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U. S. DEPARTMENT OF AGRICULTURE.

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# REPORT

OF

# THE CHEMIST

FOR

# 1907.

BY

H. W. WILEY.

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## REPORT OF THE CHEMIST.

U. S. Department of Agriculture,
Bureau of Chemistry,
*Washington, D. C., November 13, 1907.*

Sir: I have the honor to transmit herewith the annual report of the Bureau of Chemistry for the year ending June 30, 1907, together with an outline of the work proposed for the year ending June 30, 1908.

Respectfully,

H. W. Wiley, *Chief.*

Hon. James Wilson, *Secretary.*

### INCEPTION OF THE WORK FOR THE ENFORCEMENT OF THE FOOD AND DRUGS ACT.

During the year ended June 30, 1907, an unusual development in the work of the Bureau of Chemistry has taken place. The work in connection with the execution of the laws relating to the importation of foods has been gradually increasing during the past four years and the various lines of work conducted in the different laboratories of the Bureau have continued to grow in number and importance, notwithstanding the demands made on the facilities of the Bureau by that portion of the work relating to adulterated foods and drugs.

The greatest increase, both in work and personnel, however, has been due to the enactment of the food and drugs act of June 30, 1906, which became effective on the 1st day of January, 1907. Previous to this date it was necessary to carry out the provision of the law providing for the establishment of regulations. To this end a committee, consisting of H. W. Wiley, Chief of the Bureau of Chemistry, S. N. D. North, Director of the Bureau of the Census, Department of Commerce and Labor, and James L. Gerry, Chief of the Division of Customs, Treasury Department, acting for the Secretaries of Agriculture, of Commerce and Labor, and of the Treasury, respectively, prepared a set of tentative regulations. Great care was exercised in the preparation of these regulations, not only that the provisions of the law should be fully executed, but also that there should be no unnecessary annoyance or burden placed upon the trade. It was deemed advisable before the promulgation of these regulations to hold public hearings in order to obtain the opinions of manufacturers and dealers. To this end, hearings were held in New York during the month of September, 1906, and were continued for a week. Upon the adjournment of these hearings the committee met frequently for the purpose of formulating the regulations, which were finally completed, signed, and promulgated on October 17, 1906, as Circular 21 of the Secretary's Office. As soon as these regulations were published a great flood of correspondence poured into the Bureau of Chemistry, necessitating a

large increase in the clerical force. At the same time, also, arrangement was made for increasing the chemical force, to be ready for the increased activities of the work incident to the enforcement of the law on the first of January, 1907.

Between January 1 and June 30, 1907, the personnel of the Bureau of Chemistry was more than doubled, the increase being divided between the clerical force, chemical assistants, and the corps of inspectors. The work incident to the enforcement of the law proved to be of far greater magnitude than had been anticipated, and up to July 1, 1907, no actual prosecutions under the interstate feature of the law had been instituted. During this time, however, a much more rigorous execution of the law relating to imported foods was established. This was possible because under the previous laws the machinery for the inspection and analysis of the imported foods had been already well organized. The only change which was made, therefore, in this service was to transfer the execution of the law from the clause in the appropriation bill provided therefor and place it directly under the food and drugs act of June 30, 1906.

A description of the activities of the Bureau in connection with the inspection of foods and drugs is given under the appropriate divisions in charge thereof.

It will not be out of place, however, to mention in this connection that, although up to the 1st of July no actual cases had been instituted in the courts under the food and drugs act, the moral effect of the act was apparent in every branch of trade connected with the food industry. One of the most gratifying features of this preliminary activity has been the almost unanimous support accorded by the trade to the principles of the act. In the majority of cases manufacturers of food products, as well as dealers therein, have expressed their cordial support of the act and offered their hearty collaboration in securing its enforcement. The importance of this fact can not be overestimated, since the difficulties of enforcing an act, if the entire food trade were opposed to it, would be practically insuperable. Supported, however, not only by public opinion, but also by the active collaboration of producer and consumer, the food law will have that moral support which is absolutely necessary in connection with the statutory provisions to secure more wholesome and properly branded food and drug products for the market.

Statements have been made attributing the rise of prices in certain food products to the enactment and enforcement of the law. It is undoubtedly true that prior to the enforcement of the law many food products of purity and excellence were subjected to the unfair competition of imitations or adulterated articles, sold under the same name, which depressed the price below what was just and normal. It is evident, therefore, that when this unfair competition is withdrawn the prices of such commodities will naturally rise to the normal level. At the same time the consumer will be benefited, because the adulterated, debased, or misbranded articles will fall in price to a normal level, and, though paying a higher price for the pure article, he will be able to secure the inferior or misbranded article at a lower figure. Upon the great factor of prices—namely, supply and demand—the food and drugs act can have no effect whatever. With the increasing population the demand for all the necessities of life increases. If by fluctuation of crops the productive power of the coun-

try varies from year to year, there must be a natural variation in prices. It can not be demonstrated, therefore, in any convincing way that the food and drugs act has increased the prices of foods and drugs except in so far as has been indicated above. To that extent the increase in prices should be welcomed by the consumer instead of regretted, since it prevents the exercise of fraud of which he is the chief victim.

The detailed work of the Bureau will be discussed in connection with the different divisions and laboratories in charge thereof.

### BOARD OF FOOD AND DRUG INSPECTION.

The Board of Food and Drug Inspection was created by the Secretary of Agriculture on April 25, 1907, through General Order No. 111. The duties of the Board are to consider all questions arising in the enforcement of the food and drugs act of June 30, 1906, upon which the decision of the Secretary of Agriculture is necessary; to consider and supervise all correspondence involving interpretations of the law and questions arising under the law, and to conduct hearings based upon alleged violations of the food and drugs act of June 30, 1906. The Bureau of Chemistry is charged, under the act, to perform whatever analytical work may be required for the information of the board, which reports directly to the Secretary. The personnel is as follows: H. W. Wiley, Chemist and Chief of Bureau, chairman; F. L. Dunlap, Associate Chemist, and G. P. McCabe, Solicitor of the Department.

### APPOINTMENT OF FOOD AND DRUG INSPECTORS.

In February, 1907, a civil-service examination was held to secure inspectors for the enforcement of the food and drugs act of June 30, 1906. Twenty-eight appointments were made, and on June 3 these inspectors reported at Washington for instruction as to the policy to be pursued in the enforcement of the food and drugs act and the practical details of inspection and sampling. They were given lessons in the collection and mechanical preparation of samples within the District of Columbia and the State of Virginia. After more than a week thus employed the force was divided into two divisions, for the purpose of making a tour of the principal manufacturing cities located in the East and Central West. Factories were visited and inspected at Wheeling, Pittsburg, Cleveland, Detroit, Baltimore, Philadelphia, New York, and Boston, under direct supervision of officials of the Bureau. Any unfavorable conditions found in the factories inspected were subsequently discussed with the inspectors, with a view, first, of impressing upon them the necessity of sanitation in the preparation of articles of food and drugs, and, second, for the purpose of acquainting them with the methods of processing and packing generally employed in factories. By June 30, 1907, the inspectors had been assigned and had taken up temporary headquarters in their respective territories. In making these assignments two objects were kept in view, viz, the location of branch laboratories and the strategic position afforded by channels of interstate commerce.

## FOOD AND DRUG INSPECTION LABORATORIES.

### IMPORTED FOOD INSPECTION.

Six branch laboratories have been in operation at the chief ports of entry for several years, and, as is stated under the Division of Foods, additional laboratories are being installed at ports of entry of lesser magnitude, but at which considerable importations of foods and drugs occur.

Invoices of foods and drugs intended for ports at which no laboratory has been established are forwarded to the Bureau of Chemistry. Samples desired for the purpose of inspection are taken by the customs officer at such ports and forwarded to Washington or to one of the branch laboratories for examination. The chiefs of the branch laboratories have authority to take immediate action regarding shipments which, in their opinion, comply with the law. They are also authorized to take final action in the case of a violation of the law for which a precedent has been established, and may be delegated by the board to hold hearings.

In case of a doubt regarding the violation of the law, and in cases where no precedent has been established through a decision made by the Board of Food and Drug Inspection, the matter is referred by the branch laboratory to the Bureau for final action. Here the report of the laboratory is reviewed by the Division of Foods, after which it is considered by the members of the Board of Food and Drug Inspection, together with any correspondence that may have been received regarding the case. A recommendation is then made by the Board of Food and Drug Inspection to the Secretary of Agriculture, who issues instructions regarding the disposition of the case.

Acting on these instructions, the Chief of the Bureau of Chemistry sends the requisite instructions to the chief of the branch laboratory, who is authorized to request of the appropriate customs officer the release of the shipment, its relabeling, or its transportation beyond the jurisdiction of the United States, as circumstances may require.

### INTERSTATE INSPECTION.

Samples of foods shipped in interstate commerce or sold in the District of Columbia and the Territories are secured by the inspectors of the Bureau and forwarded to the laboratory situated in the section of the country in which the respective samples are taken. The reports on individual samples from the inspection laboratories are sent to the Bureau of Chemistry and reviewed by the Division of Foods. If the cases do not appear to be satisfactory from a chemical standpoint, they are held in abeyance without further reference. If the case is considered satisfactory for prosecution because of adulteration or misbranding, the report is referred to the Chief Inspector to determine whether the samples have been legally collected.

If it is found that the sample has been illegally collected, the Chief Inspector takes immediate steps to obtain a new sample, the report on the first sample being held in abeyance until the analysis of the second sample is completed. When the chemical data appear to be sufficient for prosecution and the sample is found to have been legally

collected, the reports are turned over to the Board of Food and Drug Inspection, which Board appoints the time and place of hearing and notifies the dealer. If, after such hearing, it appears that the law has been violated, the Solicitor of the Department refers the case to the proper United States district attorney for prosecution.

## BRIEF REVIEW OF THE WORK OF DIVISIONS AND LABORATORIES.

### DIVISION OF FOODS.

During the past year the analytical work incident to the study of the influence of preservatives on nutrition has been divided between the Division of Foods, under W. D. Bigelow, chief, and the force recently organized to take special charge of the physiological chemical investigations, the work assigned to the Division of Foods being the determinations of sulphur, phosphoric acid, and moisture. The entire services of three analysts and over one-half the time of a fourth for a period of over three months were required to make these determinations on 1,474 samples.

Studies of the composition of fruit, the changes which take place during the ripening, and the effect of cold storage thereon have been continued. The fruits studied were the strawberry, gooseberry, currant, raspberry, and blackberry. Considerable time has been spent in experimental work upon the manufacture of cider from apples and pears, and the effect of carbonation and sterilization upon their palatability, their keeping qualities, etc. About 150 samples have been examined and a considerable amount of research work done, methods for the determination of the organic acids receiving special attention. This work was conducted in collaboration with the Bureau of Plant Industry and required the services of one chemist for the year.

In the work upon flavoring extracts new methods have been devised for detecting adulteration of essential oils and extracts, and their composition has been studied. About 30 extracts purchased in the open market were examined and analyses made of a number of imported lemon oils.

The study of the effect of cold storage upon the wholesomeness of food has been continued. Samples of chickens, both drawn and undrawn, also of quail, and of eggs which had been placed in cold storage were examined. The study of meat extracts was continued and that of yeast extracts begun. Considerable experimental work has been done upon the methods of analysis for meat products and methods for the detection of glycerin and gelatin. About 90 samples were examined.

Some time was given to the study of methods for the detection of the artificial coating of rice, and valuable information was obtained. The results of the studies made of the analysis of chocolates and cocoas were published under the title "The Determination of Lactose and Butter Fat in Milk Chocolates."

The fuller's earth test for caramel as applied to vinegars was investigated and its usefulness reported to the Association of Official Agricultural Chemists in a paper entitled "The Fuller's Earth Test for Caramel in Vinegar."

During the year the question of the use of sulphur in bleaching food products has been prominently before the chemist and manufacturer. This division has spent considerable time in investigating the methods for the determination of free and combined sulphurous acid in these products and in determining the amounts used at the present time. Samples were obtained from known sources and others were purchased on the open market. Valuable data were obtained both as to the accuracy of the analytical methods employed for detection and the extent of the use of this bleaching agent. Determinations of sulphurous acid were made in 30 samples of hops, 25 samples of dried fruit, and 26 samples of molasses. The dried fruit and molasses were also examined for tin and zinc.

Many other problems in connection with the adulteration of food products are being systematically studied. During the year this division made tests for preservatives on 215 meat samples for the Bureau of Animal Industry. Examinations of domestic food products not heretofore mentioned have been made as follows: Vinegar, 23; wine, cider, and nonalcoholic beverages, 81; edible oils, 39; miscellaneous, including confections, baking powders, coffee substitutes, and preservatives, 225.

### IMPORTED FOOD WORK.

The number of chemical analyses in connection with the inspection of imported food products has been constantly increasing. The work done at Washington along this line consists in confirming the results of analyses made in the various branch laboratories and in making the initial examination of food products from ports of entry where no branch laboratories have been established. In this way 1,289 samples of imported foods have been passed upon at Washington. Under the scheme of organization of the Bureau for the past year, the six original branch laboratories (at New York, Boston, Philadelphia, Chicago, New Orleans, and San Francisco) were considered as a part of the Division of Foods. The following is a tabular statement of the shipments examined:

*Statement of imported food samples received by the Bureau of Chemistry, and results of inspection reported from July 1, 1906, to June 30, 1907.*

| Result of inspection. | Beer. | Miscellaneous beverages. | Coffee and cocoa. | Distilled liquors. | Egg products. | Fish. | Fruit products. | Macaroni. | Meat. | Miscellaneous. | Mushrooms. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Found contrary to law: | | | | | | | | | | | |
| Released without prejudice to future decisions in similar cases | 25 | 57 | 35 | 2 | 26 | 78 | 97 | 10 | 107 | 61 | 20 |
| Admitted after the labels were changed to harmonize with the law | ----- | 9 | 11 | ---- | ----- | 40 | 40 | 16 | 4 | 9 | 1 |
| Required to be reshipped beyond the jurisdiction of the United States or destroyed | ----- | 8 | 1 | ---- | 19 | 12 | 39 | ---- | 10 | 8 | 8 |
| Total | 25 | 74 | 47 | 2 | 45 | 130 | 176 | 26 | 121 | 78 | 29 |
| Found to comply with the law | 78 | 183 | 25 | 6 | 129 | 651 | 410 | 31 | 159 | 331 | 93 |
| Total number of samples examined from invoices detained | 103 | 257 | 72 | 8 | 174 | 781 | 586 | 57 | 280 | 409 | 122 |
| Samples taken from invoices not detained | ----- | 1 | 3 | ---- | ----- | ----- | ----- | ---- | ----- | 21 | 2 |

*Statement of imported food samples received by the Bureau, etc.*—Continued.

| Result of inspection. | Olive oil. | Oils and fats. | Spices and condiments. | Vegetables. | Vinegar. | Wine. | Chocolate. | Cheese. | Drugs. | Total. |
|---|---|---|---|---|---|---|---|---|---|---|
| Found contrary to law: | | | | | | | | | | |
| Released without prejudice to future decisions in similar cases | 60 | 16 | 105 | 171 | 33 | 10 | 32 | 30 | 9 | 984 |
| Admitted after the labels were changed to harmonize with the law | 6 | 3 | 5 | 20 | 12 | 1 | ---- | 2 | ---- | 179 |
| Required to be reshipped beyond the jurisdiction of the United States or destroyed | 2 | ---- | 23 | 36 | 3 | 2 | ---- | ----- | ---- | 171 |
| Total | 68 | 19 | 133 | 228 | 48 | 13 | 32 | 32 | 9 | 1,334 |
| Found to comply with the law | 310 | 36 | 290 | 936 | 83 | 157 | 39 | 117 | 13 | 4,077 |
| Total number of samples examined from invoices detained | 378 | 55 | 423 | 1,164 | 131 | 170 | 71 | 149 | 22 | 5,411 |
| Samples taken from invoices not detained | ----- | ---- | 1 | 2 | ----- | 2 | ---- | 4 | ---- | 36 |
| Samples inspected on the floor of the examiner's room in appraiser's stores and invoices not detained | ----- | ---- | ----- | ------- | ----- | ----- | ---- | ----- | ---- | 28,137 |
| Shipments which entered into consumption before receipt of notice to relabel | ----- | ---- | ----- | ------- | ----- | ----- | ---- | ----- | ---- | 8 |

Very little opportunity for research work is afforded in these laboratories. One paper, however, on "Formic Acid as a Preservative," has been prepared by the Boston branch laboratory.

A very large portion of the time of the chief of the division has been taken up with the installation of additional branch laboratories. The plans and specifications for 10 food and drug inspection laboratories have been prepared and suitable quarters chosen. The laboratories will be established at St. Paul, Detroit, Savannah, Seattle, Buffalo, Kansas City, Denver, Galveston, Portland (Oreg.), and Cincinnati.

The passage of the food and drugs act has greatly increased the volume of correspondence handled by the division; and this division has shared with others in the work incident to the large number of special civil-service examinations given to fill positions created by the passage of the food and drug law. The chief of the division has also assisted in selecting and training the food and drug inspectors newly appointed.

Bulletin No. 104 of this Bureau, on the "Food Legislation during the Year ended June 30, 1906," was prepared by this division.

### FOOD INVESTIGATIONS BY SPECIAL AGENTS.

An important investigation of canneries and their products, with special reference to the causes of spoilage and the use of preservatives, was conducted, laboratory experiments in the preparation of such products, including catsups, without any artificial preservative having been made with a marked degree of success. The studies in spoilage are being made along the lines suggested by factory practice in the treating and processing of canned goods. These are bacteriological in character and consist in determining the conditions most favorable to the development of the germs, the thermal death-point, the character of the spoilage produced, and the products formed, such as gases,

enzyms, etc. The sanitation of the canneries is also considered in the factory inspection and has proved to be a most important point in the enforcement of the food law.

Plans were made to extend the investigations in enological technology, and the equipping of a larger laboratory was begun in January, 1907. Special investigations were made in France touching the problems under consideration, and cultures of pure yeasts of known value, isolated in the course of the experiments made in the laboratory, can now be furnished to manufacturers or farmers wishing to experiment in the production of ciders and other fermented fruit juices. The superior products thus obtained, it is believed, will provide a profitable outlet for utilizing apples and other fruits in communities where the crops are not readily marketed and much is wasted.

SUGAR LABORATORY.

The total number of samples analyzed in the Sugar Laboratory, under C. A. Browne, chief, during the fiscal year just closed was 520, as shown in the following statement. Samples analyzed outside of the Bureau of Chemistry by members of the Sugar Laboratory engaged in special investigations such as the industrial alcohol work and the sweet-corn experiments are not included in this statement.

*Samples analyzed in the Sugar Laboratory, fiscal year 1907.*

| | No. of samples. |
|---|---|
| Cereal products (barley, malt, etc.) for cereal laboratory | 127 |
| Sugar beets | 88 |
| Honey for complete analysis (honey investigation) | 112 |
| Honey collected in execution of food law | 40 |
| Malt extracts for Drug Laboratory | 26 |
| Wines and beers for Food Laboratory | 11 |
| Sugars, molasses, etc., Association of Official Agricultural Chemists, appraiser's samples, etc | 35 |
| Miscellaneous products (potatoes, roots, cornstalks, etc.) for alcohol production | 25 |
| Dextrins, starches, and glucoses for Bureau of Engraving and Printing | 22 |
| Miscellaneous | 34 |
| Total | 520 |

The main lines of investigation conducted in the Sugar Laboratory may be summarized 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 the composition of 100 American honeys, in collaboration with the Bureau of Entomology.

(4) Investigations of various raw materials for use in alcohol production (cannery waste, cornstalks, potatoes, roots, molasses, etc.).

(5) Investigations of commercial malt and diastatic preparations.

(6) A study of the carbohydrates of the maple tree, with special reference to the action of enzyms in the transformation of the same.

The special study of the production of industrial alcohol from factory by-products, mentioned in the report for 1906, was further pursued, and additional data in regard to the alcohol procurable from such sources were obtained. This investigation has not yet reached

the point where publication would be desirable, present conditions rendering such production of alcohol unprofitable on a commercial scale.

The other special investigation mentioned, conducted under the direction of the Chief of Bureau, relating to the chemical changes taking place in sweet Indian corn in different environments, was continued. In connection with the fact previously recorded—that when pulled from the stalk and exposed to ordinary temperatures the sugar content rapidly diminishes—an interesting point developed is that cold storage during transportation and handling greatly retards the decrease in sweetness.

## DAIRY LABORATORY.

During the past fiscal year the principal lines of work conducted in the Dairy Laboratory, under G. E. Patrick, chief, have been as follows:

(1) A study of the digestibility of cheddar cheese at different stages of ripeness was continued from the preceding year. This work was done in collaboration with the Bureau of Animal Industry.

(2) Analysis and other examinations of market butter and cheese for the Dairy Division, Bureau of Animal Industry.

(3) Analysis of milks and creams sold in the District of Columbia, now completed.

(4) Analysis of ice creams sold in the District of Columbia, now completed.

(5) Analysis of condensed milks of commerce.

(6) Analysis of butter and milk used at the hygienic table in the food investigations of the Bureau.

(7) Analysis of dairy products sent in from other laboratories and departments, and by the food and drug inspectors of the Bureau of Chemistry.

(8) Study of methods for the analysis of dairy products. Some of the results of this work have been published in scientific and dairy journals; others are now in preparation for publication.

The total number of samples examined during the year was 1,573, of which 552 were butter and cheese from the Dairy Division, Bureau of Animal Industry; 532 were milks and creams purchased in the District of Columbia and vicinity; 199 were ice creams purchased in the District of Columbia; 116 were milk and butter from the hygienic table, Bureau of Chemistry; 49 were condensed milks, and the remaining 125, including those used in the study of methods, were from miscellaneous sources.

## MISCELLANEOUS LABORATORY.

During the past year the Miscellaneous Laboratory, under J. K. Haywood, chief, has examined about 1,200 samples. Some of these analyses were made as a part of the investigation work of the laboratory and either have been published or will be. Others were made for the various laboratories of the Bureau and for different Bureaus and Divisions of the Department and other Departments of the National Government. In addition to this experimental work, much time has been given to considering questions and answering correspondence relating to the food and drugs act in so far as it applies to water, cattle foods, and cattle and poultry remedies.

The work of the Miscellaneous Laboratory is divided into five distinct sections with a leader who is especially skilled in that particular work at the head of each. These sections are as follows: (1) Waters; (2) insecticides, fungicides, and weed killers; (3) miscellaneous; (4) cattle foods and grain investigations; (5) action of trade wastes on agricultural products, forests, and animals. Besides the above, certain investigations of hygienic character, such as determining arsenic in fabrics and wall paper, and analyzing the atmosphere of schools, churches, etc., are carried on from time to time as the other work of the laboratory permits.

### WATER EXAMINATIONS.

The water section has during the past year examined 30 samples of irrigation waters, principally for the Irrigation and Drainage Investigations, Office of Experiment Stations, and has made several chemical studies of especial interest to that office. Thirty complete mineral-water analyses were made and a study was conducted to find methods for determining minute amounts of lithium in mineral waters. Most of these results will be presented in a report on American mineral waters from source and will be of great value as furnishing standards in enforcing the food and drugs act. Sixty-six sanitary examinations of water have been completed, and this section during the past year made a study of the water supply of Roanoke, Va., suggesting to that city means for abating the epidemic of typhoid fever then at its height.

### INSECTICIDES AND FUNGICIDES.

This section has made examinations of 46 samples of insecticides, fungicides, and weed killers, most of this work having been done at the request of the Bureau of Entomology or Bureau of Plant Industry. A considerable amount of time also was devoted to a study of the composition of lead arsenate and the chemicals used in preparing the same as they appear on the American market. Field studies of the action of lead arsenate on foliage have also been undertaken in collaboration with the Bureau of Entomology. During the past year this section published a bulletin on The Lime-Sulphur-Salt Wash and its Substitutes, and a paper entitled "The Methods of Analysis of Lead Arsenate."

### MISCELLANEOUS WORK.

The miscellaneous section has charge of all the work of a miscellaneous character coming into the Bureau of Chemistry. During the past year 72 miscellaneous examinations have been made for the Departments of the National Government and other Bureaus of the Department of Agriculture. Besides the above, various special investigations of a miscellaneous character have been made, including in round numbers the examination of 50 to 100 samples.

### CATTLE FOOD AND GRAIN INVESTIGATION.

This section has examined about 800 samples. Fifty-seven of these examinations were made in the course of a study conducted in collaboration with the Office of Farm Management, Bureau of Plant Indus-

try, on forage and range crops of the arid and semiarid West; 10 were of a miscellaneous character; 187 were more or less complete analyses of malts and barleys in connection with a study of beers, and 567 were analyses of various imported and domestic cereal grains. The grain samples were collected by the Office of Grain Investigations of the Bureau of Plant Industry in the interest of a study now being carried on by that office and the Miscellaneous Laboratory regarding the relative feeding values and commercial importance of such grains, and the adaptability of foreign grains to the climatic conditions of the United States.

A large portion of the time of one member of this section, who was appointed referee on cattle foods by the Association of Official Agricultural Chemists, has been given to a study of methods of analysis and to problems which arose in connection with the food and drugs act. A report was made to the Association of Official Agricultural Chemists on these studies by the referee for 1906. A bulletin on the chemical and microscopical composition of cattle foods as they appear in the American market has been prepared. Certain grain investigations have been completed and will shortly be collated in a joint report of the Bureau of Chemistry and the Bureau of Plant Industry.

### TRADE WASTES.

This section during the past year made an examination of about 104 samples. An investigation of the injury to vegetation by smelter fumes near Ducktown, Tenn., was carried on and the results will be presented later. The injury to vegetation and animal life caused by smelter wastes at New Anaconda, Mont., is being studied at present. The results of both of these investigations will not only be interesting from a scientific standpoint, but will be of great value in suits between smelters and adjoining communities. Recently this section began a study to determine what amount of sulphur dioxid was injurious to trees and farm crops, and the effect of the tailings of smelters on the land and crops irrigated by streams receiving the same. This work will be continued during the summer and spring for two or three years.

### DRUG LABORATORY.

The Drug Laboratory, under L. F. Kebler, chief, was concerned during the fiscal year with the general inspection of the purity and the composition of the drugs offered on the American market and in the study of the many special problems connected therewith. The opportunity for effective work of this character was greatly increased by the council of pharmacy and chemistry of the American Medical Association, by whose activity it was made possible to obtain for examination all the new drugs offered to the medical profession.

An important question in the Drug Laboratory is that of the distinction between medicines and foods. This boundary line is extremely migratory in character, because many substances which are used for foods, either directly or for condimental purposes, are also at times prescribed by physicians for the cure, mitigation, or prevention of disease. When thus prescribed they become, to all intents and purposes, drugs, and must be judged by the drug standard. It

therefore happens that often a commodity is subject to two sets of standards—when sold and used for a food it is judged by the food standard, and when sold and used as a medicine by the drug standard. Examples of this are found in such well-known substances as brandy and olive oil. On the other hand, there are many drugs which owe their therapeutic value almost solely to their nutritive properties, but these drugs are rarely sold as foods chiefly because of their unpalatable qualities. One of the most important drugs of this kind is cod-liver oil. The policy of the Drug Laboratory is to regard as drugs all ordinary food substances of mineral, plant, or animal origin which are recognized by the medical faculty as having valuable curative properties whenever specifically used for drug purposes. While it is not always easy to determine to which category the substance belongs, it can usually be done either by the inspection of the label or by studying the trade conditions.

During the last six months of the fiscal year much time was spent in preparation for the new work incident to the enforcement of the food and drugs act, and both the personnel and the equipment of the Drug Laboratory were greatly increased.

### ANALYTICAL WORK—SAMPLES EXAMINED.

During the fiscal year ending June 30, 1907, there were examined in the Drug Laboratory 600 samples; of this number 307 were chemical reagents, 70 were samples of hops to be tested for arsenic, and the remainder were drugs of various kinds.

Chemical reagents.—The chemicals examined were those regularly employed in chemical analysis in the Bureau of Chemistry and the branch laboratories under its supervision.

Hops.—The samples of hops were examined at the request of the Bureau of Plant Industry and a number of exporters for the purpose of ascertaining to what extent they are contaminated with arsenic, and whether such contamination is sufficient to preclude their being exported to England. The object was chiefly to ascertain from what source the arsenic was obtained.

Glycerin.—Fifteen samples of glycerin were examined for the purpose of ascertaining to what extent the article as supplied on the market is contaminated with arsenic and other impurities; also for the purpose of determining whether or not the tests prescribed by the United States Pharmacopœia, eighth revision, are too rigid. It was found that very few samples could be secured which would fully comply with the standard.

Cod-liver oil.—This is a continuation of the work begun about two years ago for the purpose of ascertaining the status of American cod-liver oil in comparison with the Norwegian product, also the difference between the two from a chemical point of view. A number of samples were reexamined for the purpose of determining to what extent they are influenced by standing. The total number of oils examined was 68.

Sulphur.—Three samples of this chemical were tested for the Bureau of Plant Industry, for the purpose of ascertaining whether they

contained appreciable quantities of arsenic. These samples were employed for bleaching hops.

Post-office samples.—Thirteen samples of various drugs sent through the mails were examined, at the request of the Post-Office Department, for the purpose of giving information relative to their composition and also to determine whether or not the claims made for the same are warranted.

Official interstate samples.—Seven samples of drug products taken officially by inspectors were examined.

Samples from council of pharmacy and chemistry.—The secretary of the council has submitted during the past fiscal year 42 samples of drugs for examination, the results of which have been published by the council in the Journal of the American Medical Association.

Miscellaneous.—Under this heading are placed all drugs of which from one to three samples have been examined. These examinations include such products as headache powders, soluble iodin, soluble sulphur, kidney cures, tablets, etc.

## METHODS.

Considerable work has been done on analytical methods for the assaying of drug products. Almost all of the methods in the U. S. Pharmacopœia were tried and compared with other methods.

Various methods were tested for determining alcohol in medicinal agents containing resins, oils, oleoresins, and similar products, which make the accurate determination difficult. The refractometer was called into use, but thus far has not been satisfactory, except when distillation was first employed.

Various methods for making complete analyses of the different headache remedies of both known and unknown composition have been studied.

Considerable work has also been done on methods for detecting the various enzyms present in medicinal agents and for ascertaining to what extent these enzyms render the different substances available to the human system, as is claimed for them.

## CONTRACTS LABORATORY.

During the fiscal year ending June 30, 1907, the Contracts Laboratory, under P. H. Walker, chief, examined 870 samples. A very large part of the work of the laboratory has been done for other Departments of the Government, as the following statement will show:

| | |
|---|---|
| War Department | 20 |
| Navy Department | 6 |
| Interior Department | 64 |
| Post-Office Department | 84 |
| Treasury Department (principally for Bureau of Engraving and Printing) | 387 |
| Department of Commerce and Labor | 7 |
| Department of Agriculture | 39 |
| Government Printing Office | 17 |

The samples analyzed were quite varied in character, including pigments, oils, glue, glycerin, ink, inking pads, soap, disinfectants, steel, alloys, paints, varnishes, linoleum, and numerous other substances. An important part of the work during this year has been the examination of the supplies for the Bureau of Engraving and Printing. In the past some work has been done for that bureau, but during this fiscal year practically all of the examinations in connection with the letting of contracts were made in this laboratory.

During the year some studies were completed on the determination of the saponification number of lubricating oils containing saponifiable fats, on the unification of reducing sugar methods, and on the determination of zinc present as carbonate and as silicate in ores. Investigations made under the direction of the Chief of the Bureau on synthetic alcohol and phenacetin are almost completed.

The investigations on typewriter ribbons and carbon papers have been continued during part of the year, but, owing to the transfer of the chemist in charge of this work to another laboratory, the results have not as yet been formulated. Quite a large amount of work has also been done in the study of paints and paint materials. Much more work of a routine character has been necessary in examining the supplies bought by the Bureau than has been the case in the past, owing largely to the increased amount of material purchased.

### PLANT ANALYSIS LABORATORY.

In the Plant Analysis Laboratory, under C. C. Moore, chief, during the past fiscal year, the results of investigations relating to the poisonous properties of cassava, as outlined in the year previous, have been submitted for publication as Bulletin No. 106 of the Bureau of Chemistry.

An investigation was begun to determine the source from which alcohol, for industrial purposes, could be most economically obtained. To this end, a study of cassava was made. This plant has never been utilized in the production of alcohol, and owing to the demand in the South for a source of industrial alcohol, which would enable that section of the country to supply its own needs and even compete with the corn-producing West, plans were inaugurated to make a full investigation. A detailed study of the technical processes used in the manufacture of alcohol from substances related in general composition to this plant was made. In conjunction with laboratory tests, plans were laid to conduct the experiment upon a commercial scale. When, however, investigations in other Bureaus of the Department showed that the experiments relating to cassava culture in the Southern States were incomplete, the work in the Plant Analysis Laboratory was discontinued pending the settlement of cultural problems.

Attention was then devoted to the sweet potato, with particular reference to the utilization, in the production of alcohol, of the great quantities of potatoes that during storage become unmarketable as vegetables. As this plant is adapted to the soil and climate of the Southern States it could be produced in even greater quantities were there a profitable market. A compilation was made bearing on the present production, utilization, methods of storage, and the possibility of this source of industrial alcohol competing with others. This investigation forecasts the possibility that the sweet potato may be-

come of importance in other respects than as a food, should the use of industrial alcohol become extensive.

This laboratory has also collected a large amount of data in the investigation of inorganic plant constituents as affected by climatic environment, conducted in collaboration with various experiment stations. The submission of this material was followed by a detailed review of the work done on kindred lines, the preparation of which occupied several months.

It is proposed, because of the overlapping of these lines of work, to abolish the Laboratory of Plant Analysis at the end of the fiscal year, the chief of the laboratory to conduct his researches in connection with the section of vegetable physiological chemistry recently organized.

### LEATHER AND PAPER LABORATORY.

The number and character of samples received in the Leather and Paper Laboratory, under F. P. Veitch, chief, during the year are given in the following statement:

| | |
|---|---|
| Paper | 962 |
| Tanning materials and leather | 190 |
| Turpentines and woods | 89 |
| Miscellaneous | 47 |
| Total | 1,288 |

### TANNING MATERIAL.

An investigation of American sumacs for the purpose of determining the tannin content of sumacs from different localities, the most favorable time to gather them, and the best method of curing was begun during the year and is still in progress. Data were also collected as to occurrence, yield per acre, and uses of the native wild sumac. This plant, which is very plentiful in certain sections, may be gathered profitably at the present price of sumac and may replace Sicilian sumac in many cases. As it has been claimed that the Sicilian sumac imported now is much less adulterated than when the samples were first collected, more recent importations were sampled and are now being examined.

### LEATHER.

An extended examination of sole leather was begun and is still in progress for the purpose of determining the extent to which it is adulterated and the factors which determine the quality of such leather. Examinations of a number of bookbinding leathers have also been made.

### PAPERS.

The investigations on book and envelope papers with particular reference to the needs of the public service have been continued and the results are now being prepared for publication. A very large number of papers, envelopes, postal cards, stamped envelopes, wrapping papers, etc., have been examined during the year. The Public Printer accepts no deliveries of paper until reported on by this laboratory, and the amount of work from this source alone is exceedingly

great, requiring during the last fiscal year much of the time of the entire laboratory force. For this reason some of the research work that would otherwise have been completed must be continued in 1907–8. An examination of photographic printing papers was begun but is not yet completed.

### WOOD TURPENTINE.

The work on wood turpentines and the production of turpentine has been continued, and a large number of samples have been analyzed and practical tests made with various samples to determine their value as varnish and paint thinners.

### DESTRUCTIVE DISTILLATION OF WOOD.

In the prosecution of the work along this line a number of complete sets of products, the samples of which were taken at regular intervals during distillation, have been examined for the purpose of determining the nature and quantity of the products at various periods during production. The data thus obtained should be useful in suggesting improvements in the conduct of the chemical processes of this industry. Circular No. 36, entitled "Chemical Methods for Utilizing Wood," was issued to meet the general demand for such information.

### MISCELLANEOUS WORK.

A number of fertilizers and other miscellaneous materials have been referred to the laboratory from other Bureaus and Departments. The work of the Association of Official Agricultural Chemists and of the American Leather Chemists on tanning materials and fertilizers has been participated in and considerable time has been given to the improvement of methods of analysis.

### MICROCHEMICAL LABORATORY.

The work in the Microchemical Laboratory, under B. J. Howard, chief, for the past year has been very largely in collaboration with the other laboratories of the Bureau of Chemistry and about 3,000 samples were examined.

In collaboration with the Division of Foods, 114 samples of imported foods have been examined and 55 miscellaneous food samples. Toward the last of the year work was begun upon samples taken in connection with the enforcement of the food and drugs act. In connection with the Leather and Paper Laboratory, 608 samples were examined, the most of these being papers and paper materials. An investigation was made at the request of the Bureau of Plant Industry on photographic developing papers. The examinations of book papers have been continued. The work on imported sumacs has been nearly completed and the report upon them partially prepared. Other Departments of the Government have availed themselves of the services of this laboratory to a greater extent than ever before.

A few medicines have been examined in collaboration with the Drug Laboratory to determine, as far as possible, from their structural and microchemical characteristics, the ingredients present.

The work begun in the previous year upon barley and malts has been continued, 143 samples having been examined. Toward the last of the year a new set of samples, the product of another season's crop, was received; but the examination of these samples has not yet been made.

At the request of the Contracts Laboratory, 142 samples have been examined. These included pigments (used in paints and inks), dextrins, scouring powders, gum tragacanth, and linoleums. Twine, millinet, and khaki cloth were examined as to their fiber.

For the Sugar Laboratory 187 samples have been examined, consisting mainly of honeys and a few starches and dextrins. The work upon the honeys was done to determine the kinds of pollen present in them and to develop the microscopic method in the detection of adulteration.

Aside from work conducted in collaboration with the laboratories of the Bureau of Chemistry 132 samples of spices, including peppers, allspice, mustard, cloves, ginger, red pepper, cinnamon, and mace were examined for the Maine Experiment Station. In addition there have been examined a considerable number of miscellaneous samples and specimens in connection with research work and the development of methods. One hundred and twenty-five negatives were made during the year, most of them being photomicrographs.

A study was also made of 190 samples of sago and tapioca products to determine the nature of the starches commonly present.

Leucocyte counts were made upon 500 milk and cream samples in connection with a study of the local milk supply made by the Bureau of Chemistry.

The blood tests and microscopic examination of the urine sediments from the subjects on the hygienic table were made by this laboratory, requiring in all the making of 340 blood tests and 95 urine tests, necessitating over 1,000 separate examinations.

The manuscript for the report upon the microscopic examination of stock foods has been prepared for publication as well as the microscopic study of honey pollens.

## SPECIAL INVESTIGATIONS.

### ANIMAL PHYSIOLOGICAL INVESTIGATIONS.

This laboratory, in charge of F. C. Weber, was organized on April 1, 1907, for the special conduct of the hygienic table and the performance of all analytical work connected with the experiments performed to determine the influence of preservatives and artificial colors on digestion and health, and to conduct allied investigations on animal physiological chemistry. The work of this section from its organization to the end of the fiscal year may be summarized as follows:

(1) Conduct of the hygienic table for the administration of potassium nitrate, the calculation and tabulation of results, and the collection of 640 samples of feces and of urine, and complete analysis of 128 urine samples.

(2) Complete analysis of 12 cold-storage chickens.

(3) Complete analysis of 11 cold-storage egg samples.

(4) Examination of 30 meat extracts.

The results of the experimental work with sulphurous acid and sulphates were compiled and prepared for publication, as were also the data obtained in the investigation of meat extracts, both commercial samples and those prepared in the laboratory having been studied.

The chemist in charge also conducted the cooperative work on moisture in foods as referee in the Association of Official Agricultural Chemists.

### VEGETABLE PHYSIOLOGICAL INVESTIGATIONS.

This laboratory, in charge of J. A. Le Clerc, works in collaboration with the Bureau of Plant Industry along the following lines:

(1) The improvement of wheats grown in this country.

(2) The effect of variation in climatic conditions on newly introduced varieties of grain.

(3) The chemical changes in composition which wheats undergo when grown in different localities.

(*a*) The chemical changes in composition which go on during the different stages of growth.

(*b*) The influence of excessive moisture during the growing period and the study of its results.

(*c*) The chemical changes which take place in wheat after grinding when allowed to age in the laboratory.

During the past year this laboratory has made 3,827 determinations, almost all of which were in duplicate, making a total of about 7,000 determinations actually performed. The most important among these were the following:

| | |
|---|---|
| Determinations of phosphoric acid | 550 |
| Determinations of ash | 550 |
| Determinations of weight per bushel | 700 |
| Determinations of sugar in wheat | 232 |
| Determinations of weight per 1,000 kernels | 600 |
| Determinations of moisture | 355 |

The other determinations were of lecithins, fiber, fat, sulphur, total nitrogen, albuminoid nitrogen, soluble nitrogen, pentosans, and physical appearance. Research work was conducted in regard to the following points:

(1) The loss of phosphoric acid during the ashing of a sample.

(2) The best method for determining sugars in wheat.

(3) To improve the method and apparatus for the determination of lecithins as lecithans.

### BACTERIOLOGICAL-CHEMICAL INVESTIGATIONS.

Washington laboratory.—The work of the year, in charge of G. W. Stiles, jr., consisted of the partial identification of about 400 different organisms isolated from various sources; the testing of the germicidal or antiseptic value of a number of chemical substances; the regular bacteriological investigations of cold-storage fowl, quail, and eggs; a study of the organisms found in condensed and evaporated milk; bacteriological examinations of samples of water from various sources (wells, springs, bottled mineral waters, and the city hydrant water), and water before and after filtering by the system in the Bureau of Chemistry. A thorough study was made of milk,

cream, and ice cream as found in the local market (Washington, D. C.).

A new and very important line of activity has already been begun in collaboration with the Drug Laboratory in making a critical examination of the sterility of the various dressings, bandages, pads, ligatures, gauzes, etc., used in surgery. In this connection a brief inspection was made of a few factories preparing this class of goods.

A few tours of inspection were also made to local dairy farms and their sanitary condition was tested by plate cultures prepared upon the premises from milk, water, etc. Many of the cafés, hotels, lunch counters, milk depots, and ice-cream factories have been inspected with reference to the sanitary conditions of their refrigerators, ice boxes, kitchens, etc., and their methods of handling and caring for food products. A summary of the examinations made is as follows:

| | |
|---|---|
| Agar plates containing various organisms for identification | 39 |
| Condensed and evaporated milk | 111 |
| Cream | 139 |
| Disinfectants, germicidal value of | 25 |
| Eggs, cold storage | 8 |
| Fowl: | |
| Cold storage, drawn | 3 |
| Cold storage, undrawn | 3 |
| Fresh | 3 |
| Ice cream | 206 |
| Milk | 388 |
| Miscellaneous | 22 |
| Quail: | |
| Cold storage, drawn | 2 |
| Cold storage, undrawn | 2 |
| Fresh | 2 |
| Surgical dressings, ligatures, etc | 6 |
| Waters, mineral and other | 60 |
| Total | 1,029 |

PHILADELPHIA FOOD-RESEARCH LABORATORY.—The food-research laboratory, in charge of M. E. Pennington, was not formally established until April, 1907. Previous to that time the facilities offered by a private laboratory were used by the chemists employed for these researches in the study of certain chemical, histological, and bacteriological changes which take place in food products, more especially when stored at low temperatures. The problems which received the most attention are the rate of growth of bacteria in milk kept near its freezing point; the species of organisms which thrive under such conditions, and the chemical changes which the milk undergoes when so preserved; also whether the latter changes are to be ascribed to the action of bacteria or to the action of naturally occurring enzyms or to the combined action of both. The chemical study has dealt chiefly with the changes in the proteid constituents.

The study of the histological changes occurring in animal tissues which have been kept in cold storage for varying periods of time has been undertaken and promises to be a most important and profitable source of information for the tracing of the more obscure alterations in flesh preserved by cold.

The behavior of condensed milk and evaporated cream as culture media for organisms, particularly those usually concerned in the intestinal diseases of young children, has been investigated as part of a study to determine, if possible, whether the very high death rate of infants fed on such milks is to be ascribed to its chemical composition, which differs widely from the composition of their natural food, or whether the reason lies in some less obvious change due to the method of its preparation or added constituents.

## CLERICAL WORK.

The clerical work of this Bureau was greatly increased during the fiscal year ended June 30, 1907, by the food and drugs act. The amount of work performed is summarized as follows:

| | |
|---|---|
| Approximate number of letters written | 67,800 |
| Requisitions | 1,669 |
| Accounts audited | 3,870 |
| Serial numbers recorded and issued in connection with the food and drugs act | 12,700 |

In addition to the above, various card catalogues and records were kept of permanent property, fiscal transactions, letter files, chemical analyses, costs, the receipt and distribution of supplies, and miscellaneous matters.

The work of the property clerk was greatly increased during the year. Contracts were made for supplies and equipment for ten new food and drug inspection laboratories located throughout the country. The laboratory at San Francisco, having been completely destroyed by the earthquake and fire, had to be again equipped. In addition, work in the other five branch laboratories already established and at the Washington office was tremendously increased, necessitating a corresponding increase in the amount of supplies. The food research laboratory in Philadelphia was enlarged and a new equipment supplied at Blacksburg for enological investigations. The preparation of specifications, securing bids, and drawing and awarding contracts for the above supplies involved an immense amount of clerical work. A complete record showing the distribution of all items purchased was kept and a cost system was devised and installed.

There is urgent need for more storeroom. The present cramped quarters necessitate ordering at frequent intervals small quantities of much used supplies, which could be more advantageously purchased in large lots. This is particularly true of chemical apparatus, a large part of which is imported and requires from eight to twelve weeks for delivery.

The work involved in keeping the accounts of the Bureau was also materially increased. The examination and verification of vouchers, including traveling accounts of inspectors, formed a notable addition to this work.

## PUBLICATIONS.

The following statement shows the new publications issued—bulletins, circulars, and miscellaneous pamphlets—together with the reprints and orders for job printing. The decrease in reprints is due to the effect of General Order No. 96, restricting the free distribution of publications.

### NEW PUBLICATIONS.

*Bulletins.*—No. 84, Influence of Food Preservatives and Artificial Colors on Digestion and Health. Part II, Salicylic Acid and Salicylates, 280 pages; No. 101, The Lime-Sulphur-Salt Wash and its Substitutes, 29 pages; No. 102, Foreign Trade Practices in the Manufacture and Exportation of Alcoholic Beverages and Canned Goods—Summary of an investigation made in Great Britain and Ireland, Germany, and France, 45 pages; No. 103, Experimental Work in

the production of Table Sirup at Waycross, Ga., 1905, together with a Summary of the Four-Year Experiment on Fertilization of Sugar Cane, 38 pages; No. 104, Food Legislation during the Year ended June 30, 1906, 53 pages; No. 105, Proceedings of the Twenty-Third Annual Convention of the Association of Official Agricultural Chemists, held at Washington, D. C., November 14–16, 1906, 213 pages; No. 106, Cassava: Its Content of Hydrocyanic Acid, Starch, and other Properties, 28 pages.

*Farmers' Bulletins.*—No 268, Industrial Alcohol: Sources and Manufacture, 47 pages; No. 269, Industrial Alcohol: Uses and Statistics, 32 pages; total of bulletins, 765 pages.

*Circulars.*—No. 19 (in the series of the Secretary's Office), Standards of Purity for Food Products, 19 pages; No. 21 (of the Secretary's Office), Food Regulations, 20 pages; No. 31, General Results of the Investigations showing the Effect of Salicylic Acid and Salicylates upon Digestion and Health, 12 pages; No. 32, Extracts from the Proceedings of the Association of Official Agricultural Chemists, 1906, 14 pages; No. 33, Report on Methods of Beer Analysis, 16 pages; No. 34, Examination of Papers, 10 pages; No. 35, Report on Colors, 51 pages; No. 36, Chemical Methods for Utilizing Wood, including Destructive Distillation, Recovery of Turpentine, Rosin, and Pulp, and the Preparation of Alcohols and Oxalic Acid, 54 pages; total of circulars, 206 pages.

*Food Inspection Decisions.*—Nos. 40 to 73, 60 pages.

*Articles in 1906 Yearbook.*—The Preparation of Unfermented Apple Juice, 8 pages; The Effect of Climatic Conditions on the Composition of Durum Wheat, 16 pages.

*Unnumbered Circulars.*—Hearings before Commission on Pure Food and Drug Regulations, 4 pages; Tentative Food Standards, 7 pages.

*Report.*—Report of the Chemist for 1906, 29 pages.

Total number of pages of original matter prepared for publication, 1,095 pages.

PUBLICATIONS REPRINTED.

*Bulletins.*—No. 46, Methods of Analysis.

*Circulars.*—No. 12 (Revised), Methods for the Investigation of Canceling Inks and Other Stamping Inks; No. 25, Coloring Matters for Foodstuffs and Methods for their Detection (reprinted twice); No. 28, Provisional Methods for the Determination of Food Preservatives (reprinted three times); No. 29, Changes in Provisional Methods for the Analysis of Foods and Additions Thereto (three times); No. 31, Salicylic Acid (twice); No. 32, Extracts from the Proceedings of the Association of Official Agricultural Chemists, 1906.

*Food Inspection Decisions.*—Nos. 40 to 43 (three times); Nos. 44 to 48 (twice); No. 46 (Revised); No. 73.

*Miscellaneous.*—Table Sirups (Yearbook, 1905); Formaldehyde, Its Composition and Uses (Yearbook, 1905); Report on Fats and Oils, from Bulletin 105; Determination of Water in Foods, from Bulletin 105; Report of the Chemist, 1906.

The total number of pages in the publications reprinted was 480.

The total number of requisitions for job printing issued was 337.

## WORK OUTLINED FOR THE FISCAL YEAR ENDING JUNE 30, 1908.

DIVISION OF FOODS.

The following investigations will be conducted by the Division of Foods, some of which are in continuation of previous work:

(1) Study of the composition of fruit, the changes which take place during ripening, and the effect of different methods of storage.

(2) Investigation of quantitative methods for the determination of preservatives.

(3) Testing of methods for the detection of artificial coating of rice.

(4) A thorough and systematic study of the forms of adulteration of flavoring extracts and methods for the detection of such adulterations.

(5) Investigation of the chemical changes which take place during the fermentation of different classes of vinegar.

(6) Study of methods for detecting coloring and facing materials in tea.

(7) Investigation of the processes of bleaching flour and methods for detecting the nature and quantity of the bleach used.

(8) Study of methods employed in drying fruit, with special reference to the use of sulphur dioxid.

The work for the year ending June 30, 1909, will depend largely upon the success which attends the investigations of the present year. There are many questions yet unsolved in connection with the composition of foods and their adulteration. Some attention may be given to the problems of fermentation and to the analyses of the finished products. The study of so-called "infants' and invalids' foods" should be undertaken in the near future. The nature and extent of the increase in the food work and the miscellaneous activities of the division are difficult to forecast at this time, the developments in the enforcement of the law being of necessity largely a matter of conjecture.

### WASHINGTON FOOD INSPECTION LABORATORY.

The Food Inspection Laboratory, under L. M. Tolman, chief, was organized July 1, 1907, for the purpose of segregating certain activities previously carried on under the direct supervision of the Chief of the Division of Foods. This change in organization was rendered necessary by the great increase in volume and importance of this work incident to the establishment of ten additional inspection laboratories and the enforcement of the food law.

The special object for which the laboratory was established is to check the work of the other sixteen food inspection laboratories and examine food inspection samples collected in the Washington district. The following lines of work will also be pursued:

(1) Checking of the methods employed in the various laboratories so as to bring about uniformity in results and procedure of analysis as well as in statement of results.

(2) Investigation of the limitations of the various methods employed in the inspection work.

(3) Investigation of the composition of the fusel oil in whisky and spirits, both new and matured.

### OFFICE OF THE CHIEF FOOD AND DRUG INSPECTOR.

The rigorous enforcement of the Federal food law will be greatly facilitated by the cooperation of the several States, and to this end inspectors have been instructed to establish cordial relations with the State food officials.

The work of the inspectors as outlined for the fiscal year ending June 30, 1908, consists principally in the collection of samples for analysis, the inspection of factories, and a careful investigation of the distribution of articles of food and drugs with a view to ascertaining the chief sources of supply and the channels of commerce through which they pass.

Supplying the 16 food and drug inspection laboratories with samples for analysis will constitute the principal work of the inspectors.

The articles which it is proposed to examine especially at this time include, under "Foods," gluten flour, honey, detannated coffee, ground white and black peppers, and flavoring extracts; and under "Drugs," all cocaine preparations and advertised cures, besides the inspection of wells and the collection of samples of mineral waters. Meanwhile attention will also be directed to specific cases in which the use of illegal labels on food and drug samples is charged, for the purpose of instituting prosecutions. At the request of the Navy Department frequent inspections will be made of the food supplies purchased for the Navy.

Several large cities have been endeavoring to eliminate impure milk from their markets. The attention of the Department has been called to the fact that the State and city food officials are powerless to prevent the wholesale shipment of impure milk from one State to another. Especial attention will be given to this problem in order to remedy the evil due to such interstate shipments and a campaign of this nature will require the presence of several inspectors in each city.

In collaboration with the investigation under way in the laboratories of the effect of bleaching upon the food value of flour, a thorough inspection of the mills and of milling processes will be made. The investigation in progress in the Division of Foods to determine the effect of sulphur fumes on dried fruit will also require the work of inspectors in collaboration with the chemists.

In addition to a general inspection of wines, evidence as to the use of denatured alcohol and commercial acetic acid by vinegar and cider factories will be collected. In general, studies will be made of the methods employed in the preparation of raw materials in those food factories which use preservatives.

The work outlined above will be expanded from time to time as problems arise which require special inspectors to determine the physical conditions connected with any given phase of adulteration.

The extension of the inspection work, consisting in the detection of import, export, and interstate shipments of adulterated foods and the consequent collection of samples for examination, depends largely upon the number and working capacity of the inspection laboratories. There are 33 inspectors employed at present, and the complete equipment of the 10 new laboratories now being installed will require the increase of this number to at least 50 within the fiscal year ending June 30, 1908.

### FOOD AND DRUG INSPECTION LABORATORIES.

The work of the inspection laboratories will continue along the lines indicated by the report for 1907, but the 10 additional laboratories now in the course of construction will be completely installed, and arrangements are being made for establishing 4 more, making a total of 20 port laboratories. Of these the one located at St. Paul will begin actual work during the month of December, 1907. During the early part of 1908 work will be begun in the Buffalo and Detroit laboratories, and at a later date those located at Kansas City, Galveston, Cincinnati, Savannah, Denver, Seattle, and Portland will be completed.

The laboratories located at New York, Boston, Philadelphia, New Orleans, and San Francisco are largely occupied with the examination of imported foods and drugs, although they also give considerable attention to interstate products. The other branch laboratories devote the greater part of their attention to interstate work. All of the branch laboratories are located at ports of entry, however, and in addition to the importations at those ports arrangements are in progress for the inspection of importations at minor ports, the samples to be sent to the nearest branch laboratory for examination.

### SUGAR LABORATORY.

The work planned for the Sugar Laboratory for the year ending June 30, 1908, is in many instances a continuation of the investigations of the preceding year, and may be outlined as follows:

(1) Continuation of the studies regarding the effect of environment upon the sugar content of Indian sweet corn.

(2) Completion of the research on American honeys. The analytical part of this work is practically completed, and the work is now being compiled for publication.

(3) A study of the effect of environment and processes of manufacture upon the composition of beet molasses. Samples of beet molasses have been procured from all the leading beet-sugar factories of this country, and the work of analysis is now being carried out. To determine absolutely the effect of clarifying agents upon the composition of the resultant molasses, plans are being made for conducting cooperative experiments at one of the large beet-sugar factories during the coming season.

(4) A continuation of the work upon malt and diastatic preparations (malted foods, medicinal preparations, extracts, sirups, brewing sugars, etc.). This work, which during the past year was partly carried on in collaboration with the Drug Laboratory, will be extended so as to include a large variety of commercial products.

(5) A continuation of the work upon the carbohydrates of the maple and the possible action of enzyms in the transformation of the same. This research, initiated by the Chief of the Bureau, has been only partially completed; it is proposed to continue the work the coming winter and spring, collaborating with the Vermont Experiment Station, which is working along somewhat similar lines.

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

The work of the fiscal year ending June 30, 1909, will be a continuation of the above plans in so far as these have remained uncompleted, with such new projects as may have, in the meantime, suggested themselves.

### DAIRY LABORATORY.

The following lines of work will be pursued in the Dairy Laboratory:

(1) Analysis of all the brands of condensed milk sold in the United States.

(2) Analysis of all the brands of milk powders or dried milks sold in the United States.

(3) A study of the changes occurring in the proteids of milk kept in cold storage and by the use of various preservatives.

(4) A continuation of the study methods of analysis of dairy products. The greatest need exists for methods of detecting adulteration of butter with other animal fats.

(5) Analytical work in the enforcement of the food and drugs act and the renovated-butter law.

(6) Work for other laboratories and departments as heretofore.

The work for the ensuing fiscal year will be along the same lines.

### MISCELLANEOUS LABORATORY.

During the year ending June 30, 1908, the following investigations will be continued by the Miscellaneous Laboratory:

(1) Examination of irrigation waters for the Office of Irrigation and Drainage Investigations.

(2) Study of the composition of American mineral waters from source and as they appear in the market, in order that those provisions of the food and drugs act relating to waters may be enforced. The work is now being carried on entirely by the Bureau of Chemistry instead of in collaboration with the U. S. Geological Survey, as formerly.

(3) Water analyses will be made and the water supplies of towns will be examined when epidemics, such as typhoid, render it advisable and the town has no official chemist.

(4) Work on a spectroscopic method for determining minute amounts of lithium.

(5) Work on insecticides and fungicides for the Bureau of Entomology and other Bureaus desiring such collaboration; a study of samples of lead arsenate as they appear on the American market and the ingredients used in preparing the same, as well as field studies of the action of lead arsenate on foliage and the cause of scorching by the same.

(6) Miscellaneous investigations for other laboratories, Divisions, Bureaus, and Departments of the National Government.

(7) Study of the composition of American cattle foods as they appear in the American market, especially as it relates to the enforcement of the food and drugs act.

(8) Studies of forage and range crops of the arid and semiarid West in collaboration with the Office of Farm Management of the Bureau of Plant Industry, as well as on malts and barleys.

(9) Studies of the feeding value, commercial importance, and adaptability of grains in collaboration with the Office of Grain Investigations of the Bureau of Plant Industry.

(10) Studies of the effect of trade wastes on vegetation and animals and the investigation of the effect of sulphur dioxid on forest trees and of the constituents of the dump heap from copper smelters on various farm crops. In connection with this study an investigation will also be made of the amount of toxic elements absorbed by the various crops irrigated by water containing toxic elements.

It is hoped that a study of methods for determining the various constituents of common disinfectants and a method for judging the practical value of such compounds can be undertaken.

Studies of the chemical composition and characteristics of various imported and domestic varieties of rice and the adaptability of foreign rices to climatic conditions in the United States will be undertaken in collaboration with the Office of Grain Investigations, Bureau of Plant Industry.

If time allows, hygienic studies of the amount of arsenic in colored candies and in beers, and the condition of the atmosphere of schools, Government buildings, tenements, etc., will be undertaken.

The lines of work mentioned for the year ending June 30, 1908, will probably be continued in the following year. The work on waters and cattle foods in connection with the food and drugs act will be greatly increased, so that it will doubtless be necessary to more than double the force of these two sections. The insecticide and fungicide investigations are increasing to such an extent that it will be necessary to employ at least one more chemist on the work in a short time. The investigations of the action of trade wastes in agriculture are so constantly called for by the Department of Justice that it is even now necessary to employ an additional chemist on the work.

### DRUG LABORATORY.

The work of the Drug Laboratory outlined for the preceding year will be continued, but greatly extended in its application to the enforcement of the food and drugs act. Analytical methods must be elaborated for the determination of the various constituents required by the law to be declared upon the labels of drugs and medical mixtures—such, for example, as the detection of morphine in fluid substances containing glycerin. Such allied researches will accompany the examination of official drug samples collected by the inspectors, it being the intention to follow up closely all adulterations and misrepresentations of drugs, both of domestic and foreign origin.

These investigations, the enforcement of the law, and continued cooperation with other Bureaus and other Departments of the Government will require a greatly increased force and equipment in 1909.

### CONTRACTS LABORATORY.

The work of the Contracts Laboratory for the fiscal year ending June 30, 1908, will be along the same lines as that of the year preceding. Special attention will be devoted to the study of paints and paint materials, which will probably be continued for several years. It will be necessary to conduct some service tests, and therefore a practical expert painter should be secured, and a fund be available for making such experiments. Owing to the great variety of substances examined by this laboratory and the necessity of making exact specifications, compliance with which can be exacted, it is desirable that a set of methods useful in this kind of work be collected. Some work has already been done in this direction, and it is proposed, as soon as possible, to issue a compilation of such methods as a bulletin.

### LEATHER AND PAPER LABORATORY.

The following investigations and studies are planned for the Leather and Paper Laboratory:

(1) Continuation of the study of tanning materials with reference to the utilization of such products as grow quickly, or which have been hitherto but little used, with a view to supplementing the rapidly decreasing supply of tanning materials.

(2) Study and valuation of degras, or wool grease, and of various methods for the detection of its adulterants.

(3) Physical and chemical properties of various leathers.

(4) Principles of rapid tanning.

(5) Continuation of the study of papers for various uses, and the preparation of standard specifications for such papers.

(6) Investigation as to a new raw material for pulp and paper making.

(7) Continuation of the work on the production and industrial application of wood turpentine.

(8) Study of the adulteration of turpentine.

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

This laboratory will also cooperate, so far as the facilities will permit, with other Bureaus and Divisions of this and other Departments in work which comes within its province.

### MICROCHEMICAL LABORATORY.

The work on the methods of microscopical analysis of foods, papers, sumacs, drugs, and similar substances whose character can be shown by such tests will be continued. The enforcement of the food and drugs act will require many microscopical examinations of samples and the biological analyses of barleys and malts will again be made.

It is hoped that an increase in the force will enable the laboratory to finish the studies on book papers, sumacs, and honeys which at present are in various stages of completion.

Several lines of investigation which have been brought into prominence by the new food law will be given more attention, bearing on the identification of adulterants in foods and drugs.

### SPECIAL INVESTIGATIONS.

#### ANIMAL PHYSIOLOGICAL INVESTIGATIONS.

The work for the current year will include:

(1) Continuation of the hygienic table to complete the experiment on potassium nitrate and test other preservatives and coloring matters.

(2) Studies on the determination of purin bodies in American foodstuffs.

(3) Extraction of toxins from foodstuffs in various states of putrefaction and the effect of these toxins when injected into animals.

(4) Such experiments in animal feeding as may be required in connection with preservative work of the hygienic table.

(5) Continuation of work on meat extracts and cold-storage products.

(6) Study of methods: (*a*) for the separation of nitrogenous bodies; (*b*) Association of Official Agricultural Chemists' work on moisture; (*c*) Association of Official Agricultural Chemists' work on meat extracts.

(7) Compiling the data for the preservative reports and interpreting the results.

(8) Experiments with small animals to determine the influence of preservatives on digestion and the study of special problems which may arise in this connection.

VEGETABLE PHYSIOLOGICAL INVESTIGATIONS.

The work reported specifically in the last report and outlined as follows will be continued during the current year:

(1) Study of the deterioration of wheat or the production of white spots, thus making the grain less glutenous. This study is being carried on in greenhouse pot experiments as well as in the field at the Colorado station.

(2) Influence of fertilizers, especially phosphate salts on the gluten content of wheat, conducted in collaboration with the Tennessee Experiment Station.

(3) Influence of a preceding legume crop on the gluten content of wheat, in collaboration with the California station at Modesto.

(4) So-called "triangular experiments" as outlined in the previous report.

(5) Continuation of the study of barleys and malts and compilation of data previously obtained.

(6) Experiments on the date of planting and rate of seeding, conducted in collaboration with the stations in Tennessee, Kansas, and Nebraska.

(7) Continuation of work on Swedish Select oats in collaboration with the Bureau of Plant Industry. This investigation involves a study of the feeding value of a large number of samples, mainly of introduced varieties.

In 1908–9 it is planned to inaugurate a study of the effect of sunlight and different colored lights on the chemical composition of the grain during the growing period, in addition to the continuance of the experiments already under way.

BACTERIOLOGICAL-CHEMICAL INVESTIGATIONS.

Washington office.—Twice the number of skilled assistants and three times the space and equipment will be needed to develop and conclude the lines of investigations outlined in the preceding year, many of which are now only partially completed and by their nature require considerable time for thorough investigation.

An investigation of the sanitary condition of the Government buildings at Washington is also under consideration in collaboration with the Miscellaneous Laboratory.

Another line of work which appears to be of particular interest and of practical value is a bacteriological study of fresh meats which have been placed in cold storage, giving attention to the nature of the anaerobic organisms and others which may be concerned with the apparent ripening or softening that is noticeable soon after they are placed in such storage.

PHILADELPHIA OFFICE (FOOD RESEARCH).—During the fiscal year ending June 30, 1908, it is proposed to conduct in this laboratory investigations on the following subjects:

(1) Continuation of the chemical study of the bacterial and enzymic changes taking place in milk.

(2) Microscopically visible changes to be observed in foods in cold storage, particularly poultry, and the microscopic alterations which such tissues have undergone.

(3) Relation of bacteria to chemical and histological changes of flesh and the relative responsibility to be laid upon the fungi as compared with other agencies, such as enzyms, desiccation, etc.

(4) Keeping qualities of different breeds of fowls and of fowls put into the freezer as promptly as possible after killing and at varying periods between slaughtering and putrefaction. It is also planned to begin observations upon the effect of long-continued low temperatures of varying intensity on bacteriological and chemical changes in various food products.

## PUBLICATIONS.

The increase in publications and job printing naturally resulting from the general growth of the Bureau will necessitate the appointment of an assistant editorial clerk, and a typewriter especially fitted to copy technical manuscripts, keep records, take charge of mailing lists, distribute publications, etc.

The only important work in arrears is the editing of the reports on the experiments for the determination of the effect of preservatives and artificial coloring materials on health and digestion, and during this year it is expected with the additional force to bring all of these reports now in arrears up to date. As much haste will be made as is compatible with the extreme care necessary in the compilation of the voluminous material involved.

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