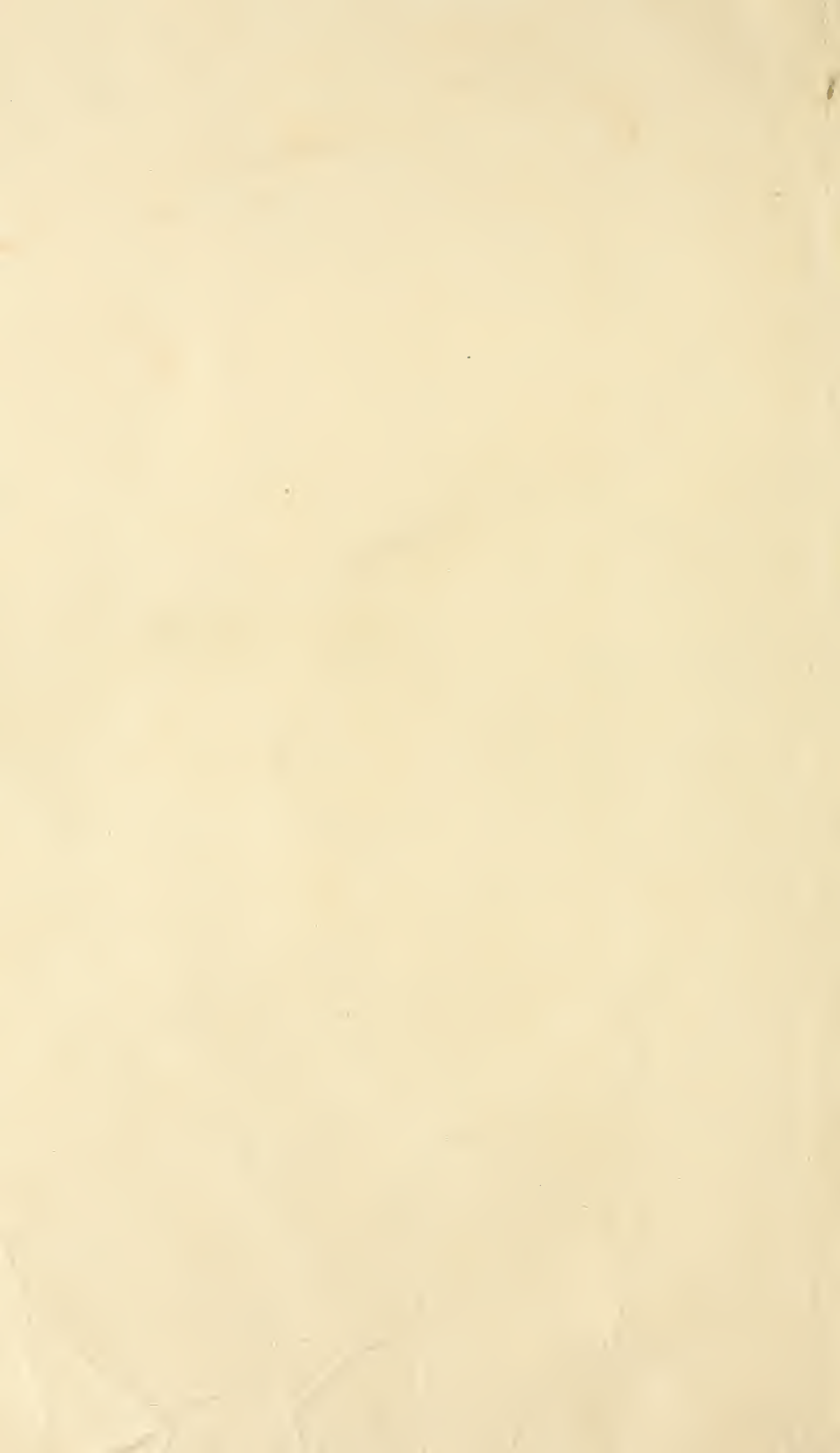


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U. S. DEPARTMENT OF AGRICULTURE.

REPORT

OF

THE CHEMIST

FOR

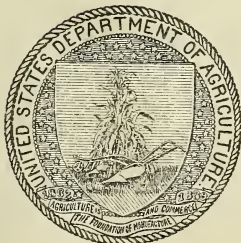
1911.

BY

H. W. WILEY.

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GOVERNMENT PRINTING OFFICE.
1911.

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REPORT OF THE CHEMIST.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF CHEMISTRY,
Washington, D. C., September 1, 1911.

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

Respectfully,

H. W. WILEY,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

FOOD AND DRUG INSPECTION.

GENERAL NATURE AND VOLUME OF THE INSPECTORS' WORK.

As the initial force in the correction of violations of the food and drugs act of June 30, 1906, the inspectors continued their work of locating and reporting instances of the production and shipment of misbranded or adulterated foods or drugs, and procuring samples of the same for examination. References of this nature, when confirmed by the necessary examinations and analyses, form the bases of punitive actions directed against the persons, firms, or corporations who may be responsible for the violations, or cause the institution of libel actions against the commodities at fault. The department submitted 312 of the latter cases to the appropriate United States district attorneys, who caused the issuance of summary orders by the proper courts to restrain traffic in the goods. After due trial some of these goods were destroyed and others returned to the claimants upon the submission of satisfactory evidence that they would not be disposed of contrary to law. The scope of inspection work as far as libel actions are concerned was very materially enlarged by a decision of the Supreme Court within the past year. It was held that an interstate shipment made in violation of the law was subject to seizure as long as the product remained in the original, unbroken package, regardless of the extent to which the shipment had entered the commerce of the State by means of intrastate sales subsequent to its delivery to the original interstate consignee.

The number of official samples collected during the past fiscal year was approximately 9,500. These were representative of products which had actually been shipped into interstate commerce for distribution to the consuming public and were subjected to examination for

purity and grade. Although there has been a great improvement in the character of foods and drugs now being manufactured and sold, as well as in the representations made concerning them, the number of prosecutions concluded during this year was greater than ever, and resulted in the inspectors devoting much time to attendance at trials and in securing needed evidence at the request of prosecuting attorneys; this, of course, affected the volume of routine inspection work. In addition to the samples mentioned, there were also obtained approximately 2,000 informal samples for the information of the bureau, for scientific research, or to indicate the general character of interstate shipments. The careful inspection of factories was not neglected, and as the location of certain classes of producers becomes better known this branch of the inspection work is being systematized so that more results are obtained with less expenditure of time and effort.

COOPERATION OF INSPECTORS IN SPECIAL INVESTIGATIONS.

WORK CONTINUED FROM THE PREVIOUS YEAR.

SARDINES.—Among the unfinished work of the preceding year was the investigation of the sardine-packing industry, which it was impossible to conclude within the usual season because of the late run of fish. This was continued during the summer and fall of 1910, and a number of reports and specimens were submitted, the examination of which verified the belief that the products were unfit for food purposes either because of age and spoilage or contamination with tin. A number of seizures of such goods was made, the last and most important of these consisting of 8 carloads of sardines which were seized before the consignee, a packing firm, had an opportunity to process them. In this case the goods were in such an advanced stage of decomposition as to constitute an adulteration. The inspectors were aided in this investigation by a number of firms and individuals connected with the trade, who were desirous of checking certain undesirable practices which had begun to invade the industry.

BLEACHED FLOUR.—The collection of official samples of flour which had been bleached with nitrogen peroxid was also continued, for repeated investigations proved that a number of mills were continuing to ship interstate consignments of such products in the face of adverse decisions by the courts. The data thus obtained was used in sustaining the department's position in the bleached-flour appeal case which was argued in the spring of 1911, following the decision in Kansas City in July, 1910.

EGG PRODUCTS AND VINEGARS.—In spite of the many actions brought against shipments of egg products which were unfit for food purposes because of filthiness, putridity, or decomposition, traffic in such inferior articles of food did not seem to abate, as a résumé of the inspection work shows that a far greater number of samples of such adulterated eggs were collected and more seizures made during this period than in the preceding year. Vinegar is another substance which continued to be the subject of sophistication, and a great many instances of adulteration have been reported, the chief form of which is the admixture of inferior vinegar with cider vinegar, and the subsequent misbranding of the compounds as apple or cider vinegar.

CITRUS FRUITS.—The investigation concerning the shipment of immature citrus fruits, begun several years ago, was again taken up at the proper season, and the collection of samples and of necessary information was continued over such a length of time as to enable the bureau to establish beyond a doubt that the interstate traffic in unripe fruit of this character, which was subsequently treated to increase the color in the peel in order to simulate full development and mature fruit, was an illegal practice. The conclusion of this investigation was followed by the issuance of Food Inspection Decision 133, giving the opinion of the department in this matter, especially as it relates to oranges.

MILK INSPECTION.—The intrusion of other work operated against the massing of a large force of inspectors at any one point, such as has been customary in conducting milk campaigns in the past, but this did not prevent a scrutiny of the milk products furnished to a number of cities throughout the country. The collection of samples in these instances was undertaken by a fewer number of inspectors who were favorably situated at locations affording strategic advantages. It is worthy of note that these collections showed that the adulteration of such valuable food substances as milk and cream is less prevalent than formerly.

NEW INVESTIGATIONS.

When the examination of a great many samples of a given line of products indicates that there are but few instances of violations, further collection is discontinued and attention is given to a new class of material. This policy caused the abandonment of some of the former subjects of investigation and the substitution in their stead of other inquiries, several of which are especially noteworthy. Simultaneous investigation was made during the fall of 1910, in a number of localities, of the tomato-canning industry. This inquiry developed that it had been a practice for factories to utilize tomato refuse in preparing soup stocks and pastes, and as this material was permitted to remain unprocessed for considerable lengths of time, under conditions which were often the reverse of sanitary, it was plain that the finished products could not be free from evidences of spoilage and bacterial contamination. As the analyses substantiated and confirmed the findings of the inspectors relative to the filthy condition of such articles, prompt steps were taken to suppress traffic in such goods, and a great many seizure actions were submitted by the department to the Department of Justice for appropriate proceeding.

The investigation of the presence of arsenic in food materials had progressed far enough to indicate that this deleterious substance was found only too frequently, and a great many official samples have been collected of baking powders and baking-powder materials, colors, and shellac and other coating materials used in the manufacture of confectionery. A large number of these contained arsenic in prohibited amounts and led to the institution of many libel recommendations. The collection of specimens of cheap confectionery during the holiday seasons, such as Christmas and Easter, revealed the too prevalent use of coloring agents and filling materials of questionable value.

The former practice of improperly branding as "Mocha" or "Java" coffees grown elsewhere than in Arabia or the Dutch East Indies has

been practically abandoned as far as interstate shipments are concerned, but a different form of sophistication was revealed in the manipulation or sweating of inferior grades of coffee to improve the appearance and to enable the sale at increased prices under false designations. Since the seizure of one shipment of this processed coffee no further violations of this sort have been reported. Greater attention was also paid to the manufacture of the various forms of prepared and dried mustard, as quite large quantities of charlock or wild mustard are known to be used, and endeavor was made to prevent the substitutions of this for pure mustard without proper declaration on the label.

Considerable attention has been given also to the spurious champagnes or champagne ciders which masquerade under the guise of genuine bottle-fermented wines. The inspectors continue to maintain vigilant supervision over bulk goods which may be misbranded as to weight or capacity; the chief commodities which are thus misbranded have been found to be vinegar, cheese, meal, and stock feeds. Since the passage of the insecticide and fungicide act the inspectors have also been charged with the collection of official samples of such commodities which have been shipped into interstate commerce subsequent to January 1, 1911.

COOPERATION IN SCIENTIFIC STUDIES.

The scientific branches of the bureau have continued to request that inspectors take up special subjects for investigation, and as instances of this sort there may be mentioned the following: The investigation of the production of infant and invalid foods, at the request of the animal physiological laboratory; the collection of authentic samples of animal and vegetable oils, together with reports on the attending processes of manufacture, for the information of the fat, oils, and wax laboratory; inspection of breweries for the purpose of making a closer study of the manufacture of beers and other fermented liquors; an extended investigation of the molasses industry, with particular reference to the moisture content in molasses, and the continued collection of authentic samples and the investigation of the manufacture of maple products, for the information of the sugar laboratory; inspection of the sources of spring waters and collection of samples, at the request of the water laboratory; and the investigation of pseudo cod-liver oil preparations at the request of the drug division.

DRUG INSPECTION.

The inspection of factories producing drug products and the supervision of interstate traffic in the case of such goods was continued. Many samples of patent and proprietary medicines were obtained for examination by the drug division, and, in addition to these, official samples were also collected of a number of pharmaceuticals which are recognized by the United States Pharmacopœia and the National Formulary. Such goods are not offered to the consuming public directly, as is the case with patent medicines, but they are manufactured for dispensing upon physicians' prescriptions, and the necessity for such articles conforming to the prescribed standards of purity and

strength is greater even than in the case of other substances whose sophistication would prove no more serious than perpetrating a fraud upon the purchaser. Several instances of violations of the law were developed in the case of adulterated crude drugs, not indigenous to this country, which were imported through ports not having laboratory inspection, and thus escaping the examination which is always made at laboratory ports. In addition to these, there were also obtained official samples of many varieties of native as well as imported crude drugs, which were forwarded to the drug division for examination.

WORK OF THE INSPECTION LABORATORIES.

Samples of interstate foods and drugs taken by the inspectors and samples of imported foods taken at the ports of entry are referred for analysis and report to the appropriate laboratory in Washington or to one of the 21 branch laboratories in other cities. The reports of the branch laboratories on these samples are referred to the appropriate laboratory in Washington for filing, and in case of those samples believed to be in violation of the law for the preparation of the proper information for the Solicitor's Office. The offices of the Bureau of Chemistry in Washington charged in this manner with the preparation of cases are: The Washington food inspection laboratory and the laboratory of food technology of the division of foods, the Washington drug inspection laboratory of the division of drugs, the water laboratory and the cattle food and grain laboratory of the miscellaneous division, and the dairy laboratory. In addition to this other laboratories and divisions make both original and check analyses of samples, but report their results to one of the laboratories mentioned above for the preparation of the case for the Solicitor. In this class may be mentioned especially the sugar laboratory and the microchemical and bacteriological laboratories, whose cases are prepared by the Washington food inspection laboratory, and the leather and paper laboratory, which examines samples of turpentine and reports its results to the division of drugs.

WASHINGTON DRUG INSPECTION LABORATORY.

During the past year the Washington drug inspection laboratory has examined 752 samples as follows: Eighty check analyses of imported drugs, 60 check analyses of domestic drugs, and 73 import products coming directly under this laboratory, the remainder, 529 samples, being domestic products; 231 of the latter were found to be either adulterated or misbranded or both, and 421 cases of interstate drugs judged to be adulterated or misbranded were prepared in this laboratory and reported to the chief of the bureau for transmission to the Solicitor. Two hundred and seventy-five cases on imported drugs, referred from the port laboratories for action, were prepared for the Board of Food and Drug Inspection, 248 of which were found to be contrary to law and 27 were released without prejudice. A number of consignments of domestic drugs have been recommended for seizure on the ground of being misbranded or adulterated or both.

DOMESTIC DRUGS.

The violations were found to be very similar to those encountered in previous years, namely, misrepresentation on the labels of bottles, cartons, and in advertising literature accompanying packages, and the absence of any statement regarding the presence of prescribed drugs, opium, morphin, codein, cocain, alcohol, ether, chloroform, etc., or the incorrect declarations of the same.

A number of the United States pharmacopœial products have been found below the requirements; that is, either deficient in alkaloidal strength, containing foreign material, or entirely spurious. Notices of judgment have been issued in connection with certain pharmacopœial drugs based upon such findings, as follows: *Belladonna* root containing ground olive pits, henbane adulterated with *Hyoscyamus muticus*, powdered gentian containing foreign material, powdered cloves adulterated with clove stalks, and colocynth (powdered) containing a large amount of the seed, specifically excluded by the Pharmacopœia.

Examination of a number of bitters of the Fernet type revealed the fact that they were of domestic origin, containing methyl alcohol, and therefore spurious imitations of products imported into this country.

The attendance of analysts in court cases has consumed much time in the last year.

IMPORTED PRODUCTS.

All cases of drug products detained at the port laboratories for which no precedent has been established are referred to the Washington drug inspection laboratory for check analysis and action, as are also all appeals in connection with imported drugs.

The quality of crude drugs continues to improve, but experience shows that it is necessary to maintain strict inspection. For example, shipments of inferior goods may be denied entry at one or more ports and subsequently consignments of a similar character, if not the rejected material, will be offered for entry at a port where it would not ordinarily be expected.

The violations met with in imported products are more or less similar to those cases noted in connection with domestic drugs; that is, misrepresentations upon the labels, cartons, and in the accompanying literature, and the absence of declarations or incorrect declarations of the proscribed ingredients.

Certain shortcomings were found in shipments of such products as cubeb, containing an excess of stems, immature and inferior berries; buchu leaves containing a large excess of stems; uva ursi, inferior in quality and contaminated with a large excess of stems; digitalis, poor quality and unfit for medicinal use; sarsaparilla root, mixed with a large proportion of rhizomes, which is the portion the United States Pharmacopœia specifically states should be excluded; gum tragacanth, of inferior quality, very low grade, and adulterated with Indian gum. Many importations of asafetida have been permitted entry in harmony with Treasury Decision 31097, which provides that under certain conditions asafetida may be allowed entry in case the

product contains 35 per cent or more of alcohol-soluble material. A number of shipments of asafetida have been found to comply with the United States Pharmacopœial standard for alcohol-soluble material.

The question of bitters has been given considerable attention. It is found that a number of these products are named after certain drugs, or statements are made on the labels which represent the articles to contain a substantial quantity of a given ingredient or ingredients, while the analyses often reveal at most only a trace of the specific drug referred to by name or by representations. Cinchona and quinin preparations are typical of this class of products. A number of consignments have been offered for entry under the name of magnesia or terms including the word "magnesia," which were found upon examination to contain only a small amount of this body, the product depending for its activity on organic acids (principally tartaric) and the sodium bicarbonate present.

The number of shipments of Chinese opium and morphin pills referred to in last year's report have materially decreased, but those shipments offered for entry are regularly detained as being in violation of section 11 of the food and drugs act in that they may be dangerous to the health of the people of the United States.

A number of importations of products containing opium, morphin, and codein have been detained as being in violation of section 11. The basis for such action was that the goods were prepared in the form of a confection, flavored in such a way as to be attractive to the taste, and recommended and presumably used as household remedies for colds, coughs, etc., but as a matter of fact some are sold as ordinary confections. The danger of such preparations is at once apparent. Certain dangerous habit-forming drugs have been eliminated from some commodities of this type during the past year.

WASHINGTON FOOD INSPECTION LABORATORY.

The Washington food inspection laboratory is charged with the analysis of the original samples sent to it for examination and with receiving the reports and arranging for or making check analysis of samples examined in the branch laboratories of all classes of foods not otherwise provided for in one of the specialized laboratories of the bureau. The total number of samples examined during the year was 3,164, of which 945 were check samples of imported foods taken at the various port laboratories. In addition to these there were 152 imported food samples taken in connection with the nonlaboratory port inspection in the Washington district, and of the total 2,067 were samples of food of domestic origin. These figures include the imported and interstate samples referred to the sugar, microchemical, and bacteriological laboratories for examination, many of which were examined in several of these laboratories and are there reported. The preparation of cases arising from these examinations forms a large part of the work of this laboratory, 2,142 having been prepared during the year. In addition to these, the food technology laboratory, although devoting its time chiefly to constructive investigation, examined 108 initial and check samples and prepared 185 cases on

extracts and essential oils originating in this or in a branch laboratory. The cases prepared by the dairy laboratory and the miscellaneous division are recorded in connection with those investigations (pp. 19, 39, and 41).

A large percentage of the domestic samples found by the branch laboratories to be adulterated or misbranded are checked by the Washington inspection laboratory, this forming its chief duty. The volume of this work, both analytical and executive, restricts to a great extent investigation, although a certain amount of research work is done in connection with special problems arising directly in connection with the law, as, for example, the investigations of cider vinegar, maraschino, noodles, beers, etc. (See pp. 26 to 30.)

All import cases not decided upon established precedents at the port laboratories and reported direct to the collector of customs are referred to this laboratory, checked, if necessary, and the case prepared for reference to the Board of Food and Drug Inspection. Seven hundred and thirty-one cases were so handled during the past year, constituting approximately one-third of the shipments detained, and of these 553 were found to be illegal and 178 were released without prejudice to future decisions. This work often necessitates investigations of manufacturing conditions, composition of foreign products and their natural variations, trade practices, etc.

WORK OF THE BRANCH LABORATORIES.

GENERAL TABULAR STATEMENT.

The following tabular statement indicates the volume and scope of the work done at the port laboratories. The varying conditions at the several ports, the different amounts of time given to court and research work, and the fact that some laboratories have a much larger force than others, makes any comparison misleading. Furthermore, at some ports chemists have been assigned to special inquiries or transferred to other laboratories to meet certain exigencies, as at Pittsburgh, Galveston, and Nashville. The main investigations inaugurated at the Washington office relating to vinegar, beers, egg noodles, and the deterioration of fruit and vegetable products such as ketchups, jams, etc., including the examination of the fresh products and the same at various stages of decomposition, were participated in by nearly all of the port laboratories and no special mention is made of them under the individual reports. Another line of work which is pursued at all of the laboratories to a greater or less degree is the cooperation with local branches of the departmental service, notably the commissary officers of the War and Navy Departments, the collectors of customs, and the collectors of internal revenue, for whom samples are examined and much time saved, especially for those located on the Pacific coast and at other points distant from Washington.

Food and drug samples examined in the various branch laboratories during the fiscal year ended June 30, 1911.

Laboratory.	Imported samples.				Interstate samples.				Total samples analyzed.	Hearings.	
	Legal.	Illegal.	Released without prejudice.	Floor inspection samples.	Legal.	Illegal.	Check analysis.	Miscellaneous samples.		Personal.	By correspondence.
Boston.....	140	232	348	9,025	36	144	40	97	1,037	317	146
Buffalo.....	89	35	7	122	259	240	6	9	645	38	64
Chicago.....	181	146	12	2,708	619	512	71	81	1,622	214	139
Cincinnati.....	201	25	.....	393	110	76	38	22	472	254	129
Denver.....	60	18	3	21	125	139	10	73	428	8	80
Detroit.....	38	19	13	246	60	80	12	53	275	15	209
Galveston.....	32	3	3	179	156	81	2	49	326	1	73
Kansas City.....	5	.....	.....	4	265	86	13	32	401	53	75
Nashville.....	14	4	5	.....	258	94	10	29	414	18	76
New Orleans.....	121	54	22	3,262	89	102	9	58	455	93	54
New York.....	2,722	1,766	682	49,643	311	530	134	365	6,510	1,257	627
Omaha.....	.....	.....	.....	.....	198	129	1	29	357	37	38
Philadelphia.....	548	142	75	5,986	18	43	22	37	885	223	107
Pittsburg.....	24	26	1	100	92	137	29	48	357	49	78
Portland.....	152	81	35	4,433	115	126	6	95	611	76	30
St. Louis.....	14	9	.....	153	198	298	28	51	598	108	60
St. Paul.....	57	19	3	222	71	62	8	30	250	35	31
San Francisco.....	281	193	17	16,309	219	155	57	66	988	117	83
Savannah.....	454	202	18	120	42	55	.....	10	781	20	204
Seattle.....	212	111	24	3,203	38	24	7	172	588	88	46
Total.....	5,345	3,085	1,268	96,129	3,280	3,113	503	1,406	18,000	3,021	2,349

BOSTON LABORATORY.

The work at the Boston laboratory was, as usual, about equally divided between import and interstate samples. The following special investigations have been continued or undertaken during the year:

FISH.—Work to detect, chemically, slight decomposition taking place in fish was continued from last year. This has been confined primarily to the sardines of the Maine coast, which, when caught filled with "red feed," a small crustacean, decompose very rapidly, and in a few hours, under usual conditions, are unfit for packing. The corrosion of unprotected tin containers by sardines in mustard sauce, as shown by periodical examinations of a lot packed under the supervision of the laboratory, showed that after processing the contents of the cans of the size known as eighths, contained about 200 mg of tin per kilo, which amount rapidly increased during four months' storage, at the end of which time about 800 mg per kilo were present. The packers have now generally adopted lacquered tins for these goods.

ARSENIC IN SHELLAC USED IN CONNECTION WITH FOOD.—An investigation was made of the content of arsenic in shellac of all kinds, but particularly in such brands as are used by confectioners for coating candy and by brewers as a varnish for their vats and other receptacles. Early in the year a confectioner's shellac was examined which contained 0.2 per cent of arsenic. This led to a study of such shellacs, and all examined were found to contain more or less arsenic, which is added in India in the form of the yellow sulphid to improve the color of the product, enabling an inferior product to be sold as a

superior one. Twenty-eight samples of shellac of various kinds purchased on the market contained an average of 526 mg of arsenic as arsenious oxid per kilo.

TALC ON CONFECTIONERY.—In connection with the work on shellac used for confectionery it was ascertained that there existed a practice of coating confectionery, such as Easter eggs, marbles, jelly beans, etc., with talc, though the use of talc in confectionery is expressly prohibited by the food and drugs act. The extent of the use of talc in this way was investigated and as a result its use has been practically abandoned, at least in so far as New England is concerned.

HOPS.—The antiseptic effect of hops has been investigated, the several samples examined of domestic and imported hops of different kinds showing that hops possess such a property in a varying degree.

CHICAGO LABORATORY.

The following investigations have been continued, and, as far as practicable, brought to conclusion during the present year:

(1) The composition of vanilla extracts prepared in the laboratory according to the United States Pharmacopœia from different kinds, grades, and lengths of beans.

(2) The composition of vanilla extracts prepared in the laboratory from typical kinds of beans following different methods of extraction.

(3) The effects of aging and bleaching on the composition and physical characters of flour.

The methods used in these investigations have, for the most part, been devised or developed at this laboratory. A method for determining the gasoline color value of flour and certain improvements in the process of determining vanillin, coumarin, and the lead number of extracts were elaborated. More recently special attention has been devoted to the determination of the color value of the lead acetate filtrate of vanilla extract as compared with that of the extract itself to obtain data of service in detecting foreign coloring matter. The quarters occupied for four years in the Manhattan Building having proved entirely inadequate, new rooms, covering about 3,000 square feet, have been secured and specially equipped in the Heisen Building, at the corner of Dearborn and Harrison streets.

NEW YORK LABORATORY.

IMPORTED FOODS.—The New York laboratory is chiefly concerned with the inspection of imported food and drug products. During the past fiscal year about 100,000 invoices of food and drug products have been inspected, representing a total value of merchandise of \$180,000,000.

Of the various lines of food products which have been inspected during this period, particular attention has been given to figs and ripe olives. During the late fall and winter months large and numerous shipments of figs and ripe olives arrive from the Mediterranean ports. Examination of these products revealed the fact that in many instances they were unfit for food, for the reason that the fruit was infested with worms or contaminated with their excreta, or fermented, moldy, and decayed. The presence of so many of the

worm-eaten and decayed olives in the shipments inspected was attributed to the practice of gathering and packing culls and windfalls, while the wormy, decayed condition of the figs was undoubtedly due to the methods used in preparation and packing. A noticeable improvement in the quality of the late shipments resulted, evidencing the exercise of more care in the selection of the fruit and the methods of gathering and packing.

During the past year a large number of samples of canned vegetables and fish have been examined for the presence of tin. Notable amounts of the salts of this metal were often found mixed with the contents, the same having been dissolved from the surface of the container. This work involved the selection of a method for the determination of tin which would be both expeditious and accurate, the procedures in common use being found lacking in both these respects.

In connection with the inspection of paprika and ground red pepper the study and detection of the adulterants commonly used has been continued. The refractive index of the nonvolatile ether extract of a large number of samples has been determined. The results indicated that when the conditions of drying the extract are properly controlled the refractive index as well as the iodine number will furnish evidence in the detection of added oil. As a result of collaboration of several chemists with the associate referee on spices, a provisional method for the detection of added oil in paprika was adopted in 1910 by the Association of Official Agricultural Chemists. In preparing the better grades of paprika only the shells and part of the seeds are used, the stems and placenta being removed. In order to utilize these by-products they are sometimes added to the cheaper grades, and as the addition of extra stems unquestionably injures the quality of the finished product it has been the practice to subject samples to careful microscopical examination in order to detect this sophistication.

The question of loss by evaporation on shipments of cloves entering into interstate commerce having arisen, certain experiments were undertaken by this laboratory upon the cloves as imported to determine the per cent and nature of this loss. Representative samples of cloves as imported were secured, put up in wooden boxes holding from 1 to 4 pounds, and allowed to stand under conditions similar to those followed by the spice grinders and spice trade, and the loss in weight determined after standing varying periods of time. Chemical analyses of the samples were also made for further information in determining the character of this loss.

In connection with the inspection of spices a large number of determinations of the ash of various varieties of black pepper and cayennes were made to ascertain the variations as to the normal ash content of these products.

COLORS.—The enforcement of the provisions of Food Inspection Decisions Nos. 76 and 77 has entailed a large amount of original work, both as regards the analysis of dyes offered for certification and the identification of colors found in foods. During the year improved methods of estimating Orange II in Orange I have been elaborated and methods for the quantitative separation of the seven permitted dyes as they occur in certified mixtures have been worked out. A scheme for the identification and separation of the oil-soluble colors has also

been originated. Many of these methods will appear in a report on coal tar colors, now in press.

CIDER VINEGARS.—The study of cider vinegar has been continued, one member of the laboratory having spent a considerable portion of the past fiscal year in the factories of New Jersey, Massachusetts, and New York. A large number of analyses of genuine cider vinegars and of vinegars manufactured from dried waste and from second pressings have been made and the data is being put in proper form for use in connection with the interpretation of results of analyses of commercial samples.

COFFEE.—The matter of the artificial sweating of coffee, which is sometimes practiced in the trade for the purpose of making the South American and other coffees imitate in color and appearance the Java coffee, has been the subject of much study during the past year. Both chemical and microscopical methods for the detection of this sophistication have been investigated to a considerable extent. These studies will be continued.

DRUG WORK.—Continued improvement in the crude drugs is shown. Only a small number of instances of entire substitution of foreign or inferior products is reported. In the case of certain leaves, such as buchu, uva-ursi, cubebs, senna, etc., the occurrence of excessive amounts of stems or twigs has raised a question as to the maximum amount of these substances that should be permitted, and as a general rule 10 per cent has been adopted as a temporary limit. This may be regarded as too liberal by many, but it was the opinion that at present trade conditions did not warrant a more severe limit, for the reason that the admixture has been very high, in some instances as much as 50 per cent, and it is necessary to give the trade some time to correct the methods of collection. Certain importers have arranged to remove the excessive portion of stems from the leaves, and shipments have been permitted entry on condition that this be done, the goods being again examined after the stems have been separated. During the past year buchu leaves have been scarce, due to the failure of the crop, and this has resulted in the presentation for entry of many lots of inferior quality as well as large quantities of long buchu, both of which have often contained large amounts of stems.

ERGOT.—Failure of the supply of ergot both from Spain and Russia has led to the shipment of very inferior lots of this product. Many of these are undoubtedly old goods and have been subjected to some process, such as baking, to prevent decay and worms, which treatment rendered the ergot worthless for medicinal purposes.

CUBEBS.—Large quantities of cubebs are continually being imported, the majority of which do not conform to the requirements of the United States Pharmacopœia, since they contain large quantities of sticks, stems, and immature and overripe berries. It is claimed, however, that these are being brought in for distillation purposes, and such shipments are released by the Treasury Department under such conditions as will insure their use for this purpose only. From the analytical figures it appears that immature berries are richer in oil than those that meet the requirements of the United States Pharmacopœia, and are therefore more suitable for distillation purposes. This matter is being further studied.

ASAFETIDA.—During the last year a large number of shipments of asafetida adulterated by the addition of foreign gums such as galbanum, olibanum, and ammoniacum have been presented for entry. This undoubtedly is due to the enforcement of the requirements of the United States Pharmacopœia with reference to the content of alcohol-soluble material. The investigations and studies necessary for the identification of these foreign gums have been made.

ESSENTIAL OILS.—The inspection of the essential oils has been extended during the past year to include all of those recognized in the United States Pharmacopœia, the work heretofore having been confined almost entirely to the orange and lemon oils. No particular investigation as to methods have been conducted, but data as to the composition of the oils presented for entry has been secured as a basis for future investigations.

PITTSBURGH LABORATORY.

The character of the samples examined at the Pittsburgh Laboratory was quite different from those of 1910, and a great deal of work was required for some classes of materials, notably candies. In addition to the regular examination of official samples, investigations of sirups and medicated soft drinks have been made. The applicability of the Rohrig tube to the determination of fat in cocoa and chocolate showed that this tube could be used in the determination of fat in cocoa with a double extraction, but was inapplicable to chocolate. A method for the determination of caramel in vanilla products has been elaborated and promises excellent results; this method is now being thoroughly tested on different kinds of vanilla extracts.

An important part of the work at this laboratory for the preceding year has consisted in the examination of a large number of samples of candies coated with shellac and other resins. Some of the earlier samples of this character examined showed the product to be coated with shellac containing rosin, and in some cases quite an appreciable amount of arsenic. The latter samples of candy show shellac only, which, however, in all cases contains a small amount of arsenic. Some manufacturers stated that they were willing to stop using the shellac provided other manufacturers will do likewise.

OTHER PORTS.

The following laboratories have made special studies of the subjects mentioned:

BUFFALO LABORATORY.—Investigations on the determination of fat, sugar, and cocoa shells in cocoa products were made. Studies were begun of various methods for the determination of fat in dried milks. Some work on the occurrence of sucrose in grape juice and the change on standing in the composition of grape juice to which sucrose had been added was begun. This work on grape juice was undertaken to determine whether added sucrose would become inverted on standing so as to make it difficult to determine upon analysis whether cane sugar had been added at the time of manufacture.

CINCINNATI LABORATORY.—An investigation of the manufacture of so-called maraschino cherries was made the subject of a special report to the bureau; the number of import samples examined was greatly increased, and the range of food products analyzed was extended.

DENVER LABORATORY.—Cooperative work for the elaboration of methods has been done, embracing flavoring extracts, sugar, and sugar products, and vinegar. The value of a new reagent, namely, paraphenylene diamine hydrochlorid, for the determination of citral in lemon oil has been experimented with and valuable data obtained. Numerous miscellaneous investigations have been carried on, such as studying different grades of coffee from the same packer in an endeavor to determine if the retail prices were consistent with wholesale values.

KANSAS CITY LABORATORY.—The photographic apparatus, adapted especially for the reproduction of labels, etc., first devised in this laboratory two years ago, was completed. Cooperative work was done on the general investigations outlined by the bureau.

NASHVILLE LABORATORY.—About 23 per cent of the total interstate samples were classified as drugs, and nearly 40 per cent of these were adulterated or misbranded. As these drugs were collected in this southern territory, the results indicate to what extent this part of the country is flooded with such concoctions. The claims were, in many cases, of an extravagant nature and calculated to play upon the imagination of the poorer class of people. This was the first year of import work at Nashville, and 24 samples were examined, of which 4 were found to be adulterated or misbranded. In collaboration with the bureau special investigations were made of the manufacture and composition of a confection in order to learn what effect the application of heat in the manufacture of this candy would have on certain fat values of the finished product. Some work was done on mixtures of coffee and chicory to obtain a method for the determination of the percentage of chicory present, based on the reducing power of pure coffee and mixtures of coffee and chicory.

NEW ORLEANS LABORATORY.—Early in the spring consignments of tomatoes from Habana were detained at this port, being misbranded as "Florida east coast tomatoes," which are considered in this market a better tomato than the Cuban variety. Eggplants marked "N. Y. eggplants" were also detained. The incoming Habana boats were met and the entire cargoes of fruit and vegetables inspected thereafter for about a month. Upon notification to the importers, and through them to the shippers, the practice of misbranding fruit and vegetables was promptly discontinued.

OMAHA LABORATORY.—Research work on methods of analysis has been conducted with special reference to the determination of sugar in chocolate, of benzoic acid in food products, and of the iodine number on chicken fat. During the year a working equipment for bacteriological analysis has been installed to permit of a more complete study of the condition of various food products. During the month of June the working force of this laboratory were engaged in preparing for, and assisting in, the field and laboratory work in connection with

the special egg investigation conducted by the Food Research Laboratory at this point.

ST. LOUIS LABORATORY.—A large number of vanilla extracts of various kinds were made for information in connection with certain vanilla extract cases pending in court, and a special study was made of a commercial egg preservative. An investigation of the changes taking place in apple juice during barrel fermentation into cider vinegar has been begun and the observations will be continued on this sample of vinegar.

SEATTLE LABORATORY.—The examination of imported foods and of various products for other departments of the Government has constituted the bulk of the work of the Seattle laboratory. Special work and investigations included: (1) The study of the distinction between crude and refined sulphur for the local customs officials; (2) a study of so-called near-beers sold in prohibition sections; (3) the preparation of Circular 63, Bureau of Chemistry, on food colors; (4) cooperative work on preservatives and headache mixtures; (5) a report of the opinions of local dealers, etc., regarding certain spices; (6) a report to the quartermaster's office, United States Army, Seattle, on the water in the submarine cable tank at Tacoma, Wash.

ST. PAUL LABORATORY.—A study was made of wheat flour of known origin and definite history for the purpose of securing information leading to the fixing of more definite limits of composition for wheat flour of the various grades. For this purpose, some 66 samples were secured and analyzed, involving about 660 determinations. The flour thus examined was obtained principally from the Southwestern States and manufactured from winter wheat. A large importation of green olives, apparently purchased as second quality, was condemned during the year, wormy olives and those stung by insects constituting the bulk of the shipment.

EXAMINATION OF DAIRY PRODUCTS UNDER THE LAW.

The work of the dairy laboratory, as in previous years, has covered the entire range of dairy products, including other articles closely related thereto, such as malted milks, lactated infant foods, butter colors, ice-cream thickeners or fillers, and other articles of minor importance. The total number of samples examined was 513, of which 320 were official interstate and import samples, the remaining 193 being of miscellaneous origin, and consisting chiefly of evaporated milks examined in the course of an investigation of the manufacture of this product. A classified list of the samples examined is as follows:

Evaporated milks.....	201	Condensed skimmed milks.....	13
Cheese.....	91	Ice creams.....	13
Cream.....	39	Oleomargarins.....	8
Butter.....	32	Ice-cream thickeners.....	5
Malted milks and lactated foods.....	29	Miscellaneous butter colors, butter	
Condensed milks.....	28	flavors, fermented milks, etc.....	9
Fresh milks.....	25		
Dry milks.....	20	Total.....	513

The greater part of the work under the food law during the year was upon evaporated, condensed, and dried milks, malted milks, lactated infant foods, cheese, and butter.

In canned evaporated milks skimming is comparatively rare and the addition of foreign substances almost unknown. The most common fault is that of low concentration—thin milk—but there has been such a difference of opinion as to the degree of concentration properly to be required in an evaporated milk that but few legal actions have been brought on this charge. In one case, however, a large shipment was seized because of low concentration, and the goods condemned by the court.

For the purpose of fixing upon a fair and just requirement in the matter of concentration the bureau in 1909 began an investigation of the manufacture of this product, which lasted until the fall of 1910. In this investigation factories were visited in various parts of the country, the processes of manufacture were observed in detail, and numerous analyses made of the resulting products produced under observed conditions. Opportunity to observe, and to investigate if desired, was freely granted at nearly all the factories visited, always, however, with the understanding and pledge that the details of factory procedure would not be divulged. The data obtained, however, were used as the basis for a decision on the subject, published early in the present year as Food Inspection Decision 131, on the composition of evaporated milk.

Shortage in the weight of canned evaporated milk is uncommon, and when found is usually so small as to be regarded as accidental, due to the faulty working of the filling machine. This view, however, could not be taken in an instance where a shipment of goods was found to contain only 15½ ounces in cans labeled as "20-ounce size."

Condensed milk, both the sweetened and the unsweetened, when designed for sale in bulk is frequently made from skimmed or partly skimmed milk, and there are constant attempts to sell these skimmed products for genuine condensed milk. The use of the term "skimmed" or "partly skimmed" is studiously avoided by some manufacturers. The distasteful term was in one instance replaced on the label by the word "blended," but the goods were seized as misbranded and condemned by the court.

Violations of law in the cheese trade consist nearly always in the sale of skimmed or partly skimmed cheese for the genuine article, and in short weights. The first is a somewhat common offense, because this practice was so general prior to the existence of the food law that to effect complete reform is a slow and difficult process.

A classified list of the cases prepared by this laboratory is as follows:

Milks and creams.....	198	Butter.....	14
Cheese.....	44	Dry milks.....	7
Ice creams.....	40	Ice-cream thickeners.....	2
Evaporated milks.....	21		
Condensed milks (sweetened).....	21	Total.....	347

Of these, 163 were prepared from analyses made in branch laboratories of fresh milks and creams and ice creams, and 30 from analyses of fresh milks and creams made by the health officer of the District of Columbia. As usual, much work has been done in the study of methods for the analysis of dairy products.

DRUG INVESTIGATIONS.

IMPROVEMENT OF METHODS.

Much time has been devoted during the last fiscal year to special investigations for formulating and adapting analytical methods to the examination of various drugs, simple and mixed. Special attention has been given to the following subjects:

ACETONE AND METHYL AND ETHYL ALCOHOLS.—Methods for the estimation of methyl and ethyl alcohol and acetone in mixtures have been studied with a view to improving and simplifying these determinations, and the results already obtained justify further work along this line.

ALCOHOL AND ETHER.—The separation and estimation of alcohol and ether, especially in mixtures containing essential oils, was studied, the method depending upon the separation of the ether by means of condensers and alcohol traps maintained at a temperature between the boiling points of the two substances and the subsequent estimation of the ether in aqueous solution by means of the refractometer. The procedure gives promise of success.

MORPHIN COMBINATIONS, ETC.—Methods for the estimation of morphin salts in preparations as such, and morphin in opium preparations such as paregoric, soothing sirups, cordials, laudanum, and Chinese pills, have been made a special study and the results obtained are very satisfactory. This method appears in Chemistry Bulletin No. 137, recently issued.

SYNTHETIC PRODUCTS.

During the past fiscal year the synthetic products laboratory has examined 197 samples, of which 119 were interstate, 27 import, and 51 unofficial. As the result of such examination 60 cases were recommended to the chief of the bureau for prosecution and 3 for seizure. During this period 18 Notices of Judgment dealing with products of this nature have been issued. The illegal samples included a great variety of products—such as preparations for headache, colds, grippe, rheumatism, fevers, asthma, etc., medicinal wines, soft drinks, and beverages, various gums, as tragacanth, Indian mesquit, ghatti, asafetida, etc. Several samples were examined for other departments and numerous check analyses were performed for other laboratories.

Cooperative work on headache mixtures and similar products has given some gratifying results, several new methods relating thereto having been elaborated, notably one for the estimation of salicylic acid in the presence of boracic acid. Methods for the quantitative separation of caffeine, acetanilid, sodium salicylate, and alcohol in the presence of essential oils have been fully tested and approved.

In connection with the examination of powdered gum tragacanth, attention was directed to the desirability of improving the methods of checking the purity of this commodity. After considerable experimentation with authentic samples of the whole and powdered gums, and also with whole and powdered so-called Indian gums (*Sterculia urens* and *Cochlospermum gossypium*), extensively employed as adul-

terants for pure gum tragacanth, it was found that the amount of volatile acid (acetic acid) generated on treatment with dilute phosphoric acid and subsequent distillation with steam could be used as an indicator of the purity of such gums, inasmuch as the Indian varieties yield approximately seven times as much volatile acid as pure gum tragacanth.

ESSENTIAL OILS.

During the year 163 samples of essential oils have been submitted to examination in this laboratory; of this number 15 were reported as adulterated or misbranded. A number of unofficial samples of oils have been examined with the object of determining the best methods for their analysis, especially with respect to the determination of the ketones and aldehydes by the hydroxylamin titration method. A variety of samples have been submitted to this laboratory for check analysis, including both import and interstate samples of essential oils, as well as samples of cod liver oil compounds, spirits of camphor, etc.

A chemical investigation of oil of chenopodium has been carried on, having in view especially the extension of our knowledge of the properties of the peculiar medicinally active ingredient, ascaridol. The results of this investigation, so far as completed, are to be found in Chemistry Circular 73.

PHARMACOLOGICAL INVESTIGATIONS.

These investigations were devoted largely to the pharmacology of caffeine and were conducted along the following lines:

(1) Research work on the comparative toxicity of caffeine in different species of animals. The results have been compiled.

(2) A number of experiments on the toxicity of caffeine under pathological conditions, with additional work on the effects of feeding caffeine over long periods of time, i. e., chronic caffeine intoxication in cats, dogs, and rabbits, both in normal and in fasting animals.

(3) The work on caffeine glycosuria has been practically completed.

(4) The study of the alleged destruction of caffeine by the liver has been completed; no destruction of caffeine was observed.

(5) The effect of caffeine on protein metabolism in dogs was also concluded. The results obtained show that protein metabolism is not disturbed to any extent during the administration of the drug, although symptoms of caffeine intoxication were manifested. When caffeine was withdrawn, however, there was a marked increase in the elimination of nitrogen.

(6) The study of the elimination of creatin and creatinin in rabbits, begun in the previous year, was concluded. It was found that caffeine stimulates the elimination of creatin, but has no effect on the creatinin.

(7) Additional experiments on the circulatory changes produced by caffeine were made, but this work has not been completed.

(8) The demethylation of caffeine in the body has been studied during the past year in rabbits and dogs, under normal and under pathological conditions. The results indicate retarded demethylation in chronic alcoholism in rabbits.

(9) The elimination of caffeine in the urine of rabbits was studied and the results obtained thus far indicate that it is partly eliminated unchanged.

Other investigations are as follows:

(1) The pharmacology of the alcohols and of other compounds of the fatty acid series was investigated and the influence of alcohol on protein metabolism was studied in dogs. The results obtained indicate that small doses of alcohol exert a sparing influence on body protein, while large doses favor protein katabolism.

(2) A good deal of work has been done on the pharmacology of oil of chenopodium and ascaridol. Experiments on this subject are still in progress.

(3) Much of the information acquired on the physiological effect of various drugs and chemicals was used in connection with the enforcement of the food and drugs act and the preparation of expert testimony along these lines. Especially was this true of the caffeine data in its relation to so-called medicated beverages.

CHEMICAL REAGENTS.

During the last year 427 chemical reagents, supplied to the Bureau of Chemistry and branch laboratories on contract, have been examined. The quality of chemicals supplied during the year does not compare favorably with those supplied in 1910. This is attributed to the fact that contracts were awarded to bidders who had not been accustomed to supplying goods to the bureau for analytical purposes. Numerous samples have been supplied by the Government General Supply Committee, with which the Division of Drugs has cooperated in every possible way.

The following represent a portion of the rejections made during the year:

Benzol, chemically pure, contained organic impurity.

Acetone, yellow in color, contained organic and nonvolatile matter.

Rochelle salt, suspended foreign material giving turbid aqueous solution.

Hydrochloric acid, low in acidity.

Potassium oxalate and citric acid contained heavy metals.

Ammonium hydroxid, low in ammonia content.

Potassium sulphate contained nitrogen.

Potassium peroxid, high in acidity and deficient in hydrogen dioxid; one shipment contained acetanilid.

Several shipments of absolute alcohol were found to contain fusel oil.

A number of lots of ether, chemically pure, absolute, were rejected owing to the fact that the article contained an excess of nonvolatile material and gave the test for the presence of peroxid.

The manufacturers, however, work in hearty cooperation with the bureau in its efforts to obtain chemicals satisfactory for analytical purposes. The special glacial acetic acid on contract required to comply with the sulphuric-acid-bichromate test has been found to meet the requirements. It is very desirable that specifications for chemical reagents be established and this work is in progress. As a further step in this direction, the following recommendations were made at the last meeting of the Association of Official Agricultural Chemists, held in Washington, November, 1910, by the committee on testing of chemical reagents, of which the chief of the division of drugs is chairman.

(1) That the designation "C. P." be applied only to such chemical reagents as are free from recognizable impurities.

(2) (a) That the term "reagent" be applied to all commonly employed chemical reagents which are free from all impurities to such an extent as to permit their use in all ordinary qualitative and quantitative chemical analyses. (b) That a specific set of tests, with which the chemical must comply, be drawn up and adopted for each chemical reagent.

(3) That the term "special reagents" be employed only for certain reagents to be used chiefly for making special determinations which require absolute freedom from certain impurities.

COOPERATION WITH THE POST OFFICE DEPARTMENT.

The Drug Division has continued to cooperate with the Post Office Department in its effort to withdraw the privileges of the mails in cases of the violations of the postal laws involving medicinal agents. To this end the analysis of the samples of medicines used is supplemented by a study of all of the claims and representations made for the products. Twenty-one of these treatments were investigated during the past year, each comprising from one to ten medicines. Seven of them were so-called "epilepsy cures." None of the latter are sold in the shops, but all were obtained through the medium of the United States mails. Each was claimed to bring about a complete and permanent cure of epilepsy, irrespective of kind and cause, if taken according to directions. The representations were conveyed chiefly in newspaper advertisements and printed matter sent through the mails to prospective purchasers; very few claims appeared upon the label of the containers themselves. The representations were generally to the effect that as a result of the use of the treatment the epileptic seizures are lessened in frequency and severity, any diseased condition of the brain is corrected, and brain tissue which has been damaged or destroyed is replaced; this change goes on steadily until the whole nervous system is restored to a sound and normal condition, and, the cause being removed, the convulsive seizures no longer make their appearance and the epilepsy is cured never to return. Such claims are false and misleading in the highest degree. The medical profession knows of no substance or mixture of substances which is capable of creating new brain or nerve tissues in place of the old which has been removed or destroyed. Some of the treatments comprised several medicines, but in nearly every instance the essential ingredient was found to be one or more of the bromids. While these agents may in some cases postpone the epileptic attacks, their effect is temporary and palliative only, and according to the best authorities they can not be considered as cures for epilepsy.

Three so-called "cancer cures" were examined. One of them, which was represented among other things to be a positive, permanent, painless cure for the disease, was found to consist of two medicines, one of which was a solution of sulphur and sodium hydroxid in water, and the other a solution of Epsom salts with a little vegetable matter. Imported Limburger or Swiss cheeses and glycerin, kneaded to a paste with the fingers and applied to the cancer, formed an important part of the "cure." Such a treatment can not cure cancer, and its

use may cause the loss of invaluable time at the only stage when cancer is believed to be amenable to radical treatment, namely, the very earliest stage. Another cancer "cure" was found to consist essentially of potassium iodid, an agent which is frequently employed in the treatment of syphilitic affections. It often forms a part of "cures" of this kind, its use being really directed to the relief of syphilitic troubles which are erroneously believed to be of a cancerous nature. The Post Office Department has issued nearly a dozen fraud orders in this class of cases and as a result the mail-order cancer cure business has practically been suppressed in this country.

Two consumption "cures" were investigated. Both were found to contain ordinary medicinal agents which might perhaps have a temporary and palliative effect in relieving the distressing symptoms of the disease, but which can not in any proper sense be considered as cures for consumption. Millions of dollars are spent annually to retard the progress of pulmonary tuberculosis, but it is well known that there is at present no specific for its treatment. Anyone engaged in exploiting a so-called consumption "cure" is simply trafficking in the life and health of the people, since the time lost in such a way may result in the death of the victim by delaying the use of proper hygienic measures.

In addition, there were investigated disguised treatments for the prevention of conception and for the production of abortion, for the restoration of hearing, and for the cure of rheumatism, and other diseases.

STUDIES OF FOODS AND FOOD MATERIALS.

SPECIAL INVESTIGATIONS OF THE DIVISION OF FOODS.

FRUIT PRODUCTS.

The economic studies relating to fruit products have been continued in cooperation with the pomologist in charge of field investigations of the Bureau of Plant Industry. In connection with the study of the utilization of surplus fruit the yield of juices made in different ways from various fruits has been studied on a scale sufficiently large to be easily extended to commercial proportions. Special attention has been given to the causes of the disappearance of flavor in the juices of citrus fruits after sterilization. The preparation of dried sugared pineapples has been studied on a scale large enough to secure data applicable on a commercial basis. The investigation of the ripening of persimmons without softening has been continued and has shown that this can be best effected by confining the fruit in a closed space in an atmosphere of carbon dioxid. Thus far the experiments have been conducted on a laboratory scale, but field work is planned for the coming season as a result of which it is believed that definite directions can be given for commercial processing by the grower.

A study of the respiration of fruits as an index of their physiological activities has been continued and extended to cover the effect of temperature on the vital processes. It has been found that various fruits differ widely in their rate of respiration, but that they are similarly affected by changes in temperature. The respiration in all

cases was increased about 2.5 times for each rise in temperature of 10° C. In cooperation with the Office of Nutrition Investigations, Office of Experiment Stations, the bureau is now studying the heat evolved by the banana during ripening in the respiration calorimeter.

THE MANUFACTURE OF CITRUS BY-PRODUCTS.

Owing to the difference in economic conditions the methods employed for the manufacture of citrus by-products in southern Europe are not applicable in the United States. A laboratory study has been made with a view to increasing the use of mechanical devices and otherwise lessening the cost of production, and has reached the stage where it seems advisable to conduct the work on a commercial scale. It is proposed, therefore, at the beginning of the next packing season, to equip a small experimental plant for the study of the economic manufacture from waste citrus fruits of citric acid, citrus oils, juices, and several preserved products.

ESSENTIAL OILS USED FOR FLAVORING FOOD PRODUCTS.

An investigation of citrus-fruit oils extending over several years has been completed during the past year, and a report upon the subject is in preparation. A study was also made of the manufacture, composition, and methods of analysis of the oils of wintergreen and birch and of methyl salicylate. It is important to know the distinguishing characteristics of these products, as the last two are frequently substituted for the wintergreen. Other essential oils, such as oil of sassafras and spearmint oil, were also studied.

FIELD EXPERIMENTS IN THE MANUFACTURE OF CIDER VINEGAR.

In order to determine the changes taking place during the conversion of cider into vinegar under commercial conditions, a field laboratory was established at a factory in Benton Harbor, Mich., and also one in Albion, N. Y. The plan of the work was to make analyses of the cider used as a vinegar stock and then collect samples of this after it had passed through generators and been converted into vinegar, in order to determine the exact changes which took place during this acetification.

This experiment was carried on during a period of several months, as it was found to take some time for the effect of a change in composition of the cider to show itself in the finished vinegar. Some very valuable information was obtained, showing that in the acetification of the cider by the generator process practically the only change is the conversion of the alcohol into acetic acid. It was also shown that the generator vinegar is very much more uniform in composition than vinegars made by the old-fashioned barrel process, during which they are subjected to varying conditions, and that certain relations exist between the ingredients of the generator vinegar which are valuable in detecting adulteration of the commercial product. The glycerin present in the fermented cider was not affected by the conversion into vinegar, and a very valuable factor was thus obtained for the detection of adulteration, which has been used in a number of cases to great advantage, proving conclusively the dilution of cider vinegar with the distilled product.

THE INFLUENCE OF TIN RECEPTACLES ON THEIR CONTENTS.

This study has been continued during the past year. A set of samples of 11 varieties of foods packed in lacquered containers of heavy and light coating were examined for the second time after the interval of a year, to note the increase of tin content on storage. Samples of 22 additional varieties of foods were examined 6 months after canning, in order to determine the amount of tin contained in the foods at the earliest date at which they are likely to reach the consumer. Additional samples of these goods are retained for future examination. The results thus far obtained indicate that some of the acid fruits when packed in plain tin contain from 200 to 250 mg of tin per kilogram of material, exclusive of juice, at the earliest date on which they are likely to reach the consumer, and that this amount is greatly increased after a year's additional storage. The amount of tin dissolved by the food is greatly decreased by the use of lacquered tin.

Special attention has been given to the question as related to a number of foods which are practically free from acid, but which are known to attack tin to a considerable extent, such as canned shrimp, pumpkin, and string beans. Since this action was most pronounced with shrimps, they were first studied, and it appeared that the action in such cases is due to the presence of volatile alkalies, inasmuch as mono-methyl-amin was found in considerable quantities in canned shrimps and amins and amino acids are present in the foods mentioned.

EDIBLE OILS.

In collaboration with the Bureau of Plant Industry, progress has been made in the clarification of peanut oil, and a study has been inaugurated of the chemical composition of various soft-shelled pecans and of the oil contained by them, with a view to determining whether the composition would shed any light on the distinguishing features of various varieties.

WORMY AND DECOMPOSED FOODS.

Certain classes of dried fruits in a wormy and partially decayed condition continue to be placed on the market. This results from several causes—sometimes from curing by imperfect methods and in insanitary surroundings, and sometimes from careless storage, the products being exposed unduly to the attacks of insects. In ripe olives decay has sometimes resulted from the practice of discarding the brine in which they were originally packed, for the purpose of saving freight. In such cases, especially when shipments are exposed to unusual delay, the goods reached this country in a condition that did not warrant their use as food. The risk involved in this method of shipment has been pointed out.

It has frequently happened also that a considerable portion of the ripe olives shipped in bulk were contaminated by worms. Figs and marrons, imported into the country to a considerable extent in the fall, were frequently found to be wormy and sometimes moldy and decayed. The efforts of the department in this direction have

resulted in a great improvement in such imported products, and it is believed that the foundation has been laid for far greater improvement during the coming season.

An extensive study has been made of the manufacture of foods from waste, trimmings, and especially from material undergoing decomposition and of the elaboration of methods by which the use of such material could be detected by the examination of the finished article. The first attention was given to the study of tomato ketchup, with the result that it is now possible to distinguish in a general way the product made from sound, ripe, and properly cleaned tomatoes from those in the preparation of which unfit material was employed. During the last year the bureau has come in contact with a large number of manufacturers of ketchup, and it is believed that great progress has been made in the elimination of the use of decomposed material in the manufacture of this product. A beginning has been made in the application of the same and similar methods to the inspection of manufactured fruit products such as jellies, jams, and marmalades. The question is still being studied both in the laboratory and in the factory.

CAUSES OF SPOILAGE OF CANNED FOODS, KETCHUPS, ETC.

Work was continued during the past season on food preservation and the methods of preventing spoilage. The study of the cause of reddening of dried cod and other salt fish was continued, especially at Gloucester, Mass. Many suggestions were made for improving the sanitary condition of the water supply and of the fish factories, which, if carried out, it is believed will lessen infection and the resultant spoilage.

During the manufacturing season experiments were continued at Lafayette, Ind., in the making of tomato ketchup, using pulps of varying quality and cleanliness and in different states of spoilage. The completed product gives evidence of the character of material used, and the method of manufacture can not completely disguise the facts when the product is subjected to microscopic and chemical tests. The three most important factors in producing a clean ketchup are the selection of the fruit, thorough washing, and rapid handling of the product in the course of manufacture. Studies were also continued on the different factors which tend to preserve the ketchup. It was found that no one of the spices nor all the spices in combination when used only in the quantities necessary for flavoring had any preservative effect. The keeping quality depends principally on quality of the raw product, cleanliness of manufacture, the concentration of the tomato pulp with the sugar and vinegar, and upon sterilization.

The work upon canned goods consisted largely in a study of the proper quantity of material to use in the can, and the degree of temperature and length of time that should be given in processing in order to get the best result in the finished product. There is opportunity for improving the general quality of canned goods, but the specific directions can not be given until the results of several seasons' work have been accumulated.

FOOD COLORS.

Two extensive studies on coal-tar colors have been brought to completion during the past year under the direction of B. C. Hesse, of New York, a color expert appointed for the purpose of making these investigations. The food-inspection laboratories at Washington, at New York, and at Seattle have also done a great deal of work along this line. The first investigation included the original work done in the bureau and also a comprehensive survey of the literature with special reference to the harmfulness of coal-tar colors and their physiological effects. These data, on which the selection of the seven permitted colors was based, are in the hands of the printer. The second study consisted in the investigation of methods for determining the chemical identity of coal-tar dyes used in food products, as a result of which 134 different chemical individuals have been grouped in 10 analytical tables. Of these only 19 are paired, leaving 115 dyes which can be conclusively identified by these tables without known specimens. The dyes of each of these pairs can be thus distinguished from every other pair and from each of the other 115 dyes, but the pairs can be distinguished from each other only by having known specimens of at least one member of the pair. In no case is one of the permitted dyes of Food Inspection Decision No. 76 paired with another dye. The tables include all but three of the dyes said to be used in food products, and these appear to be now obsolete; they also include all dyes that have been examined physiologically and which are not obsolete or impracticable for use in foods. These data are now in process of compilation.

The investigation of the character of artificial colors used in various food products has been continued and admission into the United States has been denied to foods colored with unpermitted dyes. Considerable attention has also been given to the natural coloring matter in foods, especially in flours in connection with the bleaching process, and the application of the spectroscope to the general problem. A study has also been begun of the coloring matter of the common foods which have a characteristic color with a view to establishing another means for the detection of the substitution of one food for another.

MANUFACTURE AND COMPOSITION OF EGG NOODLES.

This product is assuming considerable importance, and it has become necessary to be able to determine from the examination of the finished article the proportion of eggs used in its preparation. With this in view, a representative of the bureau visited a large factory and with the assistance of trained workers manufactured under commercial conditions egg noodles made with varying amounts of egg and from various classes of eggs. The analyses of these preparations have afforded valuable data for judging accurately of the quality of commercial products.

COMPOSITION OF BEER MADE FROM VARIOUS MATERIALS.

In collaboration with a local brewery, samples have been taken of various beers at different stages of their manufacture, and the data obtained from their examination are believed to be of value in the

interpretation of results obtained in the analysis of beer sold on the market. In connection with the study of imported foods, attention has been given to the character of lupulin imported by brewers for use in the manufacture of beer. Many shipments are found to contain an excessive amount of mineral matter, and the Treasury Department has required that the percentage of ash or mineral matter be stated on the label, provided the products are below the standard strength of the Pharmacopœia.

MISCELLANEOUS INVESTIGATIONS.

A number of special investigations have been made, involving in the aggregate much time and expense with a view to securing data necessary to the enforcement of the food and drugs act. Among these may be mentioned the following: The meaning of the term "maraschino" and the composition of the product bearing that name, samples of the genuine product from Zara, Austria, having been collected by the American consul. Attention has been given to the Spanish pimento, which is imported into the United States in considerable quantities. This product is often sold as paprika, and shipments frequently have an excessive amount of ash, due often to dirt and sand clinging to the product and ground with it. As a whole it has been found that the pure capsicums do not contain more than 6.5 per cent of mineral matter, but a special investigation is being made regarding the normal ash content of this variety.

Attention has been given to the Norwegian and Spanish anchovies, and the department has held that they may be so designated, provided the labels also contain in the English language the word "sprats," or if labeled entirely in the Norwegian or Spanish language the label bears the word "Brisling," or some other equally appropriate term showing the true character of the fish.

The manufacture and chemical composition of gelatin has been studied, with a view to securing data by which gelatin made from decomposed or otherwise inedible material might be distinguished.

ANALYTICAL METHODS.

For the sake of securing greater uniformity in analytical results and to prove the efficiency of new methods that are proposed, samples are sent from time to time to the various laboratories of the bureau for examination and report. The results are carefully studied, and where discrepancies occur (due often to the lack of detail in the statement of the method) the matter is taken up by correspondence or by the study of additional samples, until the difficulty is eliminated. Among the methods studied in this manner during the last year are methods for the detection and determination of organic acids in common foods; methods for the detection of deterioration and decay in such products as ketchups, jellies, and jams; methods for the examination of noodles with a view to determining the amount of eggs used in their preparation; methods for the examination of flavoring extracts and essential oils.

EXAMINATION OF FOODS FOR OTHER DEPARTMENTS.

From time to time during the year samples of foods have been examined for other departments of the Government, such as the Army, the Navy, the Panama Canal Commission, and the Insane

Asylum of the District of Columbia. Over 400 samples of foods were also examined for the General Supply Commission for the purpose of assisting them in awarding contracts for the present fiscal year.

VOLUME OF WORK.

It is difficult to make an adequate statement of the volume of work accomplished. The number of samples is a very unsatisfactory index of the amount of work really done, owing to the wide variation in the skill and time expended on different problems and different classes of products. As a rough estimate of the volume of the work, however, it may be said that the samples actually numbered and examined in the division of foods during the fiscal year aggregated 5,028, several numbers of course being assigned in some cases to the samples for a single investigation.

WORK OF THE FOOD RESEARCH LABORATORY ON PERISHABLE PRODUCTS.

The food research laboratory has continued the study of the handling of poultry and eggs, improving quality and lessening loss thereby, as well as furnishing information of assistance in enforcing the food and drugs act.

FIELD INVESTIGATIONS ON POULTRY.

In July, 1910, the field branch of the food research laboratory was transferred from a poultry packing plant in Atchison, Kans., where investigations had been going on for about seven months, to southwestern Iowa. Here two poultry packing houses were sufficiently close together to be drawn upon for material for laboratory investigation and for shipping experiments. The laboratory was installed in a room in one of the packing houses and was always open to visitors. The breadth of the work is well indicated by the variety of persons who came to the laboratory. They ranged from professors in agricultural colleges, keen to provide their students with the newest facts concerning food investigation, to the railway refrigerator-service man, anxious to get perishables to market in sound condition, and the housewife who wants to know how to determine the wholesomeness and desirability of the poultry she purchases.

Through the cooperation of the different branches of the industry arrangements were made for the continuous observation and investigation of poultry shipments from the time of killing, in Iowa, to the sale to the consumer in New York. The special problem selected was a comparison of "dry packing" with water chilling and "ice packing." The dry-picked poultry was chilled in cold air until the temperature of the body cavity indicated that the animal heat had been removed; then it was packed in boxes, holding 12 birds, shipped in a refrigerated car, and maintained under dry refrigeration until marketing was finished. By the method of water chilling and "ice packing" the birds, after picking, were thrown into tap water for a short time; then into water and ice; and finally into crushed ice, in which, packed in barrels, they were shipped for the six or seven day haul to New York, where they were kept in actual contact with ice until the close of marketing. In order to determine the comparative value of these two methods of

packing, chickens killed in the same way, at the same time, were chilled and packed as above indicated and shipped, side by side, in the same refrigerated car to the same receiver, and marketed, side by side. They were examined bacteriologically and chemically in the packing house before they were shipped, and after every change in environment samples went to the laboratory, where analyses determined the rate at which changes in the flesh were progressing. Visual inspection along usual market lines was, of course, a part of the testing. Such shipments were sent once or twice a week from September until February, when the poultry season for that part of the country practically closed.

The laboratory was then transferred to another poultry packing plant in Nashville, Tenn. This location was chosen because of the very rapid development of the poultry and egg industry in Tennessee and Kentucky and the important rôle which this part of the country plays in furnishing fresh eggs and poultry to the North during the winter season. The results, as measured by a keen interest on the part of the poultry men of the section and an endeavor to adopt better methods of handling for both poultry and eggs all along the line, have fully justified its selection. The same problem, namely, dry and wet chilling and shipping, is studied at this point. The general practice in the West is to ship for long hauls dry packed; the South has almost invariably shipped wet packed during warm weather. That each method of procedure might have a fair trial it has been deemed advisable to conduct experiments on the commercial routine in separate territories where each has had the preference. The length of haul is about the same in each case. The receiving point is the same. The establishment of the laboratory in the packing house itself permits of a heartier cooperation between the investigators and the industry than would otherwise be possible. General problems of all kinds are discussed, and experimentation, with the assistance of the field force, is being pushed along many minor yet important lines by the packers themselves.

Aside from the main problem chosen for the season's work, the field branch has conducted many side lines of study, testing theories of marketing by holding produce under conditions similar to those of marketing and determining in advance of shipping the general trend that the results would be likely to follow. Each problem has been referred to the laboratory, as well as subjected to careful tests such as are used by the trade to determine quality and condition. The visiting of poultry plants in the vicinity of the field station, the discussion of improved methods of handling with individuals, informal talks illustrated by charts, etc., on marketing and dressing, as well as meeting with more formal gatherings of organized associations of all branches of the industry, would entirely occupy the time of one field man should all invitations be accepted. The educational work at the receiving center among commission men, jobbers, retailers, carriers, warehousemen, etc., has progressed along many lines. An illustrated talk was given in New York, showing the usual procedures for the receiving, feeding, killing, dressing, chilling, packing, and shipping of poultry in the western producing section. This was followed by an exhibition, in one of the refrigerated warehouses in the city, of poultry dressed in various ways 1,000 miles from New York and

shipped in refrigerated cars. The condition of the birds on arrival depended upon the manner of dressing, as was plainly apparent to even the casual observer. Such practical demonstrations to the industry of the results of proper handling on the condition, appearance, and eating quality of the birds are creating a higher and more rigid standard of excellence and decreasing the poorly handled poultry found on the market.

FIELD INVESTIGATIONS ON EGGS.

HANDLING OF EGGS.

The handling of eggs has received a goodly share of attention in the field work. The condition of eggs of varied histories brought to the packing house in diverse ways has been studied on their arrival. They have been subjected to varied experimental handling and finally a number of shipments have been made, especially of the much-debated "Southern" egg to determine its ability to travel, store, and market. Experimentation along this line is especially desirable in view of the enormous numbers of southern eggs lost by bad handling and their lowered market value due to poor condition.

A practical demonstration of the field work was given during the early summer to the members of the Southern Poultry and Egg Carlot Shippers' Association when the organization meeting of that body was held in Nashville, Tenn. The demonstration, which was given in the packing house, involved killing, picking, chilling, and packing poultry, and the candling, chilling, grading, and packing of eggs. A lantern-slide talk showed as plainly as possible poultry conditions in other territories, and the laboratory, with its varied apparatus, was thrown open and its work explained.

FROZEN AND DESICCATED EGGS.

The actual condition of damaged eggs of various sorts—as cracked eggs, slightly incubated eggs (such as appear by the thousand in every market during hot weather) shrunken eggs, etc.—has been made the subject of a special investigation during the summer of 1911, as well as the study of frozen and dried eggs and egg products, the great bulk of which are prepared in the producing sections of the Central West. It has seemed desirable to conduct the experiments in that section, cooperating with the industry as heretofore, and accordingly the Omaha food and drug inspection laboratory, with its equipment and working force, was assigned to this investigation for the season, and the laboratories of the bureau in Washington, as well as the food research laboratory, were drawn upon for workers to prosecute the inquiries. Egg-breaking establishments within the radius of a night's ride from Omaha were visited and working relations established. Eggs from various sources were secured and examined bacteriologically and chemically, their quality varying from the highest grades to the eggs unfit for food as judged by odor, taste, and appearance. Samples of eggs broken and handled in the manner customary in the various breaking plants were sent to the laboratory and examined. Special methods of breaking and handling were tried, and the results carefully compared, that better methods for the saving

of eggs fit for food might be found and that eggs unfit for consumption might surely be eliminated. It is very desirable that eggs which are of doubtful shipping quality, yet still wholesome, should be conserved at the source of production, but such conservation has not heretofore been always conducted in a manner calculated to give the best results for either the consumer or the producer. The investigation outlined aims to remedy these defects so far as possible.

Any report of this field work would be incomplete without a statement concerning the industries cooperating in the solving of the problems. The poultry and egg industry, as organizations and as individuals, have placed every facility at the disposal of those conducting the investigations. While it is with the shipper on the one hand and the receiver on the other that most of the practical work has been done, yet the carrier who is endeavoring to transport the goods to market in a sound condition also cooperates in the campaign to preserve perishable products, and the warehouseman who stores perishable products is another ally in the endeavor to conserve food in a wholesome, palatable condition. Standing as the warehouseman does, between the shipper on the one hand and the distributor of foods on the other, his opportunity for influence and education is broad and varied, and his assistance in the promulgation of the doctrines of good handling is essential.

LABORATORY INVESTIGATIONS ON EGGS AND POULTRY.

At the food research laboratory in Philadelphia the commercial problems are put on a firm, scientific foundation before field experimentation is seriously considered. Chemistry, bacteriology, and histology are brought to bear on the questions, then on a foundation of fact field work is begun and not only the results but the reasons underlying them can be given to the industry. The study of the rôle played by temperature in the history of bacterial and chemical changes in flesh has been pushed. This work has continued now for about four years and a great mass of data has been collected from which, from time to time, practical information has been furnished to meetings of industrial organizations, Congressional committees, etc. The compilation of the detailed scientific data obtained is under way. Quite aside from the study of temperature proper, a number of examinations have been made of chicken flesh subjected to routine marketing. When the shipments from the field laboratory reach the receiving center, samples are sent at once to the laboratory, where chemical and bacteriological examinations are made; and again several times during the marketing samples are sent for such examinations. These analyses will aggregate many hundreds, and, taken in connection with the environment to which the flesh has been subjected, will furnish valuable data on its decomposition.

A laboratory study of eggs subjected to different methods of handling is also being conducted, as was indicated in the statement concerning the work in the field. Eggs have been analyzed after keeping for varying periods, under varying conditions. This phase of the research work has also been under way for a considerable period, and the results are now being compiled. The study of eggs in transportation and during marketing—that is, the shipments made from the

producing to the receiving centers—is carried through by means of samples sent to the laboratory, just as the poultry samples are sent.

At the Philadelphia laboratory chemical analyses of 371 samples of chickens, 75 samples of eggs, and 3 miscellaneous samples were made, aggregating 3,844 determinations; 1,384 bacteriological examinations of chicken were made, and 88 of eggs. In the field laboratories chemical examinations of 118 lots of chickens and 173 lots of eggs are reported, accompanied by 173 bacteriological examinations of eggs and 504 of chicken flesh. At Omaha, where the desiccated-egg investigation was opened on June 20, 1911, 103 bacteriological examinations of 46 samples of eggs and 5 samples of water were made, accompanied by 281 chemical determinations prior to the close of the fiscal year. This represents a total of 1,888 bacterial examinations of chicken flesh and 364 of eggs, with chemical examinations of 489 samples or lots of chickens and 294 of eggs.

BACTERIO-CHEMICAL INVESTIGATIONS.

During the past year the principal bacterio-chemical investigations conducted at Washington have concerned the conditions surrounding the oyster and clam industry and the frozen and desiccated egg products. These are continuations of investigations begun in preceding years and decided improvements have been made along these lines. The frozen and desiccated egg industries have been studied closely to determine if possible the real cause of the unsatisfactory products often found on the market. During this work numerous eggs in the shell have also been examined to supply a basis of comparison. Examinations of the mineral springs and bottling houses and inspections of the sources of the springs and bacteriological examinations of the products have been continued with good results.

Edible gelatin has received considerable study during the past year, including the examination of the raw materials and of the processes of manufacture. Much work has been done on milk, cream, and ice cream as served on dining cars. In connection with other laboratories many examinations of ketchups, tomato pastes, and tomato products in general have been made.

The nature and number of the bacterio-chemical analyses made are shown by the following tabulation of interstate samples and a statement of the number of research samples handled:

Interstate samples:		Interstate samples—Continued.	
Butter.....	6	Ice cream.....	34
Cream (raw and pasteurized)..	23	Milk (raw and pasteurized)...	133
Eggs:		Miscellaneous.....	67
Desiccated.....	99	Oysters.....	145
Frozen.....	220	Ketchup and other tomato	
Shell.....	7	products.....	368
Liquid.....	16	Water (bottled and others)....	55
Egg compounds.....	4		
Fish.....	18	Total	1,250
Gelatin.....	55		

The research samples included 23 samples of antiseptics, 112 samples of cream and milk, 103 samples of imported dried albumen, 909 samples of desiccated, frozen, and shell eggs, 52 samples of gelatin, 28 samples of infant foods, 15 samples of fish, 13 samples of antiseptic

gauzes and bandages, 51 samples of oysters, 312 samples of water, 16 samples of soap, miscellaneous 73, a total of 1,706 research samples, and a general total of 2,956 samples examined during the year.

SUGAR AND SUGAR PRODUCTS.

MAPLE PRODUCTS.

The investigation on the maple products of the United States, begun two years ago, has been completed in part. The original samples collected have all been analyzed, as well as 110 samples collected during the past year, and the results of the investigation of maple-sap sirup have been published in Chemistry Bulletin No. 134. The analytical figures on maple sugar and maple-sugar sirup have been compiled; but one or two conditions have been found on which more work will be necessary before this part of the investigation can be considered finished. This work will be done during the coming maple season. It has been noted that the metal containers for sap, and also the metal from which evaporators are made, seem to influence the product greatly. A special study of this point during the last season gave encouraging results and will be continued. The studies of the chemical composition of sirup and sugar, as affected by the souring of the sap, are still going on. As the maple season is so short, lasting not more than two weeks or a month, the manufacturing of samples must be done during that time and analyses made later, so that but little apparent progress can be made in one season.

EFFECT OF ENVIRONMENT ON SUGAR CONTENT OF MUSKMELONS, ETC.

Having completed a five years' study on sugar beets and another on sweet Indian corn, the environment work for the past year was done on muskmelons. Stations were selected at points in Florida, Arizona, Colorado, Kansas, Indiana, Maryland, New Jersey, and Connecticut, where these fruits are grown extensively. The same strain of seed was planted at each place, having been selected by the Bureau of Plant Industry, which bureau also cooperated by supervising the growing of the crops. Many analyses were made of the crops and the data for the first year, which have been compiled, indicate results of interest and profit. While, of course, no conclusions can be based on one year's work, it appears that the climatic conditions induced by relatively lower temperature and higher altitude interacting on each other result in sweeter melons. Many factors, however, enter into the problem and this year's work is only suggestive.

MOISTURE CONTENT OF LOUISIANA CANE SIRUP AND MOLASSES.

An investigation of the moisture content of cane sirup and molasses was begun during the past sugar-making season in Louisiana. Samples of these products were collected by the official inspector stationed in New Orleans, at the sugar factory, at the Sugar Exchange, and at the plants of the mixers and blenders of molasses in the same place. These samples were sent to Washington and the analytical work thereon has been finished and the results reported to the Board of Food and Drug Inspection.

SUGAR BEETS.

The methods of analysis of sugar beets are under study to adapt them more perfectly to commercial needs. A report giving the results of beet analyses of samples received from all sections of the United States as made during the years 1905 to 1910, inclusive, has been submitted, and included in this is a résumé of the methods for the determination of sugar in the beet, also a bibliography of papers devoted to this subject from 1839 to 1906, inclusive. As in previous years, a number of samples of beets were analyzed for the Bureau of Plant Industry.

SORGHUM.

In order to determine the sugar content of varieties of sorghum grown in different sections of the country and their value for sorghum-sirup manufacture, many samples have been analyzed in cooperation with the Bureau of Plant Industry at their request.

MISCELLANEOUS INVESTIGATIONS.

The chemical investigation of imported honeys has been completed and the data will be compiled as soon as the statements are received from the American consuls at the different ports from which samples were obtained as to the conditions of bee keeping, honey production, and collection there existing.

An important line of investigation has been finished, and results recorded in Chemistry Circular No. 71, on a method of extraction of grains and cattle feeds for the determination of sugars. This contains much work of a comparative nature, shows wherein errors may occur in the present methods, and proposes a new method. As the sugar content of these materials is of much importance in many cases, the need of a method giving accurate results is seen.

The analytical work on the composition and analysis of American glucose and starch sugars is receiving some study. Comparative analyses of many samples have been made and some special tests are being tried. At present only a few scattered analyses of these products are available, and this work will be of material value to the food chemist in his valuation of sirup mixtures containing varying percentages of commercial glucose.

The general methods of sugar analysis are constantly being studied in the Sugar Laboratory. New methods, as they are published in scientific literature along this particular line, are tested and their value for the work in hand determined. Especially is this so in the question of the detection of commercial invert sugar in honey and commercial glucose in sirups and molasses. This often requires much work, and may produce only negative results, which are however, as valuable as positive ones, since it is necessary to know whether the proposed methods are easier of manipulation and yield accurate figures with less chance of error than those now in use.

VOLUME OF WORK.

During the year about 800 samples were received for analysis by the sugar laboratory and, in most cases, a complete examination was made. Besides these, 400 analyses were made in the field on

muskmelons in connection with the study of the effect of environment on their composition. Classifying these samples, the distribution of the work is seen to be as follows:

Sugar-bearing plants:	
Beets.....	147
Cane and sorghum.....	121
Official food samples: Maple and cane sirups, molasses and honeys..	70
Investigation samples:	
Maple sugar and sirup.....	205
Cane sirups and molasses.....	115
Honeys.....	20
Samples from other laboratories and departments:	
Bureau of Engraving and Printing.....	8
General Supply Committee.....	22
Indian Office, Department of the Interior.....	23
Other laboratories of the bureau.....	45
Miscellaneous sirups and sugars.....	24
Total.....	800

MISCELLANEOUS INVESTIGATIONS.

WORK OF THE MISCELLANEOUS DIVISION.

In the miscellaneous division are conducted the examinations of waters, insecticides and fungicides, cattle feeds and grains, trade wastes, hygienic and miscellaneous samples, and research work along these lines.

The administrative work and correspondence of this division, especially that relating to the enforcement of the food and drugs act so far as it applies to waters, cattle feeds and remedies, and grains, the preparation of cases covering such materials, and travel in connection with expert work in court cases have occupied a large part of the time of the chief of the division, who, since December, 1910, has also devoted much time to work in connection with his duties on the insecticide and fungicide board. This work has entailed a large amount of correspondence and the investigation of various problems which have arisen in connection with the enforcement of the insecticide act of 1910.

The miscellaneous division during the past year analyzed approximately 1,566 samples, requiring about 17,064 determinations. Additional samples were examined during the course of special investigations. Following is a tabulated statement of the materials analyzed, showing the scope and distribution of the work:

Imported mineral and table waters.....	39
Domestic mineral and table waters.....	161
Miscellaneous waters.....	53
Imported cattle and poultry feeds and grains.....	4
Domestic cattle and poultry feeds and grains.....	500
Miscellaneous feeds and grains.....	329
Insecticides and fungicides.....	366
Miscellaneous and hygienic samples.....	114
Total.....	1,566

A large number of these examinations were made for other departments of the Government, other bureaus of the Department of

Agriculture, and other laboratories of the Bureau of Chemistry, as follows:

Treasury Department.....	2
War Department.....	9
Department of Commerce and Labor.....	2
Interior Department.....	5
Isthmian Canal Commission.....	13
Department of Agriculture:	
Bureau of Plant Industry.....	386
Bureau of Entomology.....	347
Bureau of Forestry.....	15
Irrigation and Drainage Investigations.....	4
Bureau of Animal Industry.....	1
Unclassified samples examined for various other departments and bureaus and other laboratories of the Bureau of Chemistry.....	78
Total.....	862

EXAMINATION OF WATERS.

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

During the year 257 samples were examined, classified as follows:

Interstate samples.....	161	Miscellaneous water samples.....	53
Foreign samples.....	39	Miscellaneous samples.....	4

Of the 161 interstate samples, 39 were found to be adulterated or misbranded, and 6 seizures were made. Of the 39 samples of foreign waters considered, 11 were found to be misbranded and their exclusion from the United States was recommended. The miscellaneous samples examined for this department and other branches of the Government service were as follows:

War Department.....	5	Plant Industry.....	3
Interior Department.....	5	Forest Service.....	12
Commerce and Labor.....	2	Unlisted.....	26
Drainage investigations.....	4		

The investigation of mineral springs at source has been continued and the data obtained collated. The first section of this investigation, which includes the springs from New England, has been issued as Bulletin 139, Bureau of Chemistry. Several other lines of original research previously begun have been continued. The spectroscopic method for lithium, which has been perfected in this laboratory, has been subjected during the past year to further trial and investigation and has definitely proved its reliability and worth. The investigation of the radioactivity of certain mineral waters has been continued and the technique of the method employed has been greatly improved. Some time has been devoted also to the perfecting of methods for the analysis of water for sanitary, technical, and industrial purposes, in cooperation with other official chemists. The character of certain chemicals used in water purification is being investigated, and the quantity of such substances remaining in the water determined.

INSECTICIDES AND FUNGICIDES.

The composition and method of manufacture of insecticides and fungicides are studied, as well as the effect they have on foliage, with the idea of increasing the efficiency of such products and suggesting methods of avoiding injury to vegetation. Investigations to discover new and improved insecticides are always under way and improved methods of examining various insecticides are studied. Since January 1, 1911, when the insecticide act of 1910 went into effect, this laboratory has been charged with the chemical work of examining insecticides and fungicides (other than cattle dips) under said act. It has also been charged with the microscopic examination of various samples of insecticides and fungicides when such work is necessary.

During the year 418 samples were examined, requiring approximately 2,800 determinations. The greater number of these samples have been examined at the request of other bureaus of the department as follows:

Bureau of Entomology:	
Insecticide and fungicide samples.....	335
Miscellaneous samples.....	12
Bureau of Plant Industry:	
Insecticide and fungicide samples.....	7
Miscellaneous samples.....	29
Other bureaus of the Bureau of Chemistry:	
Insecticide and fungicide samples.....	24
Miscellaneous samples.....	11

In addition to insecticides and fungicides, numerous other products are examined, including materials employed in their preparation; the examination of fruits, foliage, and plants which have been treated with insecticides; fruits, hops, and other materials used in the preparation of foods which may have been affected by insecticides, etc.

No inconsiderable amount of time has been devoted during the year to methods for the analysis of insecticides. An exhaustive investigation has been conducted in regard to the solubility of Paris green and lead arsenate in water, in order to establish a method for the determination of water-soluble arsenic in these materials in the enforcement of the insecticide act of 1910. This investigation has involved 3,500 determinations of arsenic. Studies have also been made on methods for the determination of other constituents in insecticides, notably, arsenic in London purple, lead in lead arsenate, and methods for the analysis of Bordeaux mixture.

Much time has also been given to the investigation of problems connected with the properties and effects of insecticides and fungicides, the basic principles of which are chemical. One investigation of this character relative to the problem of fumigation with hydrocyanic acid gas has been carried out in collaboration with the Bureau of Entomology and results of considerable economic importance have been obtained. This study was published as Bureau of Entomology Bulletin No. 90, Part III, "Chemistry of Fumigation with Hydrocyanic Acid Gas." Orchard tests with numerous arsenical compounds and other poisonous materials are being conducted as in the past, in order to study the cause of the injurious effects of such materials on foliage and to discover, if possible, some way of overcoming the difficulty, or some new compound which may be used effectively as an insecticide on peach and other tender-foliage trees and plants, without causing injury thereto.

An investigation begun two years ago relative to the toxic effect of certain elements, notably copper and arsenic, which may accumulate in the soil as the result of using compounds containing these substances as sprays, is being continued. Samples of soils, foliage, and parts of trees have been collected from widely distributed fruit-growing areas and chemical analyses are being made thereof.

Studies of methods of analysis in cooperation with other official chemists have been engaged in during the year, and these, with other miscellaneous work, have required about 600 determinations, making the total number of determinations made in the laboratory for the year approximately 7,000.

The laboratory has been enlarged and the force of chemists materially increased during the latter part of the year in preparation for the enforcement of the insecticide act, which work is now in progress.

CATTLE FEEDS AND GRAINS.

The total number of samples examined in the laboratory studying these materials was 891, necessitating about 6,000 determinations and including samples of cattle and poultry foods, both foreign and domestic, examined under the provisions of the food law, and samples analyzed in connection with the study of such economic problems as the feeding value of forage crops and the composition and value of various grains and cereals, as well as of improved methods for examining such materials.

The methods of determining crude fiber were studied and an improvement made in the apparatus for determining pentosans, which enables the analyst to get more accurate results with less labor. The work on an improved fat-extraction apparatus was continued this year and the results published in Circular 69 of this bureau.

Of the 500 interstate samples of cattle and poultry foods examined, 76 were found to be adulterated or misbranded. The distribution of the total number of samples analyzed was as follows:

Imported cattle foods and grains.....	4
Domestic cattle foods and grains.....	500
Miscellaneous cattle foods and grains.....	329
Miscellaneous samples.....	58
Total.....	891

Distribution showing cooperative work:

War Department.....	4
Treasury Department.....	2
Isthmian Canal Commission.....	13
Department of Agriculture:	
Bureau of Plant Industry.....	347
Bureau of Forestry.....	3
Bureau of Animal Industry.....	1
Other laboratories of the Bureau of Chemistry.....	9
Miscellaneous.....	8

TRADE WASTES IN RELATION TO AGRICULTURE.

This laboratory is organized for the purpose of studying the effect of trade wastes on agricultural products, on forests, and on cattle. Particular attention has in the past been given to the study of the effect of smelter wastes on agricultural products, forests, animals, and irrigation streams. This work has practically always been done

at the request of the Department of Justice and in collaboration with the Bureau of Forestry. During the past year the Department of Justice has not required any work along this line, but the laboratory has been engaged in an investigation of the sulphur trioxid content of the foliage of trees which are killed otherwise than by smelter fumes.

MICROCHEMICAL EXAMINATIONS.

INVESTIGATIONS.

While the microchemical work has been continued along similar lines as in former years, certain investigations have been made which, together with the increased demands for examinations under the food law, have taxed the facilities of the laboratory severely. Several lines of special investigation conducted during the year are worthy of special notice.

The field work on the subject of egg desiccation and freezing, which was under way at the end of the last fiscal year, was continued. Many factories engaged in the business of candling and breaking out of eggs were visited, the methods employed closely observed, and the products obtained examined, thus providing each sample with an authentic history.

The work on the microchemistry of alkaloids has been continued, a few more having been studied, together with some new combinations. Many of the combinations studied have been photographed for reference purposes, and frequently the data have been called into use in connection with the examination of drugs and drug products under the law.

The work on ketchup was continued during the last packing season, during which time a number of factories were visited for the purpose of studying the use of decayed or decomposed tomatoes in this product. It is well known that some factories have made up very badly decayed tomatoes or trimmings into ketchup, and it was for the purpose of studying the products of such practices for comparison with the good product that the study was made. The consuming public is usually unable by taste to judge of the character of the raw stock used for some of this cheap product because of the boiling, and the incorporation of spices and vinegar serves to mask to all except an expert the original character of the raw stock. The experience and knowledge gained during this inspection has been of great value in dealing with products of this kind under the food and drugs act. A somewhat similar study was begun during the last part of the year on other decayed fruit products to provide a basis for judgment when they were found in the manufactured form.

In passing upon malt sprouts as cattle food under the food and drugs act it developed that a knowledge of manufacturing methods and practice should be obtained, and for this purpose a member of the laboratory visited three of the malting centers of the Middle West and visited factories, observing the methods used and obtaining for examination representative samples from the various factories. The results obtained will be used in passing on the adulteration of such products.

Insect powder is obtained by grinding the flowers of the pyrethrum plant. In connection with the anticipated enforcement of the insecticide law, the question of the amount of stems to be permitted

was raised. To provide data for deciding this question, grinders were visited and samples collected which are also being studied for the purpose of developing methods of estimating the amount of stems present.

ROUTINE WORK.

The routine work of the laboratory has consumed a large part of the attention of the laboratory force. In general, these examinations may be divided into two classes, namely, interstate samples under the enforcement of the food and drugs act, and, second, miscellaneous samples for the various other laboratories in the bureau and department, and also for other branches of the Government service.

The amount of work done for various branches or departments of the Government has greatly increased, the Post Office Department, Geological Survey, Census Bureau, Navy Department, Isthmian Canal Commission, Government Printing Office, Bureau of Engraving and Printing, General Supply Committee, Department of Commerce and Labor, Smithsonian Institution, the District government, and others sending samples. Collaborative work has also been done with the different laboratories of the Bureau.

The following tabulated list of the samples examined during the year is complete with the exception of some of the samples studied during special investigations, and shows the wide range of materials examined as well as the volume of the work:

Miscellaneous samples:

Food (sago, tapioca, fruits, nuts, spices, coffee, tomato products, infant foods, etc.).....	809
Papers.....	3,708
Insecticides.....	777
Drugs.....	60
Cattle foods.....	34
Dextrin and paste.....	11
Paint pigments.....	14
Alkaloids.....	22
Textiles.....	506
Typewriter ribbons.....	18
Scouring mixtures, water, seeds, etc.....	96
Total.....	6,055
Interstate samples:	
Fruits, nuts, and their products.....	240
Tomato products.....	496
Cattle foods.....	374
Eggs.....	216
Spices and condiments.....	69
Fish products.....	61
Drugs.....	66
Alkaloidal substances.....	43
Teas, coffee, etc.....	39
Sago, tapioca, meat products, etc.....	206
Total interstate samples.....	1,810
Total for year.....	7,865

CONTRACT SUPPLIES.

The work of the contracts laboratory during the past year has been very similar to that of the preceding years. The constant demand for results of examinations at the earliest possible moment

leaves little or no time for systematic research. The largest part of the work of the laboratory has been the testing of miscellaneous contract supplies and the preparation and modification of specifications. Work has been continued on the study of the composition of rubber goods with a view to drawing up specifications for this class of material, but the results so far obtained are not such as to justify proposing a specification. The investigation of paint materials has been continued and a number of exposure tests has been begun. Work has also been done on authentic samples of linseed oil, made from domestic seed in cooperation with the American Society for Testing Materials, and a specification for raw linseed oil made from domestic seed has been adopted which it is believed is fair to both producer and consumer. Plans have been perfected, also, in cooperation with the American Society for Testing Materials, for a very comprehensive series of white-paint tests. Considerable progress has been made on the study of enamel-ware cooking utensils. The quality of platinum laboratory utensils is of the utmost importance to the chemist, and the great advance in the price of platinum in recent years has been accompanied by a more or less marked deterioration in the quality. This laboratory has obtained very valuable information concerning the properties of the different grades of platinum, and while the work is not complete, the information is such as to safeguard the interests of the bureau in issuing specifications for and testing deliveries of platinum ware. As another result of this study serious effort is being made by several manufacturers to improve materially the quality of their ware.

The laboratory made analyses of 2,309 samples for the various departments. The attached table shows the distribution of this work according to the material examined and the departments for which the examinations were made. In addition to the samples reported in the attached table over 4,200 pieces of apparatus were examined for the Bureau of Chemistry.

Number and distribution of samples of contract supplies analyzed in 1911.

Distribution.	Colors, paints and varnish.	Oils, fats, greases and wax.	Soap and candles.	Inks.	Typewriter ribbons.	Rubber.	Glue.	Chemicals.	Metals.	Miscellaneous.	Total.
General Supply Committee.....	514	233	153	100	45	7	62	12	98	1,217	
Isthmian Canal Commission.....	68	73	31	2	7	1	46	82	310		
Treasury Department ¹	131	44	33	5	33	42	4	292			
Agricultural Department ²	85	110	9	1	24	31	1	9	41	301	
Post Office Department.....	15	6	27	3	1	52					
War Department.....	11	2	14								
Commissioners, District of Columbia.....	4	15	20								
Government Printing Office.....	2	2	5								
Department of Commerce and Labor.....	5	13	18								
Navy Department.....	1	2									
Interior Department.....	8	15									
National Zoological Park.....	7	15									
National Museum.....	5	11	18								
Smithsonian Institution.....	1	1	2								
Panama Railroad.....	1	1	2								
Superintendent Capitol.....	1	1	1								
Samples submitted to other laboratories.....	4	1	26	32							
Total.....	820	506	265	135	72	33	97	62	52	262	2,309

¹ Including Bureau of Engraving and Printing.

² Including Bureau of Chemistry.

NITROGEN WORK.

A laboratory is especially equipped for determining nitrogen and to it are referred all samples on which this determination is to be made. A total of 12,077 such analyses were made in the past fiscal year, the samples being referred not only from the laboratories of this bureau but from other bureaus of this department and also from other departments, as follows:

Department of Agriculture:	
Bureau of Plant Industry.....	650
Bureau of Soils.....	30
Bureau of Animal Industry.....	2
Office of Experiment Stations.....	2
Bureau of Forestry.....	6
General Supply Committee.....	3
War Department.....	8
Isthmian Canal Commission.....	4
Navy Department.....	6
Treasury Department, Bureau of Engraving and Printing.....	12
Total.....	729

The laboratory has also continued to collaborate with other nitrogen chemists in studies for the improvement of the present methods of analysis.

SPECIAL RESEARCH WORK.

ANIMAL PHYSIOLOGICAL CHEMISTRY.

The work on the deterioration of meat and fish was continued and extended to include an examination of a large number of inspection samples of liquid and dried eggs and different brands of canned salmon and sardines to determine evidences of deterioration and decomposition. In this connection cooking tests were made on fish and chicken in which fresh specimens and the samples in question were prepared for the table in exactly the same manner and submitted to a committee for an organoleptic test. In all cases the majority of the jurors could detect the aged and inferior product.

Progress has been made in the collection and analysis of the various brands of infant foods now on the market. About 30 different brands have been collected and their analyses partly completed. Feeding experiments on mice and kittens have been conducted with each of the different brands being prepared, for feeding, according to the formulæ prescribed in the accompanying directions. In some cases several modifications have been tried. The data obtained are being collated.

Among the miscellaneous problems referred to this laboratory were the following: A feeding experiment on rabbits, using solutions of different strengths of calcium hyperchlorite, was conducted in collaboration with the water laboratory of the miscellaneous division. This investigation and that of other chemical agents used in the purification of water supplies will be continued during the coming year.

The question of the solubility of the silver coating on candy in the digestive juices was studied. Saliva, artificial gastric juice, and

artificial pancreatic juice were employed. No silver went into solution in any of the experiments.

A number of extracts were examined to determine whether they were of animal or vegetable origin, the differentiation of yeast extract from vegetable or plant extracts forming a part of this study. The identification of importations of canned meat was attempted, especially to determine whether they were composed of beef or of whale meat.

Some work was also done on the determination of glycogen in meat and on the analyses of culture media. The work on the analysis of beef and yeast extracts of known origin was published in circular form. A chart showing the composition of foods used for infant feeding was compiled from the data on hand and from the literature to be used as an exhibit at conventions and societies interested in this subject.

PLANT PHYSIOLOGICAL CHEMISTRY.

The investigations in plant physiological chemistry have consisted, as in previous years, of the study of the influence of environment, in its broadest aspect, upon the character of plant growth, and this laboratory has been occupied to a large extent in carrying on investigations in collaboration with the various offices of the Bureau of Plant Industry.

These collaborative studies are as follows:

(1) The study of the influence of environment on the chemical composition of the various cereals. The field work is under the immediate direction of the office of grain investigations and the chemical work is carried on by this laboratory. The grains under investigation are wheat, rye, oats, barley, buckwheat, emmer, spelts, milo, kafir, durra, etc. The work consists chiefly in growing different varieties of these grains in different localities. In this way it is hoped that valuable results will be obtained. Already thousands of analyses have been made, and a report of the work is in progress. During the past year alone over 600 samples have been received from the office of grain investigations.

(2) The analysis of wheat grown under special conditions of sunshine and shade. The physicist of the Bureau of Plant Industry has direct charge of these experiments. By the use of new and ingenious apparatus it is hoped to be able to determine the action of the solar rays in influencing the composition of wheat.

(3) The continuation of the study of plants grown in the Great Plains area. The office of dry-land agriculture of the Bureau of Plant Industry is conducting an extensive series of experiments on the influence of rotation on crop production and samples are furnished this laboratory for the purpose of determining, if possible, the effect on the chemical composition of the different methods of handling growing crops.

(4) The study of the composition of many varieties of barley grown in the same locality for a series of years. For the past three or four years the experiment station at St. Anthony Park, Minn., has been conducting variety tests of barleys with the cooperation of the Bureau of Plant Industry. Samples have been furnished this laboratory for the purpose of determining the differences in the composition of these

varieties of barley when grown year after year on the same experimental field.

(5) Milling and baking experiments to determine the value of wheat. These are supplemental to the chemical analyses which have been made for a number of years. At the present time an extensive series of milling and baking tests is being conducted, which in connection with the chemical analysis of the wheat will no doubt be of great value, scientifically and technically.

(6) The study of different varieties of potatoes for starch content. The growing of potatoes on an extensive scale would yield greater profits if care were taken to select only those varieties that are heavy yielders and are at the same time rich in starch. The tests made on potatoes were for starch content with a view to the improvement of the varieties that should be grown.

Other investigations made in this laboratory are:

(1) The study of cereals during the first few weeks of their growth and the effect of various plant foods on the composition of young plants. The work heretofore has been done mostly with mature crops or with growing crops after the plants had become well started. This experiment is to determine the changes which take place during the first two weeks of the history of the plant. Wheat seedlings were generally grown because they are easy to grow and manipulate.

(2) The study of the effect of plant food on the formation of roots of young plants. The work just described led to the study of the effect of the reaction of the solution on the root development. It was noticed in the preceding investigation that a marked effect was produced when the seedlings were grown in water culture in the presence of certain salts. This investigation was then undertaken to determine some means of correcting the undesirable effects thus produced.

(3) A study of the use of partial substitutes for flour in the baking of bread, as, for example, cottonseed flour, peanut meal, soy-bean meal, and other high-protein products. A new use for cotton seed has been found, namely, the making of cotton seed flour, containing over 40 per cent protein, as compared with the 12 per cent present in ordinary wheat flour. This cottonseed flour is being extensively used in portions of the South for mixing with wheat flour for the baking of higher protein bread. These investigations will cover not only the use of cottonseed flour in bread making, but the use of other high protein substances as partial substitutes for wheat flour. Such mixtures of course would be sold under their proper names and not as wheat flour.

(4) The study of Graham flours found on the market. The frequent requests of the division of foods for the testing of Graham flours to determine whether they are straight or mixed have led to an investigation which has been conducted by a chemist who is also a milling and baking expert, and the results of the work will be compiled in the near future.

(5) A study of starches from different plants. The experiments conducted this year are preliminary in character and include studies of the chemical and physical properties of starches from different sources and of a means for the more complete extraction of the starch from the tubers than is obtained at the present time.

In making these researches this laboratory has completed between 13,000 and 14,000 determinations of a widely varying character on about 2,000 samples.

PHYSICAL CHEMISTRY.

This laboratory was established in March, 1911, and was charged with "the study, from the physical-chemical point of view, of the action of enzymes." The work which has been completed consists of several researches on the properties and mode of action of the enzyme invertase, which inverts sugar. Preparations of this enzyme are in daily use in this bureau in the analytical estimation of sugar and the results show that the use of this new method gives a more accurate analysis than has been possible heretofore. The influence on invertase of alcohol, acids, and several other substances which occur with sugar in foods and drugs has been studied and the precautions which are necessary in the use of invertase in analysis have been worked out. In another investigation it has been shown that in all probability sugar is not synthesized from invert sugar by invertase, and that the action of this enzyme on sugar gives a complete hydrolysis and not a reversible equilibrium, as has often been believed. These studies open up a most interesting field of research and will be vigorously prosecuted.

ENOLOGICAL CHEMICAL RESEARCH.

The enological chemical investigations are conducted at the main laboratory at Stonehenge, Charlottesville, Va., and at a field laboratory at Sandusky, Ohio. At Charlottesville the regular work comprises:

(1) The study of yeast races and the preparation of desirable pure cultures for practical use.

(2) The preparation of samples of pure wines and ciders of known history for experimental studies on quality and composition.

(3) The critical chemical study of wines and ciders of known origin to determine alterations in the composition during aging and the effect of different methods of storage, and to establish the normal composition of wines made from our native grapes.

(4) Investigations of the chemical composition of commercial samples of American wines; both laboratories take part in this work.

(5) Investigation of chemical composition of American grapes and apples for the purpose of establishing the normal composition of the many varieties grown in the several fruit districts of the country.

(6) A critical study of the methods of analysis of fruit and fermented fruit products, in which the chemists at both laboratories are cooperating.

The field laboratory at Sandusky, Ohio, is occupied chiefly with the following lines of investigation:

(1) The composition of grapes and apples grown in the northern fruit belt, from central New York westward to Michigan.

(2) The preparation of natural wine samples from the important grapes grown in the northern fruit belt.

Yeast cultures for practical use were distributed, on request of persons interested in the manufacture of fruit by-products, to 13 of the chief fruit-growing States during the past year. Twenty-eight

samples of wines from native grapes and three samples of ciders were made for the purpose of studying the chemical composition and quality of these products.

Eighty samples of wines and 25 samples of ciders manufactured by this laboratory are now undergoing chemical study for the determination of technical questions as to their normal composition and the changes which occur in the important constituents of these products during maturity. The chemical work under this head comprised 2,728 determinations at the Stonehenge laboratory the past year. This study is made as exhaustive as the facilities permit, and promises when completed to furnish important data as to the normal constituents of natural wines. Sophisticated wines were also made and studied in like manner. The chemical work on ciders required 480 determinations, and has been so far completed that the fundamental facts are fairly well established, but the work on wines will require further investigation.

Of the commercial wines 133 samples were examined at the Stonehenge laboratory, requiring 2,392 determinations. These were wines made from native American grapes and the data are very important for comparison with the results on the experimental wines.

Sixty grape samples and 28 apple samples were analyzed at the main laboratory, necessitating 936 determinations. At the Sandusky laboratory 583 samples of grapes and by-products from grapes, such as pomace, etc., were handled, 4,664 determinations being made, and 498 samples of apple products were analyzed, necessitating 5,478 determinations.

The total number of determinations made during the year at Stonehenge laboratory was 6,536 and at the Sandusky laboratory 10,142.

During the past year the results on a study of the occurrence of sucrose in native American grapes and on the development of acid and sugar in native grapes during ripening has been published (Bulletin 140), and a report on the chemical composition of American grapes has been compiled. The latter contains the analyses of 100 samples of the leading varieties of American grapes made during the season of 1908; 396 samples analyzed in 1909, and 511 samples analyzed in 1910. The samples include practically all of the varieties grown in the Eastern and Central States, and in the case of the best varieties numerous samples were collected from the more important fruit districts mentioned. The completion of this work will bring together a large amount of data which has not heretofore been available.

INVESTIGATIONS OF THE LEATHER AND PAPER LABORATORY.

LEATHER.

In the research work on leather approximately 100 samples of sole leather have been examined. The results of these examinations, so far as they relate to composition, have been compiled. Approximately 58 per cent of the leathers examined are weighted with glucose, Epsom salts, or both. The weighting contains from 1 to 7.5 per cent

of Epsom salts, and as high as 15 per cent of glucose. The total maximum loading of the two found in any sample was 19 per cent. The average amount of Epsom salts in the weighted leather is 3 per cent, of glucose 8 per cent. The average amount of these adulterants in all weighted leather is approximately 9 per cent. The water-soluble materials in these leathers vary from 13 to 37 per cent. On this basis approximately 125,000,000 pounds of sole leather has been injured and lowered in wearing value by the use of glucose and Epsom salts, and the American public has paid the cost of at least 12,000,000 pounds of these materials, together with the cost of working them into the leather, plus a profit to the tanner for doing it, all to secure a less durable product. Nearly all of the leathers examined contained as much or more uncombined tannin as the best oak or hemlock bark, and the greater part of this tannin is worse than wasted. The weight of the leather is needlessly increased, thereby resulting in increased cost, and, further, the tannin thus wasted would make 40,000,000 pounds of leather. There is urgent need of reform in the tanning of leather, and the public should take immediate steps to protect itself against the fraud and the waste of national resources involved.

PAPER AND PAPER-MAKING MATERIALS.

The work on paper-making materials that are used but little and on improved processes of treatment has been continued with very encouraging results. It has been fully demonstrated that the waste pine wood of the South and Northwest is suitable for the manufacture of certain grades, especially manila wrapping, box boards, and other strong papers. As there are large quantities of this waste wood, its use for this purpose would greatly relieve the pressure on other woods better suited to make white paper. It has been shown that at a moderate estimate the value of the pulp, rosin, turpentine, and rosin oils obtained from a cord of pine wood is more than \$40. The utilization of this waste material in this way is earnestly commended to paper makers and investors, and constitutes one of the most promising fields for industrial development. The results of this investigation have also been compiled.

Cooperative work with the Bureau of Plant Industry in regard to the availability of certain plants as paper-making materials is being continued.

Cooperative work with the Post Office Department is being continued both at Dayton, Ohio, where a special laboratory is maintained for the examination of the stamped-envelope papers, and at Washington.

Numerous requests have been received from the several Federal departments for tests of contract papers, for the preparation of specifications, and for assistance in passing on supplies. Much work has been done at the request of the General Supply Committee, the Bureau of Engraving and Printing, and the Post Office Department. In addition, a member of this laboratory has served on the subcommittee on stationery of the General Supply Committee, and on the envelope committee of the Post Office Department. This committee has made material savings, estimated at approximately \$180,000 in four years, in the cost of envelopes for the departments,

and this saving has been due largely to the adoption of suggestions offered by this laboratory.

TURPENTINE AND ROSIN.

The results of the examination of 300 samples of commercial turpentines, collected all over the country, have been published (Bulletin 135). They show but little adulteration on the part of the producer, while samples collected from dealers show from 13 to 18 per cent of the samples to be adulterated with mineral oils present in amounts varying from 2 to 3 per cent to 60 or 70 per cent. The average amount of mineral oil in a barrel of adulterated turpentine was 3 gallons, equal to a depreciation in value of at least \$1.50 per barrel.

The results of the study of the production, refining, uses, and value of wood turpentine have been compiled (Bulletin 144). The work shows how the number, quality, and value of the products obtained in the distillation of wood can be increased, how the quality of the products may be improved, and the cost of production decreased. Properly refined wood turpentine has been found to be a suitable paint and varnish thinner for all but the highest grade varnishes, and it may be safely used by the workman in well-ventilated places. The production of wood turpentine together with other products of the chemical treatment of waste wood, either by means of destructive processes or by solvent processes, as previously outlined, is one of the most promising chemical industries.

The work on the grading of rosin has now reached the point where the results can be presented. It shows that the misgrading of rosin is largely due to the practice of cutting the grading samples too large, as well as to the fact that the type samples rapidly bleach out, thus becoming lighter in color than they should be. The quantity of rosin which is misgraded from these causes is large, and the loss occasioned thereby is always at the expense of the farmer who produces the rosin. It is calculated on the basis of the work so far done that in the neighborhood of 400,000 barrels of rosin are misgraded annually from the above-mentioned causes alone. Work is being continued on the preparation of more durable and serviceable rosin type samples, with encouraging results.

MISCELLANEOUS WORK.

The work of testing deliveries of paper, textiles, leather, turpentine, rosin, and other materials for the several Federal departments requires much of the time of the laboratory force. Considerable research is required in connection with this work, much useful information has been acquired from it, and several improvements in testing apparatus have been devised. Specifications to insure the delivery of materials suitable for specific purposes have been prepared at the request of other departments.

Miscellaneous samples, including fertilizers, phosphates, wastes, and various industrial materials have been examined at the request of other departments and of other bureaus of this department and the laboratory has cooperated in the study of methods for the examination of leather and tanning materials. An extended study of the fluorin in phosphate powders and of iron and alumina in phosphates is in progress.

The following tabulation shows the number and kind of samples examined in the laboratory during the year. Of these, 2,637 were papers examined at Dayton, Ohio.

Paper and paper-making materials.....	7,092
Textiles.....	1,742
Turpentine and rosin.....	352
Leather and tanning materials.....	40
Miscellaneous.....	217
Total.....	9,443

PUBLICATIONS AND PRINTING.

The following publications have been submitted for printing during the past year: Sixteen bulletins, 23 circulars, 8 unnumbered publications, 1 Farmers' Bulletin, 3 Yearbook articles, 14 Food Inspection Decisions, and 492 Notices of Judgment. There have been issued or sent to press 12 bulletins, aggregating about 1,079 pages, 17 circulars (306 pages); 10 unnumbered publications (339 pages); 3 Farmers' Bulletins (120 pages); 3 Yearbook articles (36 pages); 16 Food Inspection Decisions (30 pages); and 546 Notices of Judgment (1,129 pages, received from the Office of the Solicitor); making a total of 3,039 pages of new material published.

The bulletins included studies on the preparation of cod and other salt fish for the market and the contamination of shellfish; a series of elaborate studies of American mineral waters was begun with the report on the waters of the New England States; a report on the commercial turpentines found on the market; enological studies, dealing especially with grapes and their sucrose content; the processing of persimmons and studies in fruit respirations, and an elaborate report on the nature of coal-tar colors used in foods. The circulars cover a wide range of chemical investigations, many of them being studies for the improvement of methods of food analysis and the making of difficult determinations, as, for example, the estimation of iodine in organic compounds, the determination of tin in canned foods, the determination of small quantities of ethyl or methyl alcohol, of malic acid, of camphor, and chemical and bacteriological changes in poultry under varying conditions. The unnumbered publications included the report of the Chemist, a manual of instructions for food officials and analysts, and details in regard to the inspection of imported meat products under the law.

The Food Inspection Decisions covered Nos. 125 to 138 and included a decision by the Attorney General on labeling whiskies bearing a distinctive name, a decision of the three Secretaries forbidding the use of saccharin in foods after January 1, 1912, and decisions of the Board of Food and Drug Inspection in regard to the labeling of cordials, New Orleans molasses, and chocolate and cocoa, the composition of evaporated milk, the presence of salts of tin in foods, etc.

While the amount of job printing required for the work of the bureau, especially forms, index cards, circular letters, etc., in connection with the administration of the food law, has increased, the ordering has been so systematized that only 208 printing requests were made, as compared with 346 the preceding year. There were 146 requests drawn on the Division of Publications for drafting and photo-

graphic work in connection with the illustrating of bulletins and the ordering of apparatus and other equipment.

CLERICAL AND BUSINESS OPERATIONS.

The total appropriation for the Bureau of Chemistry for the fiscal year ending June 30, 1911, was \$985,700, of which amount \$702,340 was for the enforcement of the food and drugs act, \$109,000 was for studies in the application of chemistry to agriculture and for collaboration with other departments, \$5,000 was for investigating the character of the chemical and physical tests which are applied to American food products in foreign countries and for inspecting the same before shipment, and \$79,360 was for statutory salaries.

A total of 130,000 letters was written to approximately 24,896 correspondents; 64,700 letters were received, filed, and indexed; 88,350 mimeograph letters were sent out, treating of 446 subjects; 2,468 purchase orders were drawn for current supplies for the offices and laboratories; 9,500 vouchers were checked and passed to the disbursing officer of the department for payment; 800 letters of authorization were issued to the members of this bureau; 5,955 manufacturer's or dealer's guarantees under the food and drugs act were received, examined, filed, and serial numbers assigned thereto. In the interstate office complete records were kept of the collection, analysis, and disposition of all samples collected under the food and drugs act, as well as the development, progress, and disposition of each seizure and case based on a violation of the law. These records are complex and involve a vast mass of detail. Verbatim reports of all hearings before the Board of Food and Drug Inspection were made. In addition, complete records were kept of the analysis and action on all import cases under the food and drugs act.

THE PRINCIPAL PROJECTS PLANNED FOR THE FISCAL YEAR 1911-12.

INSPECTION WORK.

The greater portion of the coming fiscal year will be devoted to the collection of official samples of foods and drugs for analysis; to the close scrutiny of factories and conditions attending the production of such products; and to the interstate movement in adulterated or misbranded goods for the purpose of suppressing traffic therein. Inspection work will be carried on in cooperation with the scientific divisions of the bureau along the lines of investigation which may be planned by each division. One of the new subjects to be taken up during the coming year will be the investigation of the colors used in food products, the practice of drying fish and artificially coloring the same to give the semblance of thoroughly dried or cured fish being one phase of the subject to be investigated. The inspection of the milk supply furnished cities will be continued, as will also the close scrutiny of flour and cereals, dairy products, sirups, coffees, eggs, vinegars, etc.

The collection of official samples of so-called patent or proprietary medicines, many of which have in past years been declared by the courts to be misbranded, will be abandoned in view of a recent adverse

decision rendered by the Supreme Court of the United States, holding that any statement or expression of opinion relative to the curative or healing qualities of such nostrums could not be considered a misbranding within the meaning of the law. Attention will be devoted, however, to the investigation of the character of crude drugs, pharmaceuticals, and preparations to ascertain whether they comply with the standards of purity and strength required by the United States Pharmacopœia and by the published formulas of the manufacturers. Attention will also be given to the investigation of other drug products which may be required from time to time by the drug division.

It has been impossible heretofore to give any attention to inspection work outside of the confines of the United States, but plans have already been laid and the necessary steps taken to begin a vigorous and thorough inspection of the food and drug supplies shipped to Alaska, as well as those which may be produced or manufactured there. Because of the climatic conditions, the season for prosecuting this work will necessarily be of short duration, and the force is not strong enough numerically to permit a force of inspectors to be detailed for this work, but at the same time it is hoped to accomplish something toward correcting any violations of the law which may exist in that Territory.

DRUG WORK.

The work planned for the coming year consists primarily in the examination of domestic and imported drugs and the preparation of cases based upon interstate shipments found to be misbranded or adulterated. The drug work at the branch laboratories will be extended as rapidly as possible. Special investigations of analytical processes will be continued for the separation, detection, and determination of alkaloids and other plant constituents contained in medicinal products. The effects of prolonged storage on the active principles contained in medicinal agents now under investigation will be continued.

Further studies will be made for the improvement of methods for the detection and determination of opium and constituents thereof contained in medicinal agents, and of the analytical processes for the detection and estimation of such constituents as ether, ethyl alcohol, and chloroform, so frequently found in complex mixtures. It is also planned to extend the investigations covering cooperative work on test mixtures of therapeutic drugs, in particular those containing synthetic morphin derivatives, heroin, codein, etc.; substitutes for cocain, such as novacocain, eucain, alypin, etc.; natural and synthetic laxatives belonging or closely related to the emodin group. Some interesting results have already been obtained in attempts to estimate minute quantities of chloroform in complex mixtures, and further investigations along this line are contemplated for the ensuing year.

SPECIAL FOOD INVESTIGATIONS.

The examination of interstate and imported samples of foods and drugs in connection with the enforcement of the food and drugs act will continue to occupy the greater part of the time of Food and Drug

Divisions and the inspection laboratories, as well as of other laboratories, such as the bacteriological and microchemical, dairy, sugar, water, and cattle-feed laboratories, where these special subjects are handled. The executive work in connection with the assignment and checking of these investigations, and the preparation of recommendations in regard to the findings, continue to grow in volume and complicated problems are constantly arising which can only be met by extensive investigations. The following are among the special investigations to be made during this year:

The detection and estimation of decayed stock used in fruit and vegetable products will be studied in the chemical, bacteriological, and microchemical laboratories from the several points of view, and supplemented by factory experiments and inspection. The deterioration of fish and especially of canned sardines and salmon will also be investigated.

The presence of coal-tar dyes in food products of all kinds, especially with reference to their contamination with deleterious ingredients and to determine whether certified colors have been used, will form an important line of work. Methods of detection will be further elaborated and the application of the spectroscope to this work be studied.

The investigation of cider vinegar and its adulterants, the composition of spices and materials used in their sophistication, and the study of extracts and essential oils used in their preparation such as peppermint, wintergreen, and nutmeg, for the purpose of elaborating methods that will enable the detection of the most carefully prepared imitations, will all be continued.

Among other miscellaneous food investigations which are to receive special attention are the work on infant foods, including physiological and chemical studies of commercial preparations and modifications of the same; the composition of the common fruits and vegetables in the fresh condition, changes in composition of domestic and imported rice; wheat flours, edible gelatins, and such other studies as may be called for by the exigencies of the inspection work.

A new food and drug inspection laboratory is to be established at San Juan, P. R., during this year for the more efficient protection of the supplies of that territory.

FIELD INVESTIGATIONS AND RESEARCHES ON POULTRY AND EGGS.

The plans of the Food Research Laboratory include further studies, especially during the heated term, of poultry chilled in water and in cold air and shipped in ice or dry packed. The deep-seated changes that the flesh undergoes when chilled by these different methods will be more carefully and fully studied, certain preliminary results having already been obtained along that line.

The effect of temperature on flesh decomposition will be studied, more attention now being given to individual phases of the subject, such as the effect of long-continued cold on enzymes; the effect of cold applied after retrograde changes have begun; the effect of ordinary temperatures applied after long-continued cold, etc.; all these questions having already been submitted to preliminary work. Such subjects must necessarily look chiefly to the laboratory for solution, yet without the field station to provide samples of known history and to make observations concerning environment, the scientific results

would lose much of their value. Especially is this true in the study of eggs, where it is absolutely necessary that the history be known if accurate conclusions are to be drawn. The study of individual eggs and of classes of eggs as determined by the candle will be pushed, that the system of candling may be put on a more accurate and scientific foundation. The ability of certain eggs to carry, store, and stand the vicissitudes of marketing generally will continue to be investigated. Efforts at the producing center and at the receiving center to inculcate better methods of handling to prevent loss and deterioration will not be abated.

The investigation of frozen and dried eggs and egg products, which began as a cooperative study with the industry for the betterment of the product during the very last of the fiscal year 1910-11, will be pushed as rapidly as possible until the close of the egg-breaking season of 1911 and, if the results warrant, will be continued just as soon as the spring season of 1912 opens. In this investigation every effort is being made to obtain the facts concerning present procedures and customs, and to use every endeavor possible to establish routine, commercially practical methods which will enable the industry to furnish a uniformly wholesome product and save many millions of eggs that are wasted now each year because of a lack of knowledge of the subject. The scope of the research will be as wide as possible. All kinds and sorts of eggs used by the breakers, individually and collectively, will be studied bacterially and chemically. Every stage of the industrial procedure, as practiced by the various egg-breaking establishments which can be reached from the laboratory headquarters—Omaha at present—will be tested and retested. Where the acquisition of knowledge indicates points to be improved and methods for doing it, the results will at once be given to the breaker that no time may be lost in attaining the desired end. Meanwhile laboratory experiments in breaking and collecting just such eggs as the industry uses will serve as a check on commercial work and also indicate what can be accomplished by clean handling while the carrying of these same methods into the egg-breaking establishment, and the putting up of packages side by side with the regular laborers, will decide not only the efficiency but the practicality of the methods as well. An endeavor will be made during the coming year to hold more meetings and demonstrations where a number of practical poultry and egg men can be gathered together. Many of the men are urging this, and they offer their services in spreading information concerning the work of the laboratory and in collecting the industry at the appointed time and place of the meeting.

ENOLOGICAL STUDIES.

(1) The critical chemical study of wines and ciders made in the enological laboratory and the preparation of additional samples for the further study of the normal composition of these products.

(2) Experiments on reducing the acid content of wines by cellar practices.

(3) The chemical examination of pomaces from wine, cider, and juice factories with a view to saving such wastes as often occur.

(4) Installation of apparatus for a study of generation of vinegars, especially as to the use of waste products and the study of the chemical changes which occur in the manufacture of fruit vinegar.

(5) Continuation of the studies on the chemical composition of grapes and apples.

(6) Continuation of the studies on yeast races and their practical use in the factory work.

SUGAR INVESTIGATIONS.

The completion of the extensive investigation under way in regard to the maple-sugar industry will be made the most important work of the year 1912, together with the completion of the study of the moisture content of cane sirup and molasses and the work on imported honey. Preparatory work will be done looking toward as thorough an investigation of the sorghum and cane sirup industries as has been made in the case of maple products. The environment studies on the sugar content of watermelons and muskmelons will be steadily advanced.

PLANT PHYSIOLOGICAL STUDIES.

Among the principal plant physiological studies may be enumerated the following:

(1) The milling of wheats and the baking of the resultant flour in order to determine their value for bread making.

(2) The chemical study of mill products.

(3) The investigation of graham flours on the market.

(4) The study of the composition of leaves of various trees at different stages of development, for the purpose of determining their value for agricultural uses.

(5) The study of milling products from rice.

(6) Starch investigations for the purpose of determining whether it is more practicable to extract the starch from potatoes and other starch-bearing plants, when reduced to a dry condition and then ground, than it is by grinding the fresh tubers and extracting the starch, as is being done at the present time.

PHYSICAL CHEMICAL PROBLEMS.

Investigations on the following subjects are in progress in the physical chemistry laboratory: (1) The preparation of invertase from waste brewers' yeast and a further study of the laws of its action; (2) the economical preparation of raffinose from cottonseed meal and a study of its hydrolysis by invertase; (3) the quantitative estimation of cane sugar, particularly in agricultural and food products, by the use of invertase.

WORK OF THE MISCELLANEOUS DIVISION.

WATER.

The survey of the important mineral springs of the United States, which includes a very comprehensive analysis of the water from source, will be continued as heretofore. The examination of foreign and domestic waters to determine whether or not they are properly labeled under the food and drugs act will be continued. Improved methods of mineral-water analysis will be studied and the radioactivity of certain mineral-waters determined, the latter investigation

applying especially to samples coming directly from source. Improved methods for the determination of the several sulphur compounds in sulphur waters will be given especial attention and certain chemicals used in the purification of water for potable and technical purposes will be studied. Irrigation and drainage waters and methods of analysis especially applicable to them will furnish another line of investigation.

INSECTICIDES AND FUNGICIDES.

[In addition to the examination of insecticides and fungicides and the carrying out of analyses in connection with chemical problems relating thereto, as called for by other bureaus of the department, the following work and investigations will be prosecuted: (1) Analyses of insecticides for the Insecticide and Fungicide Board in connection with the enforcement of the insecticide act of 1910; (2) the study of the cause of injury to foliage of fruit trees by lead arsenate and methods for preventing this injury; (3) orchard and laboratory tests of poisonous compounds not at present used as insecticides, with the view to finding some substance which may be so used on peach and other tender foliage; (4) the supposed injury to fruit trees from the accumulation of toxic salts in the soil, due to the use of insecticides, in cooperation with the Bureau of Entomology; (5) the arsenic and copper content of fruit to which materials containing these substances have been applied in spraying operations.

CATTLE FEEDS, ETC.

The examination of the cattle and poultry feeds entering interstate commerce, also a study of range forage crops, in cooperation with the Bureau of Plant Industry, will be continued. There will be, as usual, considerable miscellaneous work for the various bureaus and departments of the Government to assist them in solving problems relating to the analyses, feeding value, commercial importance, etc., of grains and other feeding stuffs. It is planned to adapt a chemical method for the measurement of the deterioration of corn by-products, such as hominy feed, corn bran, etc., caused by mold, heating, etc.; also to make a chemical examination of the Osage orange, considered as a feedstuff. The methods used in determining the various constituents of cattle foods will be studied, and, if possible, the constituents of the ether extract of such feeding stuffs as alfalfa, grasses, and other materials, whose ether extract contains large quantities of substances other than fat, will be examined.

[SMELTER WASTES, ETC.

The effect of smelter waste on animal and vegetable life will be continued if such work is requested by the Department of Justice. Investigations relative to the sulphur trioxid content of foliage, which is killed otherwise than by smelters, will also be continued. If time permits, the effect of various trade wastes on vegetation and animals will be studied. Sanitary studies relative to poisonous substances in household articles and articles of food will be continued as heretofore.

CONTRACTS LABORATORY.

The greater part of the work of this laboratory will probably consist in the testing of miscellaneous materials purchased under contract by the Government departments, and the preparation and revision of specifications for such materials. The study of paint and paint materials and the investigations of enamel-ware cooking utensils and rubber and platinum laboratory utensils will be continued.

LEATHER AND PAPER LABORATORY.

It is proposed to pursue the following lines of work during the coming year:

(1) The study of unusual paper-making materials, method of cooking stock, and methods for the utilization and disposal of the wastes of paper making.

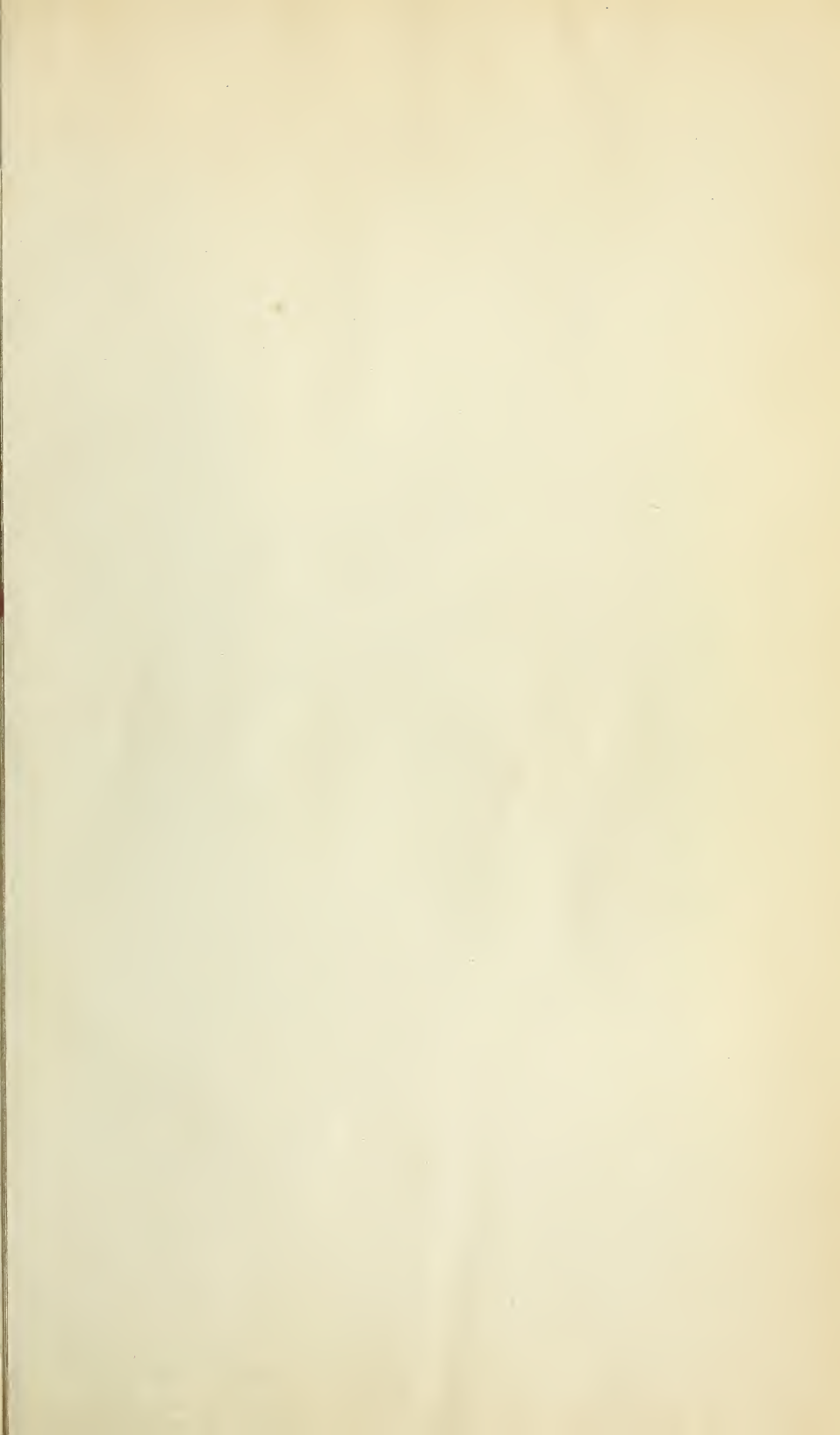
(2) Studies of the service, quality, and suitability of leather for various purposes, and experiments to improve its quality with a view to conserving raw material. An investigation of the weighting of leather, and other harmful or needless processes of leather making to improve methods of manufacture and reduce its cost. The study of native tanning materials, with particular attention to their conservation.

(3) Studies on the production, refining, nature, and uses of wood turpentine and of other products obtained by chemical methods from wood. Investigations looking to the improvement of the quality and quantity of rosin; methods of grading the same by the establishment of types. Testing of turpentine and rosin for adulterants under the food and drugs act.

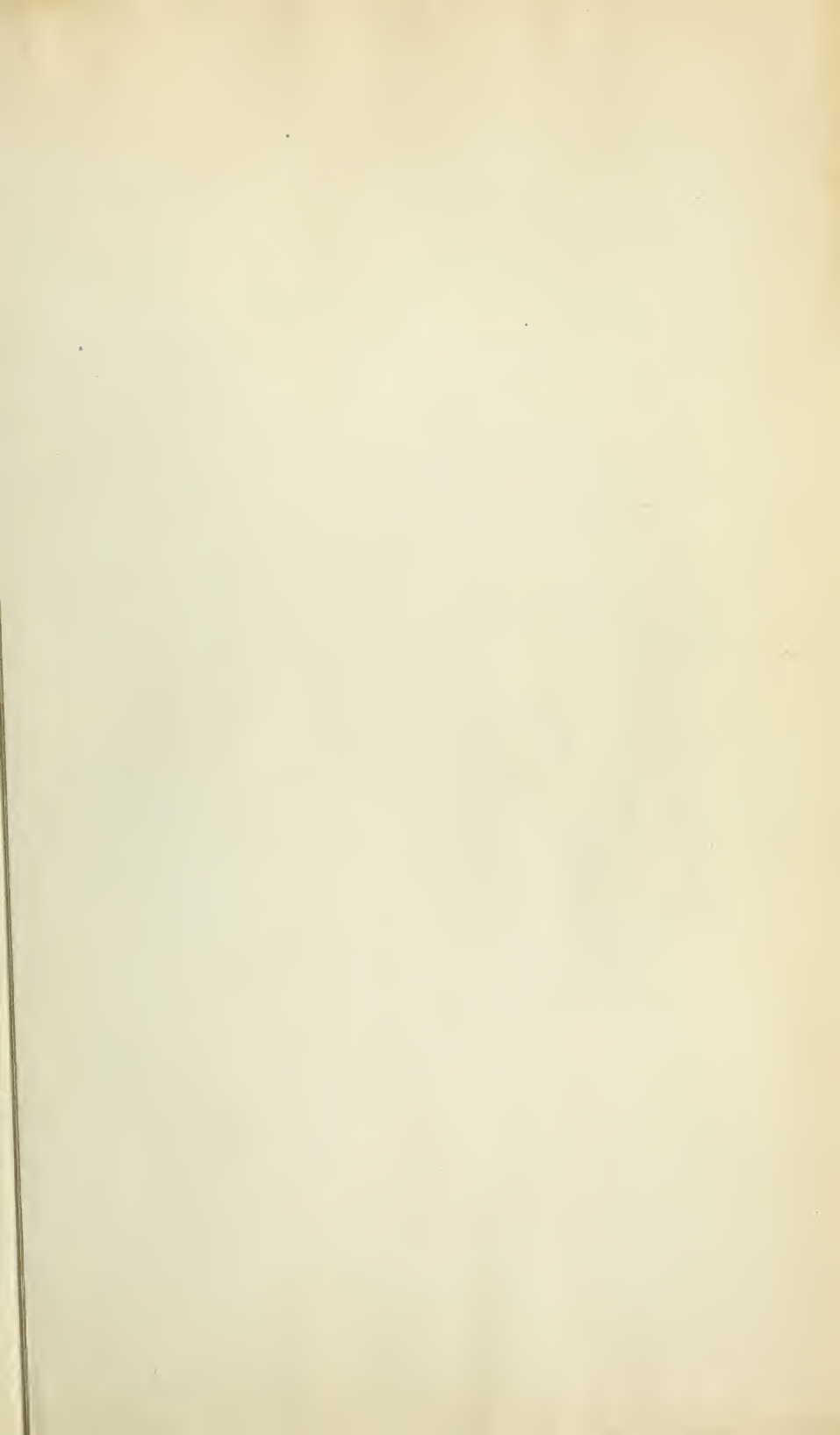
(4) The testing of leather, turpentine, rosin, paper, and the preparation of specifications therefor for other departments of the Government upon their request.



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