoid delays in delivery, as it is apparent that it is far more economical and convenient to examine the supply at the point of production or before shipment rather than after it is received at the Post-Office Department. Experience had shown that shipments of paper were received at the Post-Office Department which did not comply with the specifications of the contract under which they were purchased, and when such shipments were examined by the Bureau of Chemistry and found below standard delay and annoyance were caused thereby, both to the Post-Office Department and to the manufacturer. The establishment of a laboratory at the place of production has proved of great utility to the Department and also has been advantageous to the contractor by enabling him to avoid the possibility of rejection of a shipment, and in indicating to him the proper changes in the method of manufacture necessary to secure a product which will meet the requirements of the specification.

The investigations of the Bureau show conclusively that the quality of papers of all kinds can be greatly improved and the quantity required for commercial purposes as determined by weight can be materially reduced, to the decided advantage and profit of the public. The Bureau has also found that the permanence of Government records and of other valuable documents can be more certainly insured, and the weight, bulk, and cost of all paper used by the Government can be reduced from 10 to 40 per cent without the sacrifice of any essential quality, by introducing certain changes in the specifications upon which paper is bought in the several Departments. This work, by special direction of the Secretary of Agriculture, has engaged the attention of the Bureau for several years and specifications for paper, based on these investigations, are now being drawn which will undoubtedly insure a large saving to the Government in its purchases.

TANNING MATERIALS.

Similar investigations have also been pursued in connection with the supplies of tanning materials, the principles of tanning, and the quality of the final products. The problem of the supply of tannins is almost as important as that of paper, as the supply of oak and hemlock barks, which have been the principal sources of tannins up to the present time, is rapidly decreasing. The new forests do not develop rapidly enough to supply the increasing demand, and again the conserving of natural resources without unduly checking the growth of the industry becomes a burning question. New sources of supply are therefore to be sought, as well as a more economical utilization of those already at our disposal. Only science, and fundamentally chemical research, can solve these problems. The investigations of the Bureau have shown that other parts of the tree as well as the bark contain considerable tannin, though not enough to warrant the transportation of the wood in its natural state. The roots of the tree are also remarkably rich in tannin and could be utilized to advantage if transportation were not required. These investigations have shown the wisdom of establishing tannin-extract plants in regions furnishing the raw supply and reducing the material to a viscid state before transportation. In this way all parts of the crude solid bark or wood are reduced to a small bulk and the cost of transportation to a great distance is greatly diminished.

Other sources of tannin than those usually employed have also been investigated. Special interest has been taken in some parts of the South in the palmetto roots, which contain large quantities of tanning material, and investigations by the Bureau show that they may be profitably utilized. While the growing of tannin-producing plants is evidently not within the functions of the Bureau of Chemistry, the study of the composition of these plants, especially the determination of the quantity of tanning materials therein contained, and the preparation of the best products for application to the arts are important lines of chemical investigation.

CONTROL OF GOVERNMENT CONTRACTS.

One of the most important lines of the work has been investigations made for the Isthmian Canal Commission under arrangements by

which all kinds of supplies which are furnished to the Commission are submitted to the Bureau of Chemistry for examination. This work consists in the examination of mixed paints, Japan drier, lubricating oils and greases, rubber valves, putty, linseed oil, steel, iron, brass, copper, kerosene oil, signal oil, gasoline, coal tar, antimony, tallow, candles, soap, sal ammoniac, coal, oakum, cement, coke, shellac, boiler compound, varnish, graphite, pig tin, and creosote. The volume of this work has increased very rapidly during the year, and the control effected has been of immense value to the officials of the Isthmian Canal Commission in insuring supplies of high character. The contractors are aware that all materials submitted are examined by the Bureau of Chemistry, and this alone has been efficacious in raising the character of the supplies furnished. It is evident that if some such control were not instituted the authorities would be at the mercy of the contractors, who would be able to fill the orders with inferior materials with impunity. Under the present arrangement, however, it is quite impossible for this to be accomplished, and the futility of attempting it has resulted in the delivery of supplies of the highest character. If any of the supplies do not meet the conditions of purchase, the Bureau of Chemistry at once certifies this fact to the proper authorities, who use this knowledge in accepting or rejecting the materials.

Similar work, though of a more restricted character, has been accomplished by the Bureau during the year in connection with the Bureau of Printing and Engraving. Practically all of the enormous supplies of paints and dyes used by that Bureau are accepted only after an examination by the Bureau of Chemistry. This method of inspection has led to great economy in purchasing, and it has been shown that under the old methods materials were furnished at a much higher cost and often of inferior quality as compared with those now secured.

POST-OFFICE FRAUD ORDERS.

The work of the Bureau of Chemistry in cooperation with the Post-Office Department to prevent the sending of fraudulent material through the mails has been conducted for several years to the great benefit of the public. The samples submitted to the Bureau of Chemistry for examination consist chiefly of the so-called patent and proprietary remedies. When the examination and analysis made in the Bureau of Chemistry show these to be fraudulent in character they are forbidden transportation by the mails, and letters and other documents addressed to the proprietors are refused delivery. This cooperation between the two Departments has succeeded in the past few years in breaking up many of the principal centers for the dissemination of such fraudulent materials.

While some of the so-called remedies are actually injurious, many are substances in common use, and when properly administered under the supervision of a physician are valuable, but the principle on which the Post-Office Department has been utilized for the dissemination of literature connected with these remedies is one which has worked great injury upon the public. Claims of the most exaggerated character are made for simple remedies, and the accompanying advertising matter is of a nature to imbue susceptible persons with the

idea that they are suffering from some disease which, being purely of an imaginative character, is easily removed by the alleged remedy. The deluded subject is convinced of the virtue of the remedy and is thus led to give a certificate for its virtues. In practically all cases the price is out of all proportion to the cost of the medicine, and the fraudulent character of the transaction is beyond question. The farming community and those not within easy reach of drug stores and medicinal aid are especially the victims of this propaganda. It is hoped that the continued cooperation of the Post-Office Department and the Bureau of Chemistry may succeed in wholly eradicating this all too prevalent system of fraud. Such cooperation by experts who have been trained by long years of study and research produces the maximum of efficiency with the minimum of cost, and has the approval of the practice in other countries, notably England, where a Government laboratory has long been established to which is referred all the work of the English Government which is of a chemical nature.

POTABLE WATERS.

As a result of far-reaching agitation in regard to the impurity of municipal water supplies and the danger of typhoid and other diseases arising therefrom, the use of bottled water has been greatly increased. It is very common now to find bottled spring water not only in hotels, restaurants, and dining cars, but also in private houses. The determination of the character of these bottled waters and the question as to whether they had been subjected to any kind of sophistication are, therefore, matters calling for investigation. Accordingly, agents were sent to the original springs from which the bottled waters are supposed to come and samples at source were secured for examination, being bottled in a manner which effectually excluded all possibility of any external contamination. The waters were carefully examined, both chemically and bacteriologically, and thus the actual handling condition of the water as regards cleanliness and freedom from sophistication was determined. These data were compared with data obtained by the examination of the bottled waters purchased in the ordinary channels of commerce. In some cases there were surprising differences in character between the natural water and the bottled water sold for consumption, and in a few instances the contamination of the water was of a character to render it decidedly objectionable for potable purposes. It was evident that often great carelessness was practiced in the handling of these waters, assuming that they were really derived from the spring assigned as their source. This contamination was chiefly of a bacteriological character, and shows either that the water was not what the description represented it to be or that the original water had been so carelessly handled as to render it unfit for drinking purposes. Obviously such waters are not legitimately entitled to enter interstate commerce. Some of the data, however, seem to indicate that the waters are contaminated after they have been received in bulk, during the bottling process in the place where they are sold.

There is a peculiar tort practised upon the public in this matter because of the common belief that bottled waters are especially pure. It is manifestly of interest to bottlers of pure spring waters as well

as to consumers to be able to assure the public that any bottled waters offered to them are, in the first place, genuine waters of the spring they represent, and, secondly, that they have been so handled as to escape every kind of contamination from the time they leave the spring until they are delivered to the customer. This the present supervision and study of potable waters, with the resultant demands for correct labeling, should effect.

The examination of all of the principal lithia waters under the food and drugs act has shown that very few of them fulfill the claims made by their producers and that practically none of them contains enough lithium to produce any effect by this element as a therapeutic agent. The claims made as to the medicinal properties of a large proportion of mineral waters are very much exaggerated, and in many instances are absolutely false.

INJURY TO AGRICULTURAL INTERESTS BY SMELTER FUMES.

Another investigation in which the Bureau has been engaged and which is of great public benefit is that which relates to the injury done to vegetation and animal life by the fumes arising from smelters. It is well known that large areas of the public forest domain have been practically ruined by the fumes and other wastes from these sources. The objectionable elements in the fumes of smelters are chiefly sulphur dioxid and arsenious or arsenic oxids. The former is very destructive of forest growth and vegetation in general and the latter by falling on forage on which the cattle feed may produce poisoning. The Bureau, in cooperation with the Department of Justice, has continued this investigation during the past year, studying the extent and character of these damages, as well as methods whereby they may be avoided. It is not the purpose of this investigation in any way to restrict the activities of the smelters. The reduction of ore is a legitimate industry which should be fostered in every possible way, but the smelters should be located with a view to producing the minimum of damage to vegetation and stock, and, further, the injurious wastes should be so transformed or disposed of as to prevent injury to the surrounding agricultural interests. It is well known that by a simple chemical process the sulphur dioxid which comes from these chimneys may be converted into a commercial product, sulphuric acid; while the arsenic and arsenious oxids may also be condensed and converted into forms of chemical value.

Similar investigations are conducted on the wastes of manufacturing establishments in general which are poured into the running streams, including copper, lead, and zinc. While it may entail some expense to the owners of factories to avoid contaminating both the air and water, it is evident that such action must be taken for the benefit of the public at large.

SPECIAL FEATURES OF THE FOOD AND DRUG WORK.

The work of the Bureau of Chemistry in its more general character at the present time is directed to the control of foods and drugs offered for sale in the District of Columbia, the Territories, and the insular possessions of the United States and those entering interstate or foreign commerce. The Division of Foods and the Division of Drugs are engaged not only in the routine chemical work necessary for the

administration of the law, but also in research and investigations on which the routine analyses are based.

DRUG INVESTIGATIONS.

In the researches connected with the drug work particular attention has been directed to the character of the raw materials imported into the United States from which drugs are manufactured. These investigations have shown that large quantities of the materials offered for import are unsuitable for the purpose, being adulterated with dirt, sand, sticks, and fragments of all kinds, sometimes to the extent of more than 40 per cent. Special investigations have been made of a chemical and microscopical character for the identification of crude drugs of a vegetable origin, and widespread adulterations have been revealed by these studies. A drug recognized as standard by the Pharmacopœia may be replaced by some other member of the family to which it belongs, resembling it in general character but differing from it widely in therapeutic value. This substitution robs the drug of its efficacy and negates the work of the pharmacist and physician, preventing the patient from receiving the full benefit of the prescription.

The purity of drugs in general which are intended for sale in the District of Columbia and the Territories and in interstate commerce is necessarily an object of study. In order that it may be determined whether false statements are made on the labels it is necessary that their therapeutic and pharmaceutical properties be ascertained. In order that this may be efficiently done a new branch of investigation has been established of a pharmacological character.

During the year the properties of the beverages of the "cola type" have been ascertained by chemical research and their composition determined by careful chemical analysis. These results have been of very distinct value in a practical way. The influence of such a drug as caffeine, often present in medicated beverages of this kind, varies greatly with different individuals, making it desirable that the public should know the character of the stimulant they are buying.

It is generally believed that an alkaloid, like caffeine, when its natural form of combination is destroyed and it is administered in a pure state, is made much more active thereby, and this should be remembered when considering the amount of caffeine present in medicated beverages of this type as compared with that in coffee or tea. Moreover, a person who drinks tea or coffee is aware of the fact that he has taken into his system alkaloidal material which when used in excess may prove injurious, while the drinker of the cola beverages is wholly unaware of the nature of the drug consumed. Investigations have shown that the continued use of such beverages may be injurious and their indiscriminate use by those ignorant of their nature should be controlled. This is especially true in view of their excessive use by individuals and the rapid increase of beverages of this type varying in harmfulness.

FOOD COLORS.

Prior to the passage of the pure-food law no restriction was placed on the interstate sale of food products because of the nature of the

anilin dyes used in them. It was not at all uncommon to have absolute harmlessness and purity claimed for the dyes used for this purpose, and the condition of affairs was such that after the passage of this law it became necessary to investigate the whole subject. This the Department has done, with the very valuable aid of Dr. Bernhard C. Hesse, of New York City, who has been a consultant with the Department in regard to the subject of dyes and their use in foods.

Investigation showed that many of the dyes sold as harmless were very far from being above suspicion. Those sold as being absolutely pure, specially cleaned for use in foods, were found to be sold, at times, from the same cask as dyes used for technical purposes. This condition of affairs called for some immediate action, and pending the results of the complete investigation a list of seven anilin dyes permitted to be used in foods, temporarily, was incorporated in the regulations for the enforcement of the food and drugs act by the Secretary of the Treasury, the Secretary of Agriculture, and the Secretary of Commerce and Labor, being promulgated as Food Inspection Decision 76. This list comprises red, orange, yellow, green, and blue dyes—enough shades for all the practical purposes of those having need for such colors. These dyes must be properly cleaned before they will be certified to by the Department of Agriculture as being fit for use in foodstuffs. Up to the present time a complete list of dyes sufficiently pure for certification has not been presented to the Department. There have been a number of manufacturers, or their representatives, who have interested themselves in this problem of supplying clean, harmless dyes, and that so long a time has expired—the decision having been issued July 13, 1907—without a complete list being certified, indicates that these dyes as formerly sold must have been far from suitable for the purpose.

Meanwhile, the manufacturers are restricting themselves to these seven dyes in the uncertified form and have practically ceased to use any other anilin dyes. The Department will take no action against the users of any of these seven dyes, uncertified, pending certification of the full list and the possibility of their purchase on the market. The dye users, as a whole, are apparently perfectly satisfied with the list as chosen, for there are only occasional requests for its extension.

Since the publication of Food Inspection Decision 76, vegetable dyes have become quite a prominent factor. None of the anilin dyes permitted are oil-soluble; recourse must therefore be had to oil-soluble vegetable dyes for butter colors, e. g., annatto. The vegetable dye is a trifle more expensive and has slightly less tinctorial power than some of the oil-soluble azo dyes formerly used, but this is a negligible factor compared with the danger that may arise from the use of certain coal-tar dyes.

The Bureau of Chemistry is carrying on researches in respect of anilin dyes which are claimed by their manufacturers to be harmless, having the advantage of cheapness and high tinctorial power. Many experiments are being conducted to control the chemical work described in the certificates (see Food Inspection Decision 77) accompanying dyes submitted for certification. All of this work is carefully checked, and in every way the greatest possible care is taken to insure that only the highest grade and cleanest of permitted dyes reach the consuming public.

ADMINISTRATION OF THE FOOD LAW.

The administration of the food law has been vigorously pushed. Though the inspection force of the Bureau was newly appointed at the beginning of the fiscal year, its efficiency as a whole has been extremely satisfactory. Naturally, as in all cases of this kind, some experience and training were necessary before any effective work could be done, and while some of the inspectors perhaps have not comprehended perfectly the character of their work, and have not prosecuted it in the proper spirit, the greater number have developed qualities of a high order and have displayed a most commendable industry coupled with good judgment and tact. The moral effect produced by the fact that an inspector of the Department of Agriculture is likely at any time to come into a factory has been wholly good. As a rule, the inspectors have been received with great courtesy by the manufacturers and have received full inspection privileges. This sympathetic cooperation of the manufacturers has been manifested in many other ways. One of the most gratifying results obtained during the year has been the abandonment of the position of hostility which many manufacturers up to that time held, and an assumption of hearty cooperation not only with the inspection work of the Department but also with the broadest views respecting the wholesomeness of substances added to foods. A large number of prominent manufacturers during the year entirely abandoned the use of any kind of preservatives and openly announced their adhesion to the doctrine that drugs should not be placed in foods. Although there have been no suits brought so far involving the addition of a chemical preservative to a food, the practice has been openly discredited by so many first-class manufacturers as to warrant the statement that the cause of pure food, in so far as chemical preservatives are concerned, has been firmly established. A large number of cases of violation of the food act have already been adjudicated in the courts with uniform victories for the Government.

The details of the food and drug work are so fully given under the appropriate captions that no special comment is deemed necessary. In submitting this, the first annual report made under the food and drugs act, it seems permissible to express an appreciation of the loyal and efficient services of the chiefs and members of the various laboratories and divisions, who have made every effort to meet the exigencies created by the mass of new and varied work devolving suddenly upon them. The Department of Justice and the Treasury Department have also in the most earnest, sympathetic, and effective manner cooperated in the execution of the law, which it has been the aim to enforce in the same spirit of impartiality which animates the purely scientific work. The complex problems involved and their far-reaching effects make a conservative progress along certain lines necessary; but that the interests of the consumer and the honest manufacturer are one and not antagonistic, when considered not superficially but from a broad point of view, becomes more and more apparent with the progress of the work. Only certain special interests of doubtful or obviously illegitimate character can be injured by the consistent enforcement of the law.

FOOD AND DRUG INSPECTION.

INCEPTION OF THE WORK.

At the beginning of the fiscal year, July 1, 1907, there were 26 men stationed in various parts of the country as food and drug inspectors. The appointments were made from among successful applicants who took the civil-service examination in the February preceding, and were appointed in June. Actual inspection was not begun until July 1, 1907, the intervening time being employed in instructing the men concerning various details of the work. At that time the new branch laboratories were not yet ready to examine samples, and for the first month the inspectors were engaged in the inspection of food and drug factories. Official collection of samples, as the basis of prosecution under the act, did not begin, in fact, until the first of August. Necessarily, the first samples were collected under such conditions that prosecution could not be maintained in all instances. It was found that a great many circumstances actually encountered were not included in the instructions given the inspectors, for the reason that such details were then a matter of anticipation and conjecture. These omissions were supplied in a large number of cases by subsequent collection of the necessary information, particularly in regard to evidence showing interstate transaction. A second civil-service examination was held in March, 1908, for the purpose of providing a register from which additional inspectors could be appointed in whatever number the increased work incident to the enforcement of the food and drugs act required, and the total number of inspectors has been increased to 39, their movements being directed by the Chief Inspector, W. G. Campbell, from the Washington office.

STATISTICAL STATEMENT.

The primary object of inspection work is the collection of samples of food and drugs which are suspected to be adulterated or misbranded, and which, if the analysis proves such to be the case, form the basis of a prosecution. The entire number collected during the fiscal year was approximately 13,400, consisting chiefly of samples of extracts, spices, olive and salad oil, milk, liqueurs, wines, whiskies, molasses, vinegar, rye, diabetic and gluten flours, maple and cane sirups, coffee, cheese, honey, breakfast foods, misbranded morphin and cocain preparations, and drugs labeled as cures. These samples were divided among the 16 branch laboratories engaged in the examination of interstate samples, and the food and drug divisions of the Bureau of Chemistry at Washington, to which a large number were sent. One inspector has been assigned to each of the branch laboratories, with the one exception of Portland, and at New York and Boston two inspectors are stationed. The remaining inspectors have been located at points affording the easiest supervision of interstate distribution of food and drug supplies.

The important factories throughout the country have been inspected and the principal cities and towns have all been included in inspection routes. This has required a great deal of travel, but experience has shown that large cities are undesirable points for the operation of inspectors in collecting official samples. Most of the

samples have been taken from wholesale jobbing houses or from parties receiving the product directly in an interstate shipment from the manufacturer. This procedure minimizes the testimony necessary in bringing a prosecution.

Of the total number of samples analyzed and found to be adulterated, 814 were collected under such conditions that interstate delivery could be shown, and these cases were accordingly certified to the Board of Food and Drug Inspection for their recommendation. Of this number 96 cases were fully summarized after the preliminary hearing had been accorded the party from whom the sample was obtained in compliance with section 4 of the food and drugs act, and prior to their reference to the Department of Justice and the proper District Attorneys.

Information concerning 86 shipments made in violation of the law was reported by inspectors who also collected the data necessary to institute legal proceedings under section 10 of the law, which provides for the seizure of such goods for confiscation by a process of libel for condemnation. These reports include the following products in the indicated amounts, showing at the same time the number of seizures made and the amount actually condemned:

Record of seizures from July 1, 1907, to June 30, 1908, under section 10 of the food and drugs act.

Substance.	Seizures recommended.	Seizures actually made.	Substance.	Seizures recommended.	Seizures actually made.
Cider.....	barrels... 135	135	Flour.....	carloads.. 2	2
	do... 10	10		sacks.... 2,240	2,240
	halves... 75	75		carloads.. 2	2
	kegs.... 50	50	Canned fruit.....	cases... 342	342
Drugs:			Sirup and molasses:		
Danderine.....	barrels... 65	65	Sirup.....	quarts.. 413	413
"Brain Food".....	bottles... ..	..	Molasses.....	barrels.. 26	18
"Madam Yale".....	dozen... 83	85	Wine.....	do.... 910	1,078
	barrels... 23	24	Meal.....	bags... 300	..
	do.... 23	..	Beer.....	barrels.. 50	50
Honey.....	cases... 200	7 $\frac{1}{2}$	Vinegar.....	do.... 65	48
	barrels... 37	35 $\frac{1}{2}$	Stock feed.....	bags... 500	500
	cases... 10	10	Canned vegetables....	cases.. 988	876
	cases... 35	35			
Coffee.....	bags... 84	84			
	cases.. 205	210			

In addition to this, libel proceedings were requested in the case of misbranded whisky, both interstate and imported, to the amount of 625 barrels and 31,359 cases. Of this quantity 92 barrels and 6,702 cases were seized and either condemned and released under bond, or are at present awaiting adjudication.

SPECIAL INVESTIGATIONS AND INSPECTIONS.

The statistical statement gives a very inadequate idea of the inspection work necessary for the enforcement of the act, and the results actually obtained. A great many brief investigations have been made by inspectors to procure information necessary, in collaboration with the work of the chemists, to determine the adulteration of particular samples, and more extended investigations of a special nature which are concerned indirectly with the prosecutions of certain violations have also been made.

Some of these special duties have included sanitary inspection of mineral water springs throughout the Eastern and Southern States and the collection of official samples; an investigation of the coffee situation, including the quantity of imported coffee and the source of importation, with a view to suppressing the practice of indiscriminately labeling every coffee as a Mocha and Java, or a blend of both; an investigation of the polishing and coating of green coffees with certain colors, which led, in one instance, to the confiscation and destruction of 84 bags of such product coated with lead chromate; study of the fruit-canning industry to determine the quality of raw products used, whether sanitary methods of canning were used, and the agents employed either in coloring or in preserving; an investigation of stock feed, as a result of which several cases were reported for criminal prosecution and a large shipment adulterated with ground corncobs, and considerably below the standard established for protein and fat, was seized and confiscated; and investigations of the process of curing and drying cod and other fish and coloring smoked salmon.

Extensive consideration has been given to the practice of labeling distilled colored vinegar as "Pure Apple Vinegar," or "Cider Vinegar." Official samples of such products have been collected throughout the country and seizures made in those instances where goods were located in sufficiently large quantities to justify such a course.

Investigations have been instituted in regard to the manufacture and sale of spurious and imitation liqueurs which purport to be imported and are foisted upon the country as the genuine products of old and well-established grades.

In addition to the routine assignments requiring the collection of samples of misbranded whiskies, special effort was made, in compliance with the specific instructions of the Secretary of Agriculture, to locate wholesale shipments of this product manufactured from neutral spirits, but branded and sold as a straight whisky or whisky blend, in violation of the act as interpreted by the Attorney-General in Food Inspection Decision 65.

Attention has been given to the method and extent of the use of durum wheat by various mills which were able to employ this grade of wheat by bleaching and subsequently marketing it under a brand that gave no indication of the quality of wheat ground. These investigations resulted in the seizure and condemnation of a number of large interstate shipments of misbranded flour.

At the request of the Navy Department regular inspections have been made of the character of foods and drugs furnished under contract to the navy supply stores and battle ships.

In September, 1907, a force of 10 inspectors participated in a campaign against adulterated milk shipped into St. Louis from dairymen residing in Illinois; 1,500 samples were collected, of which number 100 were found to be adulterated, and accordingly were reported for prosecution.

Considerable attention has been given to the practice of over-marking packages of cheese, with the result that several official samples have been collected showing that by accurate weight the packages were from 8 to 10 per cent short of the amounts indicated.

Inspectors have investigated the methods of manufacturing gelatin, including in their report an account of the sanitary conditions of the various factories. This investigation disclosed many questionable practices, and revealed the fact that the processes of manufacturing edible gelatin, gelatin used in the arts and industries, and glue were intimately associated; that the raw materials, the methods of handling and storing, and the vessels and appliances used were the same, and that it was difficult to establish a line of demarcation in the course of preparation between these products.

CANNING INVESTIGATIONS.

TOMATO KETCHUP.—One line of experiments carried on in connection with factory inspection consisted in the manufacture of ketchup on a commercial scale to determine whether such products could be kept without the use of an added preservative. One of the leading manufacturers tendered the use of his plant, assistants, and material for this work, and these were accepted. Ketchup was made in the usual manner from sound, ripe stock and high-grade seasoning ingredients, care being used in every detail. The formula was that used regularly at the factory, and each batch consisted of 50 gallons of finished product.

One method was first to sterilize the bottles and corks and reheat the ketchup after "finishing" to the boiling point. The bottling was then done at about 205° F. Another batch was "finished" before cooking and then drawn directly from the kettle to the bottling apparatus and the filling done at about 205° F. This method of sterilizing was successful, but the objection in factory practice is the danger of burns and scalds in handling the bottles.

The second method was to give the filled bottles an after process. Trials were made with different temperatures and periods of cooking, varying from 160° F. for three hours to 220° F. for twenty minutes. Ketchup is a poor conductor of heat, and it was found that a high temperature for a short time was more effective than a low temperature for a long time. The breakage in bottles in temperatures of more than 200° F. becomes a serious consideration. The breakage at 190° F. is small, and that temperature for an hour seems to be sufficient.

Tests were also made to determine the relative efficiency of whole spices, and oil, water, and acetic-acid extracts of spices in keeping the ketchup both before and after the bottles were opened. It is known that some of the condiments used in ketchup have an antiseptic value, and this property was determined for each of the extracts named, the organisms used for testing the efficiency of the spice being those commonly found in ketchup.

Tests were made upon the effect of temperature in inducing spoilage both before and after the bottles were opened. None of the experimental ketchup spoiled before opening. When opened and placed in an incubator or a very warm room, the first evidences of spoilage occurred in a very few days; in a cool room spoilage was indicated in from ten days to three weeks, and in the refrigerator it was checked for from two weeks to more than two months. Good ketchup, like other good food products, calls for reasonable care on the part of the consumer as well as by the maker.

Seventy-eight samples of commercial ketchup were purchased and compared with the experimental goods. The microscopical examination indicated the origin of the stock plainly, whether made from sound tomatoes, trimming stock, or decayed material, and the presence of artificial color was shown by the effect produced upon the different constituents. The effect of sodium benzoate in the amounts claimed upon the label was compared with known quantities in experimental goods. In connection with these last experiments tests were made to determine the effect of sodium benzoate upon living protoplasm as seen in the filaments of *Penicillium*, which were greatly distorted, the character of the protoplasm being decidedly changed.

CANNED PEAS.—Work was continued upon canned peas, being directed especially to a study of the grading for quality. Nearly all factories grade peas for size, but an accurate method of grading for quality is of recent introduction. Peas may be graded upon the basis of their specific gravity, as the young and tender ones will float in salt water of low specific gravity (1.040) and the very hard ones will sink in a solution of a density of 1.1070, while the intermediate grade will float on the latter solution. By using tanks containing such solutions, any number of loads of peas may be graded properly.

Studies were made upon the changes in size, weight, and other physical characters which the peas in these different grades undergo in blanching and processing. Good peas undergo very little change, while the poor ones are radically affected. As soon as canners make use of this method of grading and learn the changes which the pea undergoes in the various steps in canning it will be possible to greatly improve the general quality of canned peas.

Eighty-six brands of peas upon the market were examined, and studies of the changes which result from spoilage were continued.

COOPERATIVE INVESTIGATIONS.

Besides the investigations indicated, which were conducted by the inspectors exclusively, a great deal of assistance has been given to other branches of the Bureau charged with special investigations. Under this head is the assistance rendered in conducting experiments in the sulphuring and drying of fruit in California; the drying or evaporating of apples on a commercial scale, and under commercial conditions, without the employment of sulphurous acid fumes, in New York, together with the collection in that vicinity of data and information relative to the industries of dried beans, peas, berries, etc.

Assistance has also been given to the chemists having in charge the investigation of the use of sulphur in the manufacture of sugar-cane sirup, molasses, and sugar, requiring on the part of the inspectors the collection of considerable data bearing upon this industry.

One of the inspectors was detailed to the Bureau of Animal Industry temporarily for the purpose of making certain investigations in denaturing greases.

Attention has been given to the importation of empty boxes bearing labels indicating that the products to be contained therein were various grades of foreign cheese. Inspections made of the domestic

plants of such importers and the collection of samples for the purpose of prosecution have resulted in the withdrawal from the market, to a large degree, of American cheese masquerading as imported goods.

Cooperation has been given in the investigation of the question of oyster contamination in and around New York waters, and further independent work was done in connection with the various sources of oyster supplies.

A large number of factories were inspected throughout the country, and much information procured for the Division of Drugs in connection with the consideration given to various cola products.

The inspectors report from all sections of the country that as a result of the collection of samples and the legal action that followed (whether a criminal prosecution or a seizure for confiscation), and also in a great many instances where no prosecution was instituted, but merely as a result of the investigation, the character of certain products has been entirely changed within the last year, the manufacturers having either discontinued altogether the adulterations formerly employed or labeled their goods to indicate the nature of the contents in a manner entirely consistent with the provisions of the food and drugs act.

FOOD AND DRUG INSPECTION AT BRANCH LABORATORIES.

In the report for 1907 the work in the examination of imported food products at six ports (New York, Boston, Philadelphia, Chicago, New Orleans, and San Francisco) was reported. During the last fiscal year 11 new branch laboratories have been installed, all of which have been in actual operation long enough to submit a report, as shown by the following table on both imported and interstate samples. Four additional laboratories, located at Nashville, Omaha, Pittsburgh, and St. Louis, are in process of installation.

Statement of food and drug samples examined in the various branch laboratories during the fiscal year ending June 30, 1908.

Laboratory.	Imported samples.				Interstate samples.			Miscellaneous samples.
	Legal.	Illegal.	Flour-inspection samples.	Total.	Legal.	Illegal.	Total.	
Boston	425	283	4,130	4,838	425	540	965	105
Buffalo	119	18	211	348	523	144	667	.....
Chicago	234	80	3,277	3,591	776	201	977	.....
Cincinnati ^a	8	3	64	75	78	83	111	4
Denver ^a	8	4	.....	12	119	19	138	.....
Detroit	40	44	.....	84	146	47	193	.....
Galveston	46	16	129	191	90	38	128	.....
Honolulu	24	18	.....	42	4	3	7	.....
Kansas City .....	.....	.....	.....	.....	54	23	77	.....
New Orleans	158	139	1,303	1,600	149	93	242	21
New York	3,310	1,502	24,463	29,275	965	239	1,204	4
Philadelphia	534	335	4,600	5,469	160	92	252	3
Portland ^a	63	22	302	387	21	51	72	17
St. Paul	53	35	283	371	222	47	269	98
San Francisco ^b	175	155	2,375	2,705	174	156	330	c 2,129
Savannah ^a	3	4	.....	7	87	60	147	.....
Seattle	144	73	2,262	2,479	13	10	23	5
Total	5,453	2,731	43,399	51,474	4,006	1,796	5,808	2,386

^a In operation about three months.

^b About seven months' work.

^c Sulphur experiments.

In connection with the examination of routine samples at the various laboratories on the results of which prosecution will be based, important problems are constantly arising which call for immediate solution. As before noted, the inspectors and chemists work together in the solution of these questions, which have given rise to the following special investigations at the laboratories named:

BOSTON.—Vanilla extract; maple sugar and cane sugar; coloring matter in foods; domestic sardines, as to kind of oil used; adulteration of cocoa products; caffeinetic acid and caffein in coffee.

CHICAGO.—Bleaching of flour; breakfast cereals.

GALVESTON.—Colors used in foods, in cooperation with the Association of Official Agricultural Chemists.

NEW ORLEANS.—Determination of sulphites in molasses.

NEW YORK.—Butter coloring; added oil in paprikas; rice coatings and polishings; food colors; liquors; flavoring extracts; teas; coffees; medicinal plants and drugs.

PHILADELPHIA.—Cocoa investigations; coloring matter in foods; nitrogen and flavoring extracts.

PORTLAND.—Certain extracts; fusel oil in distilled liquors.

SAN FRANCISCO.—Sulphuring of California fruit; samples of food products submitted to the Commissary Department, U. S. Army.

SEATTLE.—Japanese sake (general composition and content of salicylic acid); branding of canned salmon.

ST. PAUL.—Durum wheat in flour milling; bleaching of flour; cereal products; fusel oil in distilled liquors, shortening methods for determination of; oxidation of various higher alcohols constituent in fusel oil; presence or absence of furfural in natural honey as taken from comb.

A number of the laboratories have been too recently installed and are not yet equipped with a sufficient number of men to perform more than the routine work reported in the table. Others, however, have already made considerable progress along the special lines indicated, and for these a brief statement of progress is made.

BOSTON LABORATORY.

The following special investigations are in progress in the Boston laboratory under the direction of B. H. Smith:

(1) In order to determine the amount of resins and extractive matter which should be present in vanilla extract, the laboratory has prepared, or in some instances has had prepared by reputable manufacturers, nine samples of standard vanilla extract (U. S. P.) representing some five different types of beans and three different modes of manufacture, and also using in one case different percentages of alcohol in preparing the menstruum. From the "lead number" and other determinations made on these samples it is apparent that of the large number of vanilla extracts on the market but a very small percentage comply with the requirements of the Pharmacopœia, and, further, that very few commercial extracts, regardless of the kind of bean used, "contain in 100 cc the soluble matters from not less than 10 grams of the vanilla bean," as required by the standard of the Department of Agriculture. This work is being continued as time permits, and is being extended to a wider range of samples of known origin.

As opportunity has offered work on maple sugar and sirup has been done to detect adulterants, such as brown sugar and cane sugar, particularly in such samples as have been modified in ash and organic matter content to meet the chemist's usual requirements. This in-

vestigation has been confined to the quantitative ash analysis, making determinations not customarily made, such as sulphates, phosphoric acid, manganese, etc. Complete ash analyses of several samples of maple products of known origin and a few samples of brown sugar and an exhaustive examination of eight or ten commercial samples have been made. Some of the latter reported as probably pure (i. e. as conforming to the standards) appear as a result of the more detailed examination to be largely sophisticated. This work is being continued.

The identification of colors used by bakers in the preparation of cakes, pastry, etc., has been studied. From about 25 samples examined up to the present time it is plain that the colors used are chosen primarily on the grounds of cheapness and tinctorial strength. This work will also include the determination of the egg content of yellow products, as without doubt much of the color used is for the purpose of misleading the consumer on this point. Considerable work has accordingly been done on the detection of saffron, turmeric, and coal-tar colors in baked goods and macaroni.

Domestic sardines as sold in the Boston market have been examined to ascertain the kind of oil used and the truthfulness of the label. Cotton-seed oil was present in every case and the labels in general were unsatisfactory. It developed, however, that the samples taken were of last season's pack (1907) and additional samples will be taken after the new supply appears on the market.

The adulteration of cocoa products has also received attention. This work includes a study of the methods usually followed for the detection of such adulterations and of the constants of cocoa butter. Some low-priced goods are shown to be wholly fictitious, being composed largely of a glucose paste artificially colored and flavored. Others contain only shells as the cocoa constituent. Many of the penny goods, especially the so-called chocolate cigars and cigarettes, are coated with resin varnishes, and the latter are being investigated and identified when possible. A number of samples contain substitutes for cocoa butter, and these extracted fats, as well as substitutes sold as such, have been carefully examined and their constants determined.

The following investigations for the improvement of methods, indirectly connected with or suggested by the food inspection work of the laboratory, have been made:

(a) **THE ESTIMATION OF CAFFETANNIC ACID AND CAFFEIN IN COFFEE.**—The sources of error in the official method for caffetannic acid determination have been investigated and the method has been modified and shortened; this and a new method for caffein will be reported to the Association of Official Agricultural Chemists at its 1908 meeting.

(b) **THE COLORIMETRIC ESTIMATION OF BENZALDEHYDE.**—The methods used by Tolman and Chace, of the Bureau of Chemistry, have been successfully applied to determining benzaldehyde in commercial almond extracts, and the preparation of aldehyde-free alcohol has been simplified.

(c) **THE DETECTION OF CARAMEL IN VANILLA EXTRACTS.**—A critical study of methods and a comparison of results on a number of commercial extracts have been made.

Mr. Woodman, who conducted these investigations, has also served during the last year as referee in the Association of Official Agricultural Chemists on tea, coffee, and cocoa, and other members of the laboratory have assisted in other lines of cooperative work.

CHICAGO LABORATORY.

The report on the imported samples represents for the Chicago laboratory a full year's work, while that on domestic samples covers scarcely ten months, as the laboratory was not entirely equipped until September 15. Considerable time was devoted to an investigation of the bleaching of flour under the direction of A. L. Winton, chief of laboratory, including a study of methods for the analysis of flour and bread, and the examination of samples of unbleached flour and corresponding samples bleached either at mills by the commercial process or in the laboratory, using different amounts of the bleaching gas.

NEW YORK LABORATORY.

There has been very little opportunity at the New York laboratory for any work outside of the regular routine inspection work. However, the proper conduct of the inspection work has necessitated a certain amount of investigation. This has resulted in the publication of two articles, one entitled "A Method for the Detection of Synthetic Coloring Matter in Butter," by R. W. Cornelison, and one on "The Composition of Known Samples of Paprika, together with a Method for the Detection of Added Oil in Paprika," by R. E. Doolittle, chief of laboratory, and A. W. Ogden.

Considerable work has also been done on the methods for the detection of added polishing and coating materials used in the preparation of rice, and cooperative work has been conducted in connection with the Association of Official Agricultural Chemists on colors, liquors, flavoring extracts, teas, coffees, and medicinal plants and drugs.

A matter of considerable interest in connection with the inspection work has been the detection of the use of fluorids in the preparation of bar-le-ducs imported into this country. A recent shipment of German preserves was found to be preserved with formic acid.

A great number of samples have been vinegars, and certain investigations in connection with the analysis of this product are now under way. Miscellaneous work included the examination of about 750 samples of products for the Panama Railway Commission and resulted in the rejection of a large number of shipments of products intended for this branch of the Government. The laboratory has also analyzed 65 samples of oils, which were submitted for certification for export trade.

ST. PAUL LABORATORY.

Active work on domestic samples in the St. Paul laboratory was commenced about November 1, 1907. With the exception of a small amount of microscopical work, the time previous to that date was spent in the equipment of the laboratory and inspection of imports, an effort being made to cover inspection at the ports of both St. Paul and Minneapolis.

A special investigation of the use of durum wheat in flour milling was made under the direction of A. S. Mitchell, chief of laboratory, with the assistance of Inspector D. M. Walsh. In this connection interviews were obtained with a number of the leading millers and about 47 samples of wheat secured at the mills. The composition of these samples was ascertained as far as possible, and the varieties and their relative amounts determined. This work afforded valuable information regarding the branding of wheat flour.

A special investigation was conducted, in conjunction with the Chicago and Washington laboratories, upon the bleaching of flour. The scope of this investigation covered the prevalence of the procedure, its chemical and physical effect upon the flour, the methods for its detection, and the commercial ethics of the practice. This work necessitated a review and careful study of the methods of grading by physical examination and of practical baking contests. Fully 200 preliminary analyses and trials were necessary before satisfactory methods of examination could be adopted. The final report embodies the results of 1,018 determinations, 775 being chemical and 243 physical.

This investigation also resulted in a number of improvements in the methods of analysis of cereal products, all of which will be placed at the disposal of the referee upon official methods for cereal analysis of the Association of Official Agricultural Chemists. Incidentally, valuable information was obtained regarding wheat and germ oil and the respective iodine numbers of the same.

Research was also conducted with a view to improving and shortening the present methods for the determination of fusel oil in distilled alcoholic liquors. In this connection a study has been made of the oxidation of the various higher alcohols constituent in fusel oil, including amyl, isobutyl, and propyl alcohols and their behavior both in acid and in alkaline media. It is hoped that this work will afford a method by which the oxidation can be performed with speed and thoroughness, effecting a saving of eight hours in time over the usual process and insuring greater reliability in the results. A minor investigation regarding the presence of furfural in natural honey as taken from the comb was also made.

All requests for analysis of food products made by the United States Army Quartermaster, Division of North Dakota, at Fort Snelling, and by the Treasury Department at Minneapolis and St. Paul have met with prompt compliance.

IMPORTANT FOOD INVESTIGATIONS.

Much of the time of the chief of the Division of Foods, W. D. Bigelow, has been consumed with the organization of 15 new branch laboratories, 11 of which were fully installed, with the routine administrative work of the Bureau, and with correspondence concerning the enforcement of the food and drugs act. In addition to the samples included in the report of the Washington food inspection laboratory, in this division, 2,577 samples of a miscellaneous nature were examined. Some of the more important special investigations made, bearing for the most part on problems connected with the administration of the food law, are summarized briefly.

OYSTERS.

A careful study has been made of the composition of oysters with a view to determining the treatment they have received before entering the market. A number of beds in the vicinity of New York were studied and samples of oysters taken from them subjected to the ordinary commercial treatment and modifications thereof. It was found that some dealers and shippers not only subject the oysters to excessive washing, but also add water to them, either directly or in the form of ice. The natural oyster without washing exudes over 30 per cent of liquor, sometimes more than 40 per cent, whereas the washed oyster exudes almost always less than 25 per cent. The unwashed oyster contained more than 18 per cent of solids and less than 0.5 per cent of sodium chlorid, whereas the washed oyster was found to contain less than 16 per cent of solids and less than 0.25 per cent of sodium chlorid.

The beds examined were limited to the vicinity of New York and additional data from other localities should be secured before generalizations can be made. Judging from the data secured, however, a can or package of oysters containing more than 30 per cent of liquor has either received added water or has not been washed or treated with water in any way. If it contains more than 30 per cent of liquor and at the same time less than 18 per cent of solids, or 0.5 per cent of sodium chlorid, it has apparently received an addition of water, either directly or in the form of ice. Considering the superiority of those oysters which have been washed for as short a time as possible and to which neither water nor ice has been added, the desirability of shipping in receptacles in which the ice is not brought in immediate contact with the oysters is at once apparent. These figures, however, must be modified in the case of fresh water oysters.

LEMON OIL.

For about six months the assistant chief of division, E. M. Chace, was detailed to investigate the lemon-oil industry in Sicily, and the entire time of two analysts under his direction is given to the examination of samples so secured. This investigation was called for by difficulties arising in the inspection of imported lemon oils, claims being made regarding the nature of the products which could not be otherwise substantiated.

COMPOSITION OF FRUITS.

Studies relating to the composition of fruit and the changes which take place during ripening have been continued. Studies on the ripening of plums and the identification of the acids in fruits have also been undertaken. In collaboration with the pomologist in charge of Field Investigations in Pomology, Bureau of Plant Industry, a careful study has been made of the composition of California peaches, plums, and pears in connection with pre-cooling and shipping experiments.

In collaboration with the office just mentioned and with the agricultural explorer in charge of Foreign Seed and Plant Introduction, Bureau of Plant Industry, further study was given to a method of ripening persimmons, the process used consisting in exposing the fruit to fumes of alcohol in closed wooden tubs, the natural astringency disappearing while the fruit remains firm.

The study of the preservation of unfermented apple juice has been continued. This work has not been confined to small packages, but has included experiments with samples preserved in glass, tin, and wood, and the preservation of apple juice in barrels was found to be practicable. The packages were opened from time to time and organoleptic tests made.

DISTILLED SPIRITS.

During the year an extensive investigation as to the manufacture and methods of handling distilled spirits was begun, the chief of the Washington food-inspection laboratory visiting most of the large distilleries in this country and making a detailed study of these points. In order to determine the effect of various methods of maturing the spirits, an experimental warehouse has been established in Louisville, Ky., and 60 barrels of whisky have been set aside by various distillers in this country for the experiment. These spirits are kept under different conditions of heat and moisture and samples will be taken year by year to determine the effects of the various methods of treatment.

A study has also been begun on the methods of analysis of distilled spirits, with the result that several improvements have already been made. Special attention has been given to the methods for the determination of fusel oil, with the result that a modification of the present method has been effected, which greatly reduces the time necessary for the determination and gives a much more satisfactory result.

To determine the composition of American whiskies, samples from most of the principal distilleries in this country have been obtained and most of them examined.

ANALYTICAL METHODS AND CHECKING OF INSPECTION SAMPLES.

Much attention has been given to the study of analytical methods for the judgment of the nutritive value and purity of food, and progress has been made in the quantitative determination of salicylic acid and benzoic acid and the determination of tin and other heavy metals in food products.

The Washington food-inspection laboratory, of the Division of Foods, established July 1, 1907, under L. M. Tolman, chief, has for its special work the checking of analytical work of the branch food inspection laboratories, both as to methods and as to results of analyses, and the examination of food-inspection samples taken in the vicinity of Washington under the food and drugs act of June 30, 1906. During the year ending July 1, 1908, considerable work was done in checking the various methods employed at the other inspection laboratories, every effort being made to ensure uniform practices in making analyses and reporting results.

During the year 2,706 samples of imported goods taken at the various port laboratories were reexamined in this laboratory. The total number of domestic samples examined, including 432 samples of distilled spirits and interstate and miscellaneous samples, amounts to 1,562. In addition, all of the interstate samples which are found in the branch laboratories to be adulterated and upon which it is decided to bring prosecution are checked in this laboratory before the final transmission of the cases to the United States Attorney.

A large part of the work of this laboratory consists in preparing cases for the consideration of the Board of Food and Drug Inspection, all of the analytical cards on food samples from the branch laboratories passing through the Washington food-inspection laboratory for examination and the preliminary recommendation of cases for prosecution.

DRUG INSPECTION AND CORRELATED STUDIES.

On January, 1908, the Drug Laboratory was reorganized as the Division of Drugs, L. F. Kebler continuing in charge of the work. The investigations concerned chiefly the composition, purity, adulteration, and misbranding of drugs and chemicals as found on the American markets and shipped in interstate commerce in violation of the food and drugs act. This required a study of the methods of analysis and the correctness of the standards at present official for certain drug products, and investigations of normal products with a view to establishing standards and supplying necessary data upon which to base action.

The collaborative work conducted during the past few years in connection with the United States Pharmacopœia products was continued. Special investigations were also instituted relative to certain medicated soft drinks and the character of ginger and ginger compounds. The keeping qualities of hydrogen peroxid were investigated and a study of the deterioration of certain plant products and preparations derived from the same was also continued. Considerable work was done relative to establishing quantitative and qualitative methods for estimating the constituents present in headache mixtures and other preparations containing habit-forming drugs such as acetanilid, antiphyrin, acetphenitidin or phenacetin, morphin, etc.

During the fiscal year ending June 30, 1908, there were examined in this division 1,787 samples. Of this number 482 were chemical reagents; 568 were imported products; 363 domestic samples; 35 samples of hops, tested for the presence of arsenic; 80 samples of medicated soft drinks; 32 samples of prescription schemes; 29 specimens of "loco" plant products, tested for barium content; and miscellaneous samples covering a wide variety of drugs and miscellaneous drug products, such as rat and roach paste, examined for the Biological Survey of the Department of Agriculture; castor oil pills, and peppermint oil to determine the quality of the oils produced from peppermint plants grown in various sections of the United States.

CHEMICAL REAGENTS.

The chemicals examined were those regularly supplied to the Bureau of Chemistry on contract and requisition to be used in analytical work. All chemical reagents are examined in the Division of Drugs, and supplies sent to the branch laboratories only after they have been analyzed. A marked improvement in quality has been noted, as compared with those delivered five years ago, when the systematic examination of these chemicals was begun. Manufacturers of chemical reagents have manifested a commendable willingness to supply these agents of the quality specified. In a number of cases the chemicals examined during the year were of a very inferior

quality, being contaminated with dirt, insoluble matter, and impurities, which were detrimental to the ultimate success of analytical work. In the past it was common to receive a mixture of uranium and sodium acetate when uranium acetate was ordered, but this adulteration was not found during the last year.

DOMESTIC DRUGS—OFFICIAL AND UNOFFICIAL SAMPLES.

By "official samples" of drug products are meant those which have been collected in accordance with the regulations prescribed under the food and drugs act; those designated as "unofficial" are samples collected for information and study, the data obtained forming a basis for future action.

The Division of Drugs indexed during the last year 1,714 domestic drug products, of which number 1,525 were official and 189 unofficial; 363 official and 105 unofficial samples have been analyzed. Of the official samples analyzed 40 were found to be either adulterated or misbranded, in the meaning of the food and drugs act; cases based upon four of these have been adjudicated in the courts, the fines imposed varying from \$10 to \$700, the cases dealing with the following products: "Cuforhedake, Brain Food," "Sartoin Skin Food," "Liquid Sulphur," and the illegal sale of cocain in the District of Columbia. The remaining cases have been certified for prosecution and are either in the hands of the proper United States District Attorneys or are ready to be forwarded to the Attorney-General of the United States for action. A number of drug products were also seized in libel proceedings for condemnation, it being found that they were either adulterated or misbranded in the meaning of the law, and these cases are still pending in the courts.

IMPORTED DRUGS.

The examination of 568 samples of imported drug products included chemical analyses, verification of the results reported by the various branch laboratories, and examination of samples submitted by different laboratories of which no analyses had been made. In many cases it was also necessary to investigate the nature of the claims and representations made for certain products.

Many adulterated and misbranded products were consigned for importation. Some of the typical forms of adulterations found were as follows:

(1) Ground dandelion root adulterated with from 20 to 40 per cent of sand and small pebbles having an appearance and color approximating the color and size of the ground drug.

(2) Powdered licorice root adulterated with fine sand to the extent of 25 per cent.

(3) A number of importations marked "Sarsaparilla root" were found on examination to consist of the rhizomes, the roots having been removed and the rhizomes repacked and shipped to the United States. The Pharmacopœia distinctly directs that these rhizomes be eliminated before the product is used in the manufacture of medicinal agents.

(4) Asafetida containing from 9 to less than 50 per cent of alcohol-soluble material was frequently offered, and in a number of cases the

article containing the higher per cent of alcohol-soluble material was allowed to enter without prejudice to future decisions. The organic matter present in these asafetidas amounted to as much as 80 per cent in some cases.

(5) Belladonna root highly adulterated with pokeroot was a common article offered for importation. As a rule, the content of alkaloid was low in proportion to the degree of adulteration.

(6) Calendula flowers colored with saffron were offered on several occasions under the name of "feminelle." These importations of feminelle were brought in separately because it was well known that saffron adulterated with this product could not enter, although the object of their importation was to adulterate saffron after the article had passed the custom-house.

(7) In many cases the labels on the package or the circular accompanying the importations contained false or misleading statements. Conspicuous among these was Haarlem oil, the circulars accompanying these importations in the past containing misrepresentations of the worst character. The old circulars have, however, been largely discarded and modified statements are now made. Other preparations of the "cure" type containing false and misleading statements were forbidden entry because of the unwarranted claims.

In some cases when it is found that drug products are adulterated an attempt is made to secure permission to relabel, and one of the common expedients resorted to is to ask the privilege of relabeling "for technical use," the object being solely to secure the entry of the consignment that the dealer may dispose of it as he sees fit. It should be stated, however, that as a rule the leading importers have made every possible effort and shown every desire to import goods of a high quality, conforming with the provisions of the food and drugs act.

MEDICATED SOFT DRINKS.

Approximately, 80 samples of these products have been examined. The investigation was undertaken for the purpose of ascertaining the nature and character of the beverages sold principally at soda fountains, and special attention was given to the detection and estimation of caffeine, cocain, and coloring matter. A complete analysis has been made in every case, not only to determine the composition of the product, but also to ascertain whether the ingredients claimed to be present were actually used in preparing the drinks. With few exceptions, all contain caffeine added as such. In fact, the caffeine is rarely introduced by using an extract of the plant or article containing the caffeine in natural combination. Cocain was also found to be present in a large number, and many were artificially colored with coal-tar dyes and agents derived from vegetable and animal sources. The caffeine present in an ounce of medicated soft-drink sirups, the quantity usually entering into a glass of the drink, varied from a trace to 1.2 grains. A considerable number of the medicated soft drinks were free from cocain; and when its presence was established the amount varied from a trace to 0.05 grain to the ounce, the average amount used in preparing a glass of the beverage. Fifty-four cups of tea and coffee, as served at representative hotels, cafés, and restaurants of Washington, were collected and analyzed for the purpose of ascertaining the quantity of caffeine present and comparing

it with the amounts contained in the medicated soft drinks. The average amount of caffeine per cup of coffee was 2.2 grains, varying from 1.55 grains to 3.74 grains. The average content of caffeine per cup of tea was 0.98 grain, varying from 0.31 grain to 2.15 grains. An interesting point brought out is that the tea and coffee served at the better-class hotels as a rule contain the greater per cent of caffeine.

TINCTURE AND ESSENCE OF GINGER.

When this investigation was instituted there were not sufficient data available to indicate what constitutes a normal tincture of ginger, neither was it possible to determine from analysis the amount of active material that should be present in an essence made in accordance with the standards promulgated in Circular 19 of the Office of the Secretary. It was therefore decided to purchase a considerable number of representative tinctures of ginger and to manufacture several from the various gingers known in commerce, using various strengths of alcohol. These gingers were carefully analyzed to determine their physical and chemical constants for future use. It was found that the tinctures of ginger as supplied by the best manufacturers were fairly uniform in composition and agreed closely with those manufactured in the Division of Drugs in accordance with the directions prescribed by the United States Pharmacopœia, but, on the other hand, the majority of the essences usually supplied were of an inferior quality, and did not correspond with the standard promulgated.

In the past it has been a very common practice to use capsicum to fortify ginger products, and an investigation was made to determine whether it is possible to detect capsicum under such conditions. A considerable number of authentic specimens of different varieties were collected and studied, with the result that a method has been solved which appears to give satisfactory results for the detection of this adulterant.

GLYCERIN.

Fourteen samples of glycerin were examined during the year, constituting a continuation of the work begun during the preceding fiscal year for the purpose of determining whether or not the goods supplied on the market are contaminated with arsenic or other objectionable agents, and also whether or not the United States Pharmacopœia standard, Eighth Revision, was satisfactory. It was found that the glycerins supplied were of a good grade, but very few were found to comply in every detail with the Pharmacopœia standard. Several contained traces of arsenic, and the presence of foreign odoriferous products was established in the case of a large majority of the samples tested.

HOPS.

Thirty-five samples of hops were examined at the request of the Bureau of Plant Industry for the purpose of ascertaining to what extent they were contaminated with arsenic and whether such contamination is sufficient to render them unfit for use in the preparation of food products. The amounts of arsenic found in the samples submitted vary from a trace to 2,500 parts per million.

HYDROGEN PEROXID.

A study of hydrogen was undertaken primarily for the purpose of ascertaining whether or not a deterioration or marked loss takes place on standing, and, if so, to what extent. The conditions were such as would ordinarily obtain, or should obtain, in the average drug store, and the 91 samples used have been under observation for nine months, the intention being to hold them one year. It was found that most of the brands of hydrogen peroxid supplied contained acetanilid. This chemical is added with the belief that it inhibits the deterioration of the product. While the investigation is not as yet complete, the results at this time indicate that the changes on standing are not very rapid and it is doubtful if the presence of acetanilid materially retards such deterioration.

" LOCO " PLANTS.

Twenty-nine samples of " loco " plants were examined at the request of the Bureau of Plant Industry for the purpose of ascertaining whether barium were present, and, if so, to what extent, the object of the investigation being to determine the cause of the disease known to stock raisers as " loco." The barium content of the ash of the samples examined varied from nothing to 0.124 per cent.

PRESCRIPTION SCHEMES.

Since the passage of the food and drugs act there has been placed on the market a line of preparations the advertisements of which embody a prescription; that is, in the advertisement will be found a prescription which contains several well-known remedies, together with a product under a coined name, and in order to secure the remedy it is necessary for the patient to purchase a certain amount of this product. For the purpose of securing some data relative to the medicinal value of these drugs it was decided to make an investigation and compare the actual virtues of the remedies with those claimed for them by their promoters. The patient is frequently led to infer from the advertiser's claims that the products sold under coined names are new to the pharmaceutical and medical professions. Examination, however, invariably reveals the fact that the product exploited is nothing but a well-known drug or a mixture of well-known drugs, and the claims made relative to the virtues of the supposedly new remedy are, as a rule, exaggerated and misleading. In many cases it is stated that the remedy is a panacea for consumption, when, as a matter of fact, the medicine does not contain any agent or combination of agents which could be looked upon as possessing any curative properties for tuberculosis. Such remedies are plainly fraudulent and harmful in that the purchaser is led to use them and thus lose valuable time which could be employed to advantage by resorting to the open-air and proper-diet treatment in combating this disease.

COUNCIL OF PHARMACY AND CHEMISTRY OF THE AMERICAN MEDICAL ASSOCIATION.

The work in cooperation with the council has been continued during the last fiscal year, and while only a limited amount of time could be given to it, several investigations were made, the results of which were published in the Journal of the American Medical Association, under the general heading of Pharmacology, and a number of frauds were exposed. Several preparations advertised to possess marvelous digestive properties due to the presence of special enzymes were found to be practically devoid of any action whatever. Another preparation claimed the presence of a bile acid which an examination failed to reveal.

COOPERATION WITH POST-OFFICE DEPARTMENT.

During the year the Division of Drugs made analyses of five medical "cures" sent through the mails and submitted by the Post-Office Department. This investigation required not only the analyses of the agents used in the treatment of the disease, but also an inquiry into the nature and truthfulness of the representations, claims, and promises accompanying the remedies. In most cases the treatment included several agents, and as many as seven have been examined constituting one treatment. These examinations during the past year consisted of consumption cures, tobacco habit cures, and epilepsy cures. In most cases these remedies consisted of mixtures of ordinary medical agents which are useful but can not in any case be considered as cures for the disease specified.

CHEMICAL STUDIES OF SUGAR-BEARING PLANTS.

The total number of samples analyzed in the Sugar Laboratory during the last fiscal year was 1,284. Samples analyzed in the field by members of this laboratory engaged in the sweet-corn investigations are not included.

The distribution of work upon these samples, indicating the scope of the laboratory, was as follows:

Cereal products (barley, malt, etc.) for Vegetable Physiological Laboratory	157
Sirups (soda fountain) for Drug Laboratory	137
Malt extracts for same laboratory	7
Wines and brandies for same laboratory	6
Honey for complete analysis (honey investigation)	26
Honey collected in execution of food law	11
Molasses collected in execution of food law	13
Other samples of molasses and sugars	30
Maple sirup collected in execution of food law	34
Miscellaneous sirups (cane, glucose, etc.)	14
Sugar beets	285
Sugar cane and sorghum	11
Liquors from cans of peas	84
Miscellaneous products (potatoes, watermelons, cantaloupes, corn, and cornstalks)	25
Cane molasses and sirup for sulphur dioxide determination in New Orleans, La	408
Dextrins, starches, and glucose for the Bureau of Engraving and Printing	27
Miscellaneous	9
Total	1,284

The main lines of investigation conducted in the Sugar Laboratory by A. H. Bryan, in charge, are as follows:

(1) Effect of environment upon the sugar content of Indian sweet corn (under the supervision of the Chief of the Bureau).

(2) Referee work upon methods of sugar analysis, Association of Official Agricultural Chemists.

(3) Study of methods for the detection of adulteration in honey.

(4) Investigations of various raw materials for use in alcohol production (corncobs, stalks, and shucks; watermelons, cantaloupes, molasses).

(5) Investigation of commercial malt and diastatic preparations.

(6) Investigations of methods of analysis for maple products and their valuation.

(7) Investigations into the sulphur-dioxid content of Louisiana cane molasses and sirup. This work was done in collaboration with the Division of Foods.

(8) Investigations of the sugar content of soda-fountain sirups, in connection with Division of Drugs.

(9) Investigations of the sugar content of barley and malts in connection with the investigations in vegetable physiology.

DAIRY PRODUCTS.

The principal lines of work conducted in the Dairy Laboratory, of which G. E. Patrick is chief, have been as follows:

(1) Analysis of dairy products, including renovated butter, for the Dairy Division of the Bureau of Animal Industry, as in previous years.

(2) Continuation of the analysis of milk, cream, and ice cream sold in the District of Columbia. Report of this work, as it relates to the cream and ice cream, has been published in Bulletin 41 of the Hygienic Laboratory, Public Health and Marine-Hospital Service, Treasury Department.

(3) Analysis of condensed milks sold in the United States, with a study of the question of standards for unsweetened condensed milk.

(4) Studies of methods for the analysis of condensed milks and ice creams, a report upon some of which has been submitted for publication in Bulletin 116 of this Bureau (Proceedings of the Association of Official Agricultural Chemists for 1907).

(5) The analysis of import samples of dairy products taken at the ports of entry and of domestic samples purchased throughout the country by the inspectors under the food and drugs act. Of the import samples examined the greater part have been of the various European cheeses, while the domestic products examined have been mainly interstate samples of milk, condensed milk, and cheese. As a result of the work upon the import goods many shipments of European cheeses have been required to be relabeled—false or misleading labels being replaced by truthful ones—before entering our commerce, and some were found to be so plainly fraudulent as to be entirely denied entrance to the country. It can be positively stated that as a direct result of this work there is a marked improvement in the quality of some of the imported cheeses, as well as in the truthfulness of the labels on this class of goods in general.

As regards the domestic (interstate) samples, their examination has led to a considerable number of prosecutions, in which the trials are now pending. Most of these are cases of adulterated milk.

The total number of samples examined during the year was 588, of which 87 were for the Dairy Division of the Bureau of Animal Industry, 107 were milk and ice cream samples collected in the District of Columbia, 66 were samples of condensed milk from all parts of the country, 50 were import samples from the various ports of entry, 148 were inspectors' samples from interstate commerce, and the balance were miscellaneous samples, including those used in the study of analytical methods.

WORK OF THE MISCELLANEOUS LABORATORY.

During the fiscal year 1,366 samples were examined in the Miscellaneous Laboratory under the direction of J. K. Haywood. Some of these analyses were made as a part of the research work conducted by this laboratory, the results of which either have been published or are being collated and studied for that purpose. Many of the analyses have been made for other laboratories of this Bureau and for the several Bureaus and Divisions of this Department and for other Departments of the Government.

In addition to the experimental and research work much time has been given to the consideration of the correspondence and problems incident to the proper enforcement of that portion of the food and drugs act which applies to waters and foods and remedies for cattle and poultry.

The work of the laboratory is organized under six distinct sections with a specially trained man in charge of each section. These subdivisions are as follows: (1) Waters; (2) cattle foods and grains; (3) insecticides, fungicides, and weed killers; (4) trade wastes; (5) hygienic investigations; (6) miscellaneous.

WATERS.

The water section has examined during the year 85 samples of mineral water. This work, organized on a comprehensive plan in 1902 for the examination of the more important mineral springs of the United States, being continued for the purpose of securing reliable data for the proper enforcement of the food and drugs act. Fifteen samples of bottled mineral and table waters found upon the market have been submitted to analysis, and as a result two prosecutions have been recommended for violation of the misbranding clause of the food law. Twenty-six samples of water were examined for sanitary purposes, 6 for technical purposes, and 4 for irrigating purposes.

In addition to the routine work considerable time has been devoted to research work, looking to the improvement of methods of analysis, particularly with reference to the determination of small amounts of lithium by a spectroscopic method.

CATTLE FOOD AND GRAIN INVESTIGATIONS.

This section has examined during the year 907 samples. Two hundred and thirty of these were commercial feeds, obtained by inspectors on the market, and were examined to determine their com-

pliance with the provisions of the food and drugs act. Fifty samples were found adulterated, or misbranded, and prosecution under said act has been recommended to the Board of Food and Drug Inspection.

In cooperation with the office of Grain Investigations of the Bureau of Plant Industry, 240 samples have been analyzed, as follows: Wheat 61, oats 30, barley 31, rye 8, emmer 6, buckwheat 3. This is a continuation of the investigations begun in 1902 for the purpose of studying the composition and comparative value of new or introduced varieties of cereals for making bread, cereal foods, macaroni, etc., for feeding stock, and for other uses.

In cooperation with the office of Farm Management analyses were made of 210 samples of grasses and forage crops from the arid and semiarid regions for the purpose of studying their relative feeding value. Analyses were also made of 27 samples of corn, 100 samples of potatoes, 71 samples of cassava, and 29 of miscellaneous materials.

In cooperation with the Chicago and St. Paul laboratories baking investigations were conducted to determine the effect of bleaching upon the quality of flour, 52 samples being examined.

Twenty-two samples of miscellaneous feeds were analyzed to determine the variation due to several different methods of sampling.

INSECTICIDES AND FUNGICIDES.

The work of this section during the year has consisted of the analysis of insecticides, fungicides, and weed killers to the number of 108. The majority of these examinations were made at the request of the Bureaus of Entomology and Plant Industry.

Field studies of the action on foliage of lead arsenate and impurities which it contains, in collaboration with the Bureau of Entomology, mentioned in last year's report, have been continued, and the investigation is nearing completion.

Samples of all the brands of lead arsenate that could be found on the American market were collected by the Bureau of Entomology and complete analyses of them have been made. Numerous samples of the chemicals used in the manufacture of lead arsenate were also collected, and analyses of these materials were made for the purpose of determining whether it is practicable to give the orchardist directions for preparing advantageously at home lead arsenate for spraying purposes. This study is practically completed as far as the analytical work is concerned and the results are being collated.

A study of the composition of "self-boiled" lime-sulphur wash was made for the Bureau of Plant Industry. The effect of mixing lead arsenate and lime-sulphur wash, and Paris green and lime-sulphur wash for spraying purposes was also studied at the request of the Bureau of Plant Industry, and some experiments are being conducted on the treatment of binder twine with various materials for the purpose of repelling grasshoppers and other insects which destroy the twine.

Considerable time is given to the study of the methods of analysis of insecticides, in cooperation with the Association of Official Agricultural Chemists.

TRADE WASTES.

This section during the year has examined 109 samples. The investigation of the injury to vegetation by smelter fumes near Duck-

town, Tenn., has been continued and part of the results collated and published. The investigation at New Anaconda, Mont., of the injury to animal and vegetable life caused by wastes from smelters and mines has been continued and a preliminary report of the work has been made. Research work, both laboratory and field, has been continued to determine the effect of sulphur dioxide on forests and farm crops, and studies are in progress to determine the effect produced on plants by copper, arsenic, and other trade wastes.

A large part of this work is being performed at the request of the Department of Justice and in cooperation with the Forest Service.

HYGIENIC AND MISCELLANEOUS WORK.

The hygienic work includes investigations relating to the public health, i. e., the examination of wall papers and fabrics for poisonous or deleterious materials, the examination of poisons and poisonous substances in common use, the composition of the atmosphere of schools, public buildings, railroad cars, etc. The work of the miscellaneous section includes investigations of an official and public nature which may be properly made by this Bureau and which are not provided for in other established laboratories. About 100 samples have been examined during the year.

EXAMINATION OF CONTRACT SUPPLIES.

The sample book of the Contracts Laboratory shows 1,238 samples entered for the past fiscal year. This, however, does not really indicate the total number of samples examined, as frequently a large number of examinations are made under one entry. For instance, the 288 numbers assigned to apparatus purchased for the Bureau of Chemistry and examined in this laboratory represent the examination of 5,137 pieces of apparatus. By far the largest amount of work done was for other Departments, as the following summary will show:

	Number of samples.
War Department	96
Navy Department.....	1
Interior Department.....	13
Post-Office Department.....	16
Treasury Department (Bureau of Engraving and Printing).....	570
Department of Agriculture (exclusive of Bureau of Chemistry).....	18
District of Columbia.....	6
Government Printing Office.....	12
Isthmian Canal Commission.....	82
Bureau of Chemistry (5,137 pieces of apparatus).....	288
Miscellaneous	136

The character of substances analyzed was widely varied, including pigments, oils, paints, varnishes, glue, glycerin, ink, typewriter ribbons, carbon papers, inking pads, soap, disinfectants, steel, alloys, and numerous other substances. In the report for the fiscal year ending June 30, 1907, it was stated that an important part of the work had been the examination of supplies for the Bureau of Engraving and Printing; 50 per cent more work has been done for the Bureau of Engraving and Printing during the year just past. Another very important line of new work is the examination of supplies for the

Isthmian Canal Commission, which did not begin until April 23, 1908, 82 samples having been received since that date.

Owing to the large number and varied character of the samples examined for other Departments, it has not been possible to devote more than a small fraction of the time to investigation work, though considerable progress has been made on the study of paints and paint materials, and Bulletin 109, giving some technical methods of testing miscellaneous supplies, principally paints and pigments, has been issued by Percy H. Walker, chief of this laboratory. Much more work has been necessary in examining the supplies bought by the Bureau of Chemistry than was done in the year preceding.

INVESTIGATIONS CONDUCTED BY THE LEATHER AND PAPER LABORATORY.

The number and character of samples received in the Leather and Paper Laboratory during the year are given in the following table:

Paper and paper-making materials.....	2,463
Leather and leather-making materials.....	31
Turpentine, tars, oils, and wood products.....	91
Miscellaneous.....	47
Total	2,632

TANNING MATERIALS.

The investigation of Sicilian sumacs, which was extended to cover the examination of more recent importations, has been concluded and a report on the subject by F. P. Veitch, chief of laboratory, is now in press (Bulletin 117). The former conclusion that, though the Italian laws forbid the exportation of unmarked adulterated sumac, large quantities of the adulterated material are exported to this country is confirmed, so that it is advisable for all purchasers of sumac who desire a pure article to have consignments examined before accepting them. A number of miscellaneous native tanning materials have been examined during the year, but nothing has been discovered that promises to be of commercial importance.

LEATHERS.

The investigations on leather begun last year are still in progress, and the difficulties encountered in the lack of suitable methods of analysis and testing have been successfully met. This work has been further hampered by lack of sufficient force to handle it satisfactorily, but it can now be developed rapidly.

PAPERS.

The testing work for other Departments of the Government has been continued and has embraced all kinds of papers. In addition to the regular testing of supplies the laboratory has made, at the request of the Post-Office Department, a careful test of the kind and proportions of material used in the stamped envelopes at the mill making this paper, and is also testing the deliveries of paper at the stamped-envelope agency. In addition to checking and testing all deliveries

of stamped envelope and postal card papers for the Post-Office Department, the laboratory tests all deliveries of paper to the Government Printing Office, contract samples for the Bureau of Engraving and Printing, and many samples for other Departments of the Government. This testing work has required at times the entire time of the laboratory force and employs three men continually.

A number of samples of new paper-making materials have been examined, with negative results from the industrial viewpoint. The work of the laboratory during the last five years has emphatically demonstrated the fact that the papers now made in this country are of lower quality and are much thicker and heavier than they should be. The practical result of this fact is that the purchasers, of whom the Government is the largest individual buyer, get more paper of inferior quality than is required for their purposes, at a total greater cost, and at a greater expense for transportation, storage, and handling than is necessary, and furthermore the raw materials for paper making in this country are being consumed unwarrantably. The laboratory is now engaged in the preparation of specifications for papers suitable for various purposes the general adoption of which it is estimated will result in a saving of from 10 to 50 per cent of the weight of paper now consumed, without sacrificing the interests of the public, and will at the same time conserve largely the raw materials involved, notably wood, which is the principal substance employed.

TURPENTINES.

The work on wood turpentine has been continued, with especial reference to the improvement of the product as found on the market, in order that it may be adapted for use as a paint and varnish thinner. The tests of commercial wood turpentine as a paint and varnish thinner begun last year have been concluded, and the results will be published as soon as practicable. All turpentine and tars purchased by the Isthmian Canal Commission are referred to this laboratory for examination and constitute an important item.

MISCELLANEOUS WORK.

Work on the distillation of wood has been continued as time permitted, but owing to insufficient force the work has not advanced sufficiently to justify any conclusions.

A number of miscellaneous samples, including fertilizers, peats, and other industrial materials, have been examined during the year for other Bureaus of this Department and for other Departments. The work of the Association of Official Agricultural Chemists and the American Leather Chemists on tanning materials and fertilizers has been shared, and much time has been given to the improvements of the methods of analysis. Important improvements have been made in the methods for examining leather, papers, and turpentine. At the request of the American Chemical Society the laboratory is engaged, with others, in an effort to devise an accurate and suitable method for determining iron and alumina in phosphate rock, a problem of great moment to the fertilizer industry.

MICROCHEMICAL INVESTIGATIONS.

The work of the Microchemical Laboratory, under B. J. Howard, has been conducted along the lines followed in former years, but has increased greatly in volume, and additional assistants have been appointed. Much work has been done in collaboration with the other laboratories and divisions of the Bureau and Department, and other branches of the Government service. The greater part of the work, however, has been done in connection with the enforcement of the food law. For example, spices, including mace, paprika, nutmegs, coriander, caraway, mustards, and peppers, have been examined, 400 samples of peppers alone having been subjected to a microscopical analysis to determine their purity. Among other food products examined were flours—rye flour for detection of wheat or other adulteration, and buckwheat for the detection of foreign products such as wheat and corn products. A considerable number of coffees were analyzed, including the green, roasted, and ground products and various coffee substitutes. Honeys were examined to determine whether they were made from the flowers indicated on the label. Rices were tested for the presence of extraneous materials, such as talc, and coloring matter, such as ultramarine blue.

Lines of food research have included a study of methods for detecting eggs which have been kept in cold storage and are sometimes sold as fresh eggs; a study of pollens from flowers visited by bees in the collection of honey, for the purpose of identifying the floral source of such products when sold in the market; and the examination of several members of the composite and mustard families used as drugs or foods or as adulterants of such products, for the purpose of establishing histological characteristics for their identification.

More attention has been given than formerly to microscopical methods for the determination of the purity of drugs. Among those examined during the year were saffron, sarsaparilla, matico, cannabis indica, coto bark, simaruba, calendula, cumin seed, anise (both the ordinary and star varieties), belladonna root, belladonna leaves, poke root, rhubarb, stramonium leaf, hyoscyamus, gentian, and others. A considerable number of prepared drugs have been examined in collaboration with the Division of Drugs in the enforcement of the food and drugs act and for the Post-Office Department in connection with fraud-order cases.

The need of microchemical methods of identifying many of the alkaloids has arisen in the drug work, and investigations have been carried on with more than forty such bodies. The results thus far obtained indicate that when this work is completed material aid may be given by the microscope in establishing the identity as well as the presence of the members of this interesting group of bodies in drugs and medicines.

Among the inorganic products examined, paints and paint pigments have constituted the largest group, since the microscopical method can be applied in the identification of many of these products. For branches of the Government outside the Department of Agriculture the largest service has been rendered in the examination of papers for the Government Printing Office and the Post-Office Department, for whom over 2,000 samples have been examined. The

routine examinations conducted by the laboratory constitute the bulk of work performed and make it rather difficult to carry on research work, but a certain amount is necessary in order to solve new problems of a practical nature which are constantly arising in the analysis of various products.

NITROGEN DETERMINATIONS.

Approximately, 8,750 nitrogen determinations have been made in the Nitrogen Section, in charge of T. C. Trescot, during the last fiscal year, two chemists and a laboratory helper being engaged in the work. The more important samples include those representing the effect of environment on the composition of wheat, received from the section of Vegetable Physiological Chemistry; the excreta analyzed for nitrogen in connection with the experimental table, referred from the section of Animal Physiological Chemistry; the cattle foods, examined primarily in the Miscellaneous Laboratory, although the prosecutions under the food and drugs act are based chiefly on the protein content; and a large number of dairy products, especially cheeses, referred from the Dairy Laboratory, which are also examined in connection with the enforcement of the food law. In the majority of cases only two determinations are made on each sample, although on quite a number, notably the wheats, as many as seven or eight determinations of nitrogen in its various forms are made.

Research work looking to the improvement of the methods for the determination of nitrogen is conducted in cooperation with the Association of Official Agricultural Chemists, the studies of the last year having been devoted especially to the determination of nitrates, with particular reference to fertilizer analysis.

SPECIAL INVESTIGATIONS.

ANIMAL PHYSIOLOGICAL CHEMISTRY.

The laboratory of Animal Physiological Chemistry, in charge of F. C. Weber, as in previous years, has been charged with the conduct of the hygienic table for the study of the influence of preservatives and colors on health and digestion, and the control of the analytical work attendant on the investigation, practically all of which is now performed in this section. The results obtained on the preservatives so far studied have all been compiled and submitted for publication; the reports relating to sulphurous acid and benzoic acid have been issued, and those on formaldehyde, copper sulphate, and potassium nitrate await publication. Several minor investigations for the further study and elucidation of problems arising in connection with this work were completed, among which may be mentioned the working out of a method for the estimation of hippuric acid in the urine, and another for the determination of the acidity of very dilute solutions.

The first series of experiments to determine the effect produced by coca cola on human subjects was completed, and the results are being compiled.

An important study of commercial meat extracts and similar preparations was completed and the results submitted for publication as

Bulletin 114. The chemical work on the effect of cold storage of meats, chickens, quail, and eggs was performed in this laboratory, and the results, extending over a period of two years, have been compiled and submitted as a preliminary report on the subject.

A study of the metabolism of organic and inorganic phosphorus was conducted by feeding these substances to rabbits, and comparative analytical studies were made throughout, as well as a detailed post-mortem examination.

A great deal of work on the study and adaptation of methods was done in connection with the conduct of the food investigations, some of which is not yet completed. Among other miscellaneous studies of this nature may be mentioned one on enzymes resulting in two valuable communications to scientific journals entitled "The Inversion of Cane Sugar by Invertase."

In the prosecution of these investigations 450 samples were examined, representing approximately 900 determinations.

VEGETABLE PHYSIOLOGICAL CHEMISTRY.

The work of the section of Vegetable Physiological Chemistry, in charge of J. A. Le Clerc, is done mostly in collaboration with the various divisions of the Bureau of Plant Industry, principally those concerned with Grain Investigations, Grain Standardization, Dry Land Agriculture, and Seed and Plant Introduction.

During the last year more than 9,000 determinations of the various constituents of cereals and other plants were made in carrying on this collaborative work, covering the analysis of 850 samples. Some of the results obtained show that the white spots so common in wheats during certain years are generally produced by excessive moisture during the growing period. The "triangular" experiments, mentioned in previous reports, show that the climatic conditions have a greater influence upon the composition of grains than have the original composition of seed, time of planting, soil, or other conditions; other investigations show that a large proportion of every plant-food constituent is removed from the growing plant by rainfall, thus affecting most experiments wherein the composition of the final crop is considered in drawing conclusions. The work on American barleys and malts has been continued. The results so far obtained show that the differences in climatic conditions in this country are such that barleys of the highest valuation can be grown either for malting or for feeding, depending upon the locality.

BACTERIOLOGICAL-CHEMICAL INVESTIGATIONS.

WASHINGTON LABORATORY.

The work of the Washington Bacteriological-Chemical Laboratory, in charge of G. W. Stiles, jr., consisted of the partial identification and classification of more than 500 different organisms isolated in pure culture from various sources; the testing of the germicidal, antiseptic, and preservative value of a number of chemical substances; the regular bacteriological investigations of cold-storage beef, ducks, eggs, fish, fowl, and quail; a study of the bacterial content of swelled and unswelled cans of condensed and evaporated milk; bacteriological examinations of waters from many sources (wells, springs,

city hydrants, and water coolers) subjected to various treatments (bottled, filtered, distilled, and carbonated).

Examinations were also made of telephone receivers and of cracked dishes from public restaurants. A number of hotels, cafés, lunch counters, milk depots, ice-cream factories, surgical-dressing factories, bakeries, cold-storage plants, boats, abattoirs, etc., were inspected with reference to the sanitary conditions of their ice boxes, refrigerators, and kitchens and the methods employed in handling food products. An important investigation was begun on the bacteriological condition of waters, oysters, and clams from sources subject to sewage contamination. Part of the work on milk, cream, and ice cream has been published by the Marine-Hospital Service.

Work has been done in collaboration with the Division of Foods, Division of Drugs, Miscellaneous Division, and the Dairy, Contracts, Microchemical, Sugar, and Animal Physiology laboratories. For the latter a number of differential leucocyte counts of blood were made.

The samples examined were as follows:

	Number of samples.
Beef, fresh and cold storage.....	9
Blood, differential leucocyte counts.....	99
Clams, samples.....	6
Cultures, identification and classification.....	517
Dishes, cracked.....	24
Disinfectants, antiseptics, preservatives, germicidal value.....	55
Ducks, fresh.....	4
Eggs, fresh and cold storage.....	8
Fish, fresh (bass, shad, perch, mackerel).....	8
Fowl:	
Cold storage, drawn.....	2
Cold storage, undrawn.....	2
Fresh.....	2
Ice.....	4
Ice cream.....	112
Milk and cream.....	22
Condensed.....	113
Evaporated.....	76
Miscellaneous.....	19
Oysters, samples.....	26
Quail:	
Cold storage, drawn.....	2
Cold storage, undrawn.....	2
Fresh.....	2
Surgical dressings, gauze, ligatures, etc.....	46
Telephone receivers.....	18
Water:	
City hydrant.....	19
Miscellaneous.....	46
Sea.....	44
Spring, bottled.....	64
Spring, at source.....	51
Well.....	99
Total.....	894

PHILADELPHIA OFFICE, FOOD RESEARCH.

In this laboratory, under the direction of M. E. Pennington, the investigations have related chiefly to the changes undergone by flesh foods, including milk, when preserved by low temperatures. Some of the results obtained during the study of milk when cold stored were published in the *Journal of Biological Chemistry* for 1903. It

consisted of the examination of various grades of milk, from the purest product obtainable by scientific methods of dairying to the market milk of cities, to determine the kind and extent of the chemical changes taking place during varying periods of storage at 0° or a few degrees below 0° C. Bacterial growth, a factor of such vast importance from the viewpoint of sanitary milk, was also studied, with the astonishing result that it was possible to demonstrate the increase of organisms from a few hundreds per cubic centimeter to billions per cubic centimeter during a period of from four to six weeks, even though the temperature (-1.2° C.) was sufficiently low to cause the formation of a mass of ice crystals which rendered the milk an almost solid mass. Chemical analysis, more especially of the proteins, determining casein, albumin, albumose, peptone, and amido acids, showed that an extensive protein degeneration always took place, sometimes one-half of the casein being changed to lower forms. Corresponding studies made of milk kept at room temperatures show a totally different condition both chemically and bacterially.

The work done on the changes observed in cold-stored chickens has been embodied in Bulletin 115 of the Bureau of Chemistry, and also in a communication sent from the Bureau of Chemistry to the First International Congress of Refrigerating Industries, to be held in Paris during October, 1908, and in an article in the Yearbook of the Department of Agriculture for 1907. The latter article deals with the appearance of fresh and cold-stored chickens, recording for general information, more especially for the housewife, the differences between the two and showing the effects of long periods of storage (a maximum of three years) on the color, texture, and odor of the skin, muscles, and viscera. The investigations which led to this article dealt with chickens prepared and stored for market purposes and purchased from reputable dealers. They were examined chemically, bacteriologically, and histologically, the three examinations being made simultaneously on each bird, or lot of birds, that the information gathered from the three lines of investigation might be correlated. Chemical analyses were made of the light and dark meat separately, determining not only the ash, water, solids, and total nitrogen, but also the distribution of the nitrogen among the various classes of proteins—coagulable proteins, albumoses, peptones, etc.—since it is in this distribution that the effects of long-continued preservation by cold are probably to be found. The analysis of the fat was also made, and the chemical findings abundantly confirm the usual statement that the taste of the fat of cold-stored chickens is much altered. The bacteriological examination showed that organisms were present in the flesh of cold-stored chickens even after four years of hard freezing, and their numbers varied greatly. Growth was prompt, showing that their vitality was not greatly altered. The microscope has been found to be a most valuable aid to the study of cold-stored chickens in that, with proper histological methods of preparation, marked and characteristic changes of the muscle fibers can be demonstrated. In all of this work it has been found necessary to study fresh chickens exactly as the cold-stored fowls are studied, thereby furnishing valuable comparative data concerning one of the most important foods.

Up to the present time the publications from the Philadelphia Food Research Laboratory relating to cold-stored chickens have dealt al-

most exclusively with chickens of market quality. There are under way, however, experiments to determine the changes taking place in fowls of a known history and kept under the most favorable storage conditions. Experiments are also in progress to determine the temperature at which organisms reproduce when in their natural environment. Another far-reaching study, which has been under way for a number of months, relates to the penetration of the flesh by bacteria, especially those of the alimentary canal, and the relative keeping qualities of drawn and undrawn poultry.

It is believed that only by the coincident study of each sample or experiment from the three points of view, chemical, histological, and bacteriological, with, as far as possible, a correlation of the three lines of information so obtained, will it be possible to define and interpret the changes incident to the decomposition and putridity of foods.

Since this bacteriological-chemical laboratory at Philadelphia is occupied exclusively with research, the statement of the number of samples examined gives no adequate idea of the actual amount of work done, each sample representing seven or eight determinations. All analyses were made in duplicate or triplicate, and in many cases, especially where chickens were involved, the flesh of a number of birds constituted a sample.

	Number of samples.
Chemical analyses of milk.....	37
Bacteriological examinations of milk.....	37
Chemical analyses of chickens (light meat, dark meat, and fat).....	53
Bacteriological examinations of chicken flesh.....	101
Histological examinations of chicken flesh.....	107
Bacteriological examinations of fish.....	2
Various experiments with condensed milks, involving both chemical and bacteriological work.....	13
Total.....	350

ENOLOGICAL CHEMISTRY.

The principal work in enological chemistry undertaken for the year was a continuation of the study of cultures of pure yeasts in relation to the fermentation of fruit juices and the dissemination of these cultures to persons and firms engaged in the manufacture of fruit by-products which require such organisms. These investigations, as heretofore, were in charge of William B. Alwood.

The offer to furnish these cultures was made public in a very limited way, yet requests were received from seventeen States and Territories, representing all sections of the country, and a large number of cultures were sent out. A number of large firms used the cultures, and the reports have been uniformly promising, so much so that the coming season several large factories are intending to use these cultures exclusively. The best results have, however, been reported from individuals who make small quantities of cider and give individual attention to their work.

A study of the use of sulphur in connection with the handling and fermenting of fruit juices was begun and conducted on a commercial scale. This work is not yet complete, but the results thus far obtained are important from both a practical and a technical point of view.

The preparation of pure cider with special yeast cultures, which has been in progress for some time, but was interrupted by the removal of the laboratory from Blacksburg to Charlottesville, Va., was resumed, and some very successful work is nearing completion. This experiment demonstrates clearly the ease with which farmers can make a most wholesome and superior cider for home consumption.

For the purpose of arriving at a more definite idea as to the quality of native American wines and ciders, the Enological Laboratory has begun the collection of these goods where they can be obtained directly from the manufacturer and are of known purity, and especially when made from a known variety of fruit. These samples are analyzed and other important data are collected that the various types of these goods may be defined and standards gradually determined.

The analytical work of the laboratory was not organized until February, 1908, since which time 111 samples have been analyzed, covering 1,567 determinations made in connection with the experiments mentioned and the physiological studies of pure yeast races which is being conducted. The equipment of the laboratory and cellars was greatly increased during the early part of the year, making it possible to conduct the investigations enumerated on a broader scale than formerly.

PUBLICATIONS.

During the fiscal year ending June 30, 1908, twenty bulletins, six circulars, twenty-three food-inspection decisions, and three notices of court judgments have been prepared for publication. Of the bulletins submitted ten, containing 1,649 pages, have been published. six are in press, one proved to be unavailable, and three are awaiting approval.

Including three Yearbook articles, the annual report, and three unnumbered circulars, the total number of pages of original material printed is 1,953, and the equivalent of about 1,200 pages in addition has been submitted and publication is pending.

Five parts of Bulletin 84 were edited, completing to date the record of the investigation of the effect of preservatives and coloring matters on health and digestion as conducted at the experiment table. Parts III to VII treat of sulphurous acid, sodium benzoate, formaldehyde, copper sulphate, and potassium nitrate, each part containing from two to three hundred pages and presenting voluminous analytical data and the discussion thereof.

The revision of the official methods of analysis, as authorized by the Association of Official Agricultural Chemists and prepared by a committee appointed for the purpose, was issued in a preliminary form and again as finally revised (Bulletin 107, and 107 Revised). The importance of this revision, especially in view of the legal standing of the methods in the enforcement of the food laws, can hardly be overestimated, all changes made in the methods during the last nine years having been incorporated, and a logical rearrangement of all general methods and food methods made.

Other important features of the year's publications are the compilation of the State food laws passed during the preceding fiscal year, a large number having been placed on the statute books under the

stimulus of the Federal food law (Bulletin 112, Parts 1 and 2); reports on the composition of commercial feeding stuffs and of honey, both of value to the consumer and to those enforcing the food laws; a study made at the instance of the Department of Justice in regard to the injury by smelter fumes to vegetation and animal life; technical methods for the testing of miscellaneous supplies, and the study of pure yeast to be applied in various industries.

As to reprints, although the order (General Order No. 93) restricting the free distribution of bulletins is observed strictly, it was found necessary to reprint 17 bulletins, 17 circulars and separates, and 26 food-inspection decisions, representing 2,802 pages. The food-inspection decisions are distributed as thoroughly as possible, abroad as well as in this country, in order that manufacturers, dealers, importers, foreign manufacturers and exporters, and our consuls abroad may be informed. To effect this, reprints aggregating from ten to twenty thousand a year have been found necessary in many cases, in addition to the original edition of 15,000. The decisions represent 82 pages of original material, covering Food Inspection Decisions 74 to 96, and 126 pages of reprints. These decisions deal with a variety of subjects, most frequently being called forth by the inquiries received from correspondents or some exigency arising in the course of the administration of the law. Their scope may be illustrated by the following subjects: Labeling of mixtures of cane and maple sirups and of corn sirup; labeling of coffees; of bitters; of medicinal and table waters; the use of certain preservatives, dyes, and coloring materials in foods; restrictions and explanations as to the proper use of guaranties and serial numbers.

A new series of circulars, giving notice of court judgments, was inaugurated during the year in accordance with section 4 of the food and drugs act, which provides that "after judgment of the court, notice shall be given in such manner as may be prescribed by the rules and regulations." Three of these have been issued, covering the misbranding of apple cider, molasses, and flour.

While the supplies needed by the seventeen port laboratories and the main office have, of course, increased greatly in volume, an effort has been made to reduce the number of forms, circular letters, etc., to a minimum, and to order in as large quantities as storage room would permit. The number of orders for job printing has not, therefore, greatly increased, amounting to 476, including 155 orders on the photographic laboratory, as compared with 337 in the previous year.

To bring the work in arrears up to date (i. e., the checking and editing of the five food-table reports mentioned) a temporary appointment was made for about nine months, in addition to the appointment of a permanent assistant to the editorial clerk which was made in September.

THE LIBRARY.

During the year 3,064 books were added to the library, 2,812 of which were shipped to 20 branch libraries in the laboratories outside of Washington, each of which has been provided with a card catalogue of the books deposited in it. The books for two more laboratories have been bought and catalogued and will be shipped as soon as the laboratories are opened. One hundred and forty journals were subscribed for, received, recorded, and forwarded to the branch labora-

tories, and 399 books were bound for use in various laboratories in Washington and elsewhere.

The current daily work of the library has been much increased by the larger number of persons using it and also by the amount of research work required, especially in connection with the food work, viewed both in its scientific and in its administrative aspect. This growth has interfered with the systematic translating and indexing of much material useful to the Bureau of Chemistry, which work should be provided for in the future.

CLERICAL WORK.

The clerical work of the Bureau was particularly increased in connection with the purchase and distribution of supplies for the eleven new branch laboratories, travel and other expense vouchers, notably for inspectors, records of inspection work, records of the analyses of imported and interstate samples, and records of pending cases and hearings under the food and drugs act. An itemized statement of the volume of this work is as follows:

Approximate number of letters written.....	100, 000
Purchasing orders.....	2, 925
Vouchers examined.....	6, 544
Serial numbers for guaranties recorded and issued in connection with the food and drugs act.....	7, 885
Letters of authorization issued.....	523
Contracts.....	24
Leases.....	25
Quotations, informal, secured.....	2, 550

Card-index records were kept of fiscal transactions, letter files, permanent property, chemical analyses, cost of projects and divisions, receipts and distribution of supplies, guaranties, interstate and imported food and drug cases, time and efficiency records of employees, certifications, examination papers, inspections, and miscellaneous matters.

A general storeroom was established in Washington from which chemicals and chemical apparatus will be distributed to the branches. Heretofore, owing to limited storeroom, it has been necessary to have a large part of the supplies shipped directly from the dealers to the branches and no uniformity could be insured. Now all supplies are tested in the Contracts Laboratory and the Division of Drugs before being accepted, thus insuring a high and uniform grade of chemicals and apparatus for the branch laboratories. Requisitions from these laboratories can now be filled more promptly, and lower prices are obtained by purchasing larger amounts.

The cost-keeping system inaugurated during the previous year has been worked out in detail and is proving satisfactory.

Owing to the fact that all drug and food inspectors and a large proportion of the men placed in charge of branch laboratories were new in the service and not familiar with the Department's methods and regulations for incurring expenses and making out travel and other expense vouchers, it was necessary to instruct them in detail in these matters, and the work involved a large amount of correspondence.

It has been the aim to classify the work of clerks and fix salaries, as far as practicable with present statutory grades in accordance with the plan adopted by the Keep Commission. All statutory grades below \$900 per annum have been discontinued.

WORK OUTLINED FOR THE FISCAL YEAR ENDING JUNE 30, 1909.

OFFICE OF CHIEF INSPECTOR.

The principal work for the ensuing year will be the collection of official samples. These samples will cover certain listed products of both foods and drugs concerning which there is a definite policy of prosecution, and in the case of foods do not include those products in which preservatives are used, pending the decision of the Referee Board.

It is not irrelevant at this point to indicate the difficulty of the inspector's task in securing samples. The conditions obtaining in the collection of such samples for State prosecution are materially different from those under which samples must be collected for prosecutions under the Federal act. In the first case it is not necessary to show an interstate transaction nor that the goods were received by the dealer subsequent to January 1, 1907, or any other date; it is not necessary to make collection in original unbroken packages nor to have such samples identified with the shipment received at any particular time. Provisions are made in the State laws which impose usually heavy penalties for the refusal of a merchant to sell or deliver a sample to the inspector under the conditions prescribed by the act. There is a marked difference between the performance of inspectors' duties, for which the inspector is clothed with every police power conferred by the State, and a similar collection, requiring the ascertainment of vastly more data, under circumstances wherein the inspector must rely solely upon his own initiative.

The availability of the inspecting force will be materially decreased by their attendance as witnesses upon the cases pending from the past year's work. This will leave little time for the consideration of special investigations. Short assignments are also necessary from time to time to determine certain facts in connection with particular violations which may be considered properly a part of routine inspection duty, but in their very nature can not be indicated in advance. Such work requires much time and, being closely connected with prosecutions, demands immediate attention, thereby interrupting duties outlined for the particular inspector concerning the collection of samples of a totally different kind. The necessity of increasing the inspecting force is therefore apparent.

The extensive investigations begun the past year for the suppression of interstate sale of distilled, malt, and wine vinegars as apple or cider vinegar will be continued, as will also those devoted to the adulteration and misbranding of spurious liquors and whiskies.

Milk investigations similar to the one conducted last year at St. Louis will be undertaken at various cities so located that a large portion of the supply enters into interstate commerce at those points.

An investigation of the marketing of sophisticated waters, represented to be the natural product of mineral springs, will be rigorously pursued and steps taken to suppress such trade practices.

The effort to suppress the practice of branding inferior grades of coffee as Mocha and Java and domestic cheese as imported products will be increased.

Instructions have also been issued to reach millers and commission merchants dealing in stock-feed who adulterate wheat products in wholesale quantities by the addition of rice hulls, corn-cob meal, and other adulterants, or color such an admixture or a poorer grade of pure bran with coal-tar dyes to conceal inferiority.

Finally, a systematic campaign will be instituted against the extensive practice of overmarking canned goods and staple products, these frequently being found upon examination to be from 15 to 25 per cent underweight.

DIVISION OF FOODS.

Much time will be occupied with the routine administrative work of the Bureau, the correspondence relative to the enforcement of the food and drugs act, and the questions relating to the organization of the new branch laboratories now in course of construction, the volume of this work being constantly increasing.

The investigation of lemon oil with special reference to the samples collected in Sicily by the assistant chief of division during the last fiscal year will be brought to completion, and the study of fruits in collaboration with the pomologist in charge of Field Investigations in Pomology, Bureau of Plant Industry, will be continued.

The study of analytical methods for determining the quality and purity of foods will also be continued, and from time to time special investigations of particular classes of food, in localities where they enter largely into interstate commerce, will be conducted.

The manufacture without the use of preservatives of foods ordinarily treated with chemicals for this purpose will be further investigated and the study extended to a wider range of products.

The work of the food-inspection laboratory will be a continuation of the special work for which the laboratory was established—that is, the checking of results and methods and the examination of the regular food-inspection samples of this locality and those referred from the branch laboratories for confirmation. The great increase in the number of food-inspection laboratories will result in a corresponding increase in this work of checking analytical results. More extensive work will also be conducted along the line of unifying methods for reporting results of analyses in the various food-inspection laboratories.

In addition, the study of the maturing of spirits will be continued and the composition of the solids and flavoring matters in whiskies will also be investigated. These studies will include the determination of fusel oil and other methods of analysis of distilled spirits and an extensive cooperative test of these methods in the various laboratories of the Bureau, as well as with other chemists interested in the subject.

DIVISION OF DRUGS.

The work for the fiscal year ending June 30, 1909, will continue along the same lines as those of the last year, but will be more specialized in view of the fact that four new laboratories have been established in the Division of Drugs, namely, the drug-inspection labora-

tory, synthetic-products laboratory, the pharmacological laboratory, and the essential-oil laboratory.

The work of the drug-inspection laboratory will consist chiefly in analyzing and keeping systematic records of all domestic and imported drug products not provided for by special laboratories.

The duty of the synthetic-products laboratory consists in making an investigation of synthetic products and the preparations used in their manufacture, in determining their purity, and establishing methods of analysis by means of which they may be detected or estimated. Methods of analysis thus elaborated which appear to give satisfactory results will be tested by the cooperation of chemists throughout the United States, using known and unknown material.

The pharmacological laboratory will undertake various studies of simple and mixed drugs for the purpose of determining their action upon the animal economy, such as the influence of caffeine and caffeine products on metabolism, also to what extent one drug may counteract the undesirable effects of another. Physiological tests of drug products will also be made for the purpose of determining their activity and usefulness for medicinal purposes and to elaborate methods which will serve to confirm the presence of certain potent agents when indicated by chemical analysis.

The essential-oil laboratory will investigate essential oils and products in the manufacture of which the same are used; the lines of work to be first instituted in this connection include the study of Pharmacopœial standards of essential oils and investigations as to the variability of genuine oils; comparisons of chemical and physical properties of oils of different origin and produced under different conditions; and the character and extent of adulterations. The special oils to be first investigated include cassia, peppermint, santal, thyme, etc.

MISCELLANEOUS DIVISION.

By order of the Secretary, dated July 1, 1908, the Miscellaneous Laboratory was made a Division, and the following laboratories were created therein: (1) Water; (2) cattle food and grain investigation; (3) insecticide and fungicide; (4) trade wastes. The studies and investigations planned for the year ending June 30, 1909, are as follows:

WATER LABORATORY.

(1) The composition and character of mineral waters of the United States. (2) Table and medicinal waters found on the market, for the purpose of securing data for the enforcement of the food and drugs act. (3) Water supplies of cities, towns, etc., when the exigencies of the public service demand the same. (4) Irrigating waters in cooperation with the Irrigation Investigations of the Office of Experiment Stations. (5) Improvement of methods of analysis of mineral waters, especially methods for determining small amounts of lithium, and the examination of certain springs for radio-active properties.

CATTLE-FOOD AND GRAIN INVESTIGATION LABORATORY.

(1) The composition of American cattle foods as they appear on the American market, especially as it relates to the enforcement of

the food and drugs act. (2) In collaboration with the office of Farm Management of the Bureau of Plant Industry, forage and range crops of the arid and semiarid West, and also malts and barleys. (3) Feeding value, commercial importance, and adaptability of grains, in collaboration with the office of Grain Investigations of the Bureau of Plant Industry. (4) Milling and baking qualities of cereals will be continued and the effect of bleaching upon flour.

INSECTICIDE AND FUNGICIDE LABORATORY.

In cooperation with the Bureau of Entomology the following studies will be pursued: (1) Lead arsenate and other insecticides upon the market and materials used in preparing them. (2) The injury to foliage by certain insecticides. (3) The chemical changes which take place when lead arsenate and Bordeaux mixture are mixed and sprayed upon foliage. (4) Studies of methods of analysis of insecticides, in cooperation with the Association of Official Agricultural Chemists.

TRADE WASTES.

(1) Arsenic and other poisons in fabrics and other materials. (2) Effect of sulphur dioxid upon different species of plants. (3) Resisting power of certain plants to copper, arsenic, and other smelter wastes.

HYGIENIC AND MISCELLANEOUS.

(1) Arsenic and other poisons in fabrics and other materials. (2) Disinfectants, methods of manufacture, and practical value of such compounds. (3) The atmosphere of schools, public buildings, and railroad cars, etc.

SUGAR LABORATORY.

The plans for the work of the fiscal year ending June 30, 1909, are in large part a continuation of the investigations already described in so far as they have not been finished, and may be outlined as follows:

(1) Continuation of the studies regarding the effect of environment upon the sugar content of Indian sweet corn. This work was begun three years ago and will be continued as outlined one year more. The results will indicate in general the latitudes in which sugar corn of the highest sugar content is produced, also the changes in sugar content of the same variety of corn when grown in different localities. In connection with this work the Sugar Laboratory is collaborating with the Bureau of Plant Industry in corn selection for increasing the content of sugar.

(2) The collection and analysis of samples of honey imported into the United States. In this connection studies will be made of the effect of heating and of storage on the composition of the honey, and methods for determining adulterants will be studied.

(3) The composition of cane molasses and sirup, especially with a view to determining the admixture of small quantities of commercial glucose, will be investigated.

(4) The analysis of samples of beet molasses already collected, to determine the effect of environment and process of manufacture upon the composition.

(5) A study of methods of determining sugar in the beet. This is of great importance to the beet-raising farmer, as well as to the manufacturer of sugar, as the price paid for beets depends generally on the per cent of sugar found by analysis.

(6) A study of the composition of the extract of maple wood, hickory bark, corncobs, etc. It is proposed to determine, if possible, the constants of such materials, that they may be used in maple products investigations.

(7) A continuation of the work upon malt and diastatic preparations. This is work which has been done in past years partly in collaboration with the Drug Laboratory, and will be extended so as to include a large variety of commercial products.

(8) A continuation of the work upon chemical methods employed in the analysis of sugar and carbohydrates. This is primarily referee work for the Association of Official Agricultural Chemists, and includes a study of methods used for honeys, sugars, molasses, dextrans, malt products, etc.

(9) A continuation of the work on the manufacture of alcohol from farm wastes and agricultural products. Up to this time the work has been conducted on small quantities of various materials, but a plant manufacturing about 75 gallons of alcohol in a day of seven hours is now in process of installation at the Bureau of Chemistry. It is proposed to use the most important types of agricultural products and wastes for making industrial alcohol, such as corn, potatoes, cull fruits, watermelons, and cantaloupes; also canning wastes from corn canneries, such as cobs, etc., and molasses, running the plant three or four days with each material. From the data obtained the commercial yield and cost of manufacture may be estimated and the availability of the particular material for alcohol-making on a commercial scale determined. A course of lectures on fermentation and alcohol-making will accompany this experiment, and a representative from each experiment station will be requested to be present and participate in the work.

DAIRY LABORATORY.

Aside from the analytical problems arising in connection with the routine work, two milk studies are contemplated.

(1) A study of the process of condensing milk, with the object of determining the practical limit of condensation consistent with a good mechanical condition.

(2) A study of the composition of cow's milk produced in the States of Washington and Oregon, as compared with that produced in other sections of the country.

LEATHER AND PAPER LABORATORY.

The following investigations, some of which are continued from last year, are planned for the Leather and Paper Laboratory:

(1) Investigations of sole, harness, and bookbinding leathers, with especial reference to the qualities that determine their value in service.

(2) Principles of rapid tanning.

(3) Continuation of the study of paper for various uses and the preparation of standard specifications for such paper.

(4) Continuation of the testing of paper for other Departments of the Government. Special work in addition to the regular work along this line has already been asked for by one of the Departments.

(5) Investigation of new raw materials for pulp and paper making.

(6) Continuation of the work on the production and industrial uses of wood turpentine and heavy oils.

(7) Study of the adulteration of turpentine.

(8) Continuation of the work on the destructive distillation of woods, with particular reference to increasing the yields of products.

CONTRACTS LABORATORY.

The work for the fiscal year ending June 30, 1909, will be along the same lines as that of the year preceding. As much time as possible will be devoted to the study of paints and paint materials. It is also proposed to do some work on the methods of analysis of alloys. The very rapidly increasing amount of work requested by other branches of the Government makes it evident that the Contracts Laboratory will require very much more space and a number of additional chemists. During the last six months of the fiscal year ended June 30, 1908, practically no work of investigation was done, the whole force being fully occupied with routine work in the examination of samples from other Departments, and during a great part of the time it was necessary to borrow additional chemists from other laboratories.

The new work demanded by the Isthmian Canal Commission and the rapidly increasing orders received from the Bureau of Engraving and Printing may be especially specified as large items of increase in the work of the coming year.

MICROCHEMICAL LABORATORY.

In addition to continuing the routine examination in collaboration with the other laboratories of the Bureau the following special studies will be made:

Microchemical examinations of eggs in cold storage, histological examinations of cold-storage fish, investigations looking to the identification of alkaloids in drug products by means of the microscope and histological studies of drugs in general, and an extensive study of mustards for the preparation of standards.

SPECIAL INVESTIGATIONS.

ANIMAL PHYSIOLOGICAL CHEMISTRY.

The work for the coming year will include a continuation of the metabolism experiments, especially the study of coca cola; the determination of purin bodies in American foodstuffs; the chemical work in connection with the investigation of the deterioration of food products; experiments in animal feeding in connection with both the preservative work, and the question of the deterioration of foods under varying conditions of storage; the application of the enzym studies to the work on foods, and studies of methods of analysis.

VEGETABLE PHYSIOLOGICAL CHEMISTRY.

During 1908 the following studies will be prosecuted: Influence of environment on the composition of grains and the products therefrom; the influence of plant food on the composition of plants; the chemistry of plants during different periods of growth; the changes in the composition of grains during storage, germination, and malting; the comparative composition of frozen and normal wheats, and the food value of the organic phosphorus of grains.

BACTERIOLOGICAL CHEMISTRY.

WASHINGTON OFFICE.—In addition to the regular routine investigations as outlined in the summary of last year's operations and the cooperative work with other laboratories of the Bureau (giving special attention to the bacteriology of food products and their wholesomeness from this point of view), the following investigations are contemplated or in progress:

(1) The determination of the germicidal value of various chemicals and of such juices as those from lemons, limes, and other citrus fruits, cocoanut, gooseberry, blackberry, raspberry, strawberry, currants, apples, peaches, etc.

(2) The work already begun on the examination of mineral waters at their source, and of the bottled market product, will probably be completed.

(3) Investigations of the bacterial content of various vegetables consumed in the raw state, giving special consideration to their possibility of disease transmission when grown under conditions liable to pollution from sewage and waste products.

(4) "The bacteriology of the fly and its dangers" is a problem that should be studied in the most minute detail, since in the crusade for cleanliness of food products and improved sanitary conditions this factor must be seriously considered.

(5) Extended investigations of the oyster industry will be made as time and opportunity permit.

PHILADELPHIA OFFICE.—This section of the work was formally organized as the food research laboratory on July 1, 1908.

During the fiscal year ending June 30, 1909, it is proposed to conduct in and under the direction of this laboratory investigations bearing upon the alterations undergone by preserved foods, following as well as broadening and extending the lines of work reported in 1907-8. Such investigations will necessitate chemical analyses and bacterial examinations of the foods and in many cases a histological study will also be prosecuted since this line of work has yielded valuable results.

It is planned to continue the study of stored chickens and to extend the work to poultry in general and various meats in search of information to assist in the enforcing of the food and drugs act.

The study of milk will also be continued from a chemico-bacteriological standpoint, and it is intended to take up especially the action of bacterial and naturally occurring enzymes in their relation to milk decomposition.

ENOLOGICAL CHEMISTRY.

PURE RACES OF YEAST.—The cellar studies in progress will be extended to include a dozen races of pure yeast in grape and apple juice, with unsown casks for comparison, all in commercial quantities. In the laboratory the ability of these yeasts to break up given percentages of sugar will be determined. The latter experiment will be conducted in champagne bottles to determine the quantity of sugar to be used in champagnizing fruit juices. The data secured will make it possible to state accurately what effect a given yeast will produce under given conditions.

The quantity of pure yeast that should be used in fruit juices or fruit pulp in factory work to secure dominant fermentation, thus excluding malferments, will also be investigated. The isolation of new races of yeast and the study of their physiological peculiarities as relates to the development of the fermentation industries will be studied as the current work permits and the use of the pure yeasts already tested will be extended as rapidly as possible.

O



