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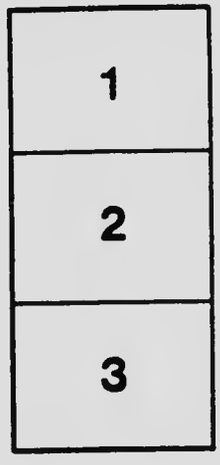

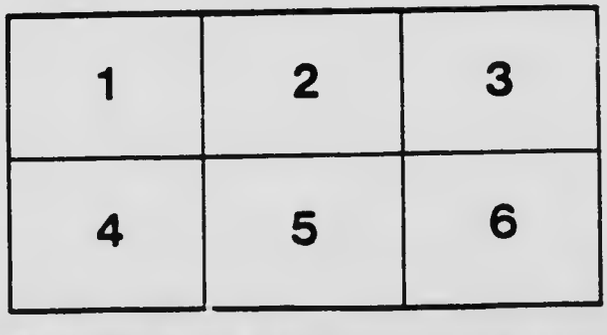

LABORATORY

OF THE

INLAND REVENUE DEPARTMENT,

OTTAWA, CANADA,

1902.

BULLETIN No. 83.

LIME JUICE AND CATSUP.

LABORATORY

OF THE

INLAND REVENUE DEPARTMENT

BULLETIN No. 88

LIME JUICE AND CATSUP

OTTAWA, December 15, 1902.

W. J. GERALD, Esq.,
Deputy Minister Inland Revenue.

SIR,—I beg to transmit herewith a report of Mr. A. McGill, M.A.. assistant analyst to the chief analyst, on Lime Juice and Ketchup or Catsup together with tabulated statements of the analytical results obtained by him in this laboratory, which also show the nature and origin of the different samples examined.

I have the honour to be, sir,
Your obedient servant,

THOS. MACFARLANE,
Chief Analyst.

LABORATORY OF THE INLAND REVENUE DEPARTMENT,
OTTAWA, November 25, 1902.

THOS. MACFARLANE, Esq., F.R.S.C.,
Chief Analyst.

SIR,—I beg to submit my report upon Ketchup and Lime Juice, together with a memorandum in which I have endeavoured to present, as clearly as I can, the state of existing knowledge on the subject of preservatives in food and of artificial colouring matters therein.

I have the honour to be, sir,
Your obedient servant.

A. McGILL.

LABORATORY OF THE INLAND REVENUE DEPARTMENT,
OTTAWA, November 24, 1902.

MEMORANDUM accompanying a report upon 24 samples of Ketchup and 27 samples of Lime-juice.

In these reports, as well as in that concerning unfermented grape juice (18 samples) which I handed in on the 27th ult., I have specially kept in view the detection of chemical preservatives and of artificial colouring matters.

Although I have, in most cases, made these determinations quantitatively, I prefer, in these reports, merely to state the presence or absence of the preservative, or colouring matter, without giving any statement of the quantity found. It is well known (see paragraph 75, Report of the British Food Commissioners, and elsewhere) that quantitative methods for the estimation of preservatives and colouring matters in foods, are far from being perfect. Work is being done in this laboratory, and in all national food laboratories, with a view to perfecting methods of research; and there is little doubt that methods commanding universal acceptance and recognition will soon be available. Meantime, our qualitative processes are above suspicion, and the presence of these antiseptics and dyestuffs can be ascertained with absolute certainty in most cases. The following note shows that it is not only the peculiar nature of the food stuff, which may present difficulties to the analyst, but that manufacturers of preservatives seek, by making these as complex as possible, to hamper the search for them, in food.

In November, 1898, (Analyst, 1898, 309—) A. C. Chapman, F. I. C., called the attention of the British Society of public analysts to the fact that very complex mixtures were sometimes put on the market as food preservatives. He had found one which contained sulphate of alumina, chloride of sodium, nitrate of sodium, sulphurous acid, chloral hydrate, benzoic acid and iodine, the last probably as hydriodic acid.

Dr. RIDEAL, in discussion, said that he had met with several such complex preservatives, which he asserted to be almost invariably of French origin, and probably intended to baffle analysts through the introduction of a large number of ingredients.

In a few of the ketchups it will be seen that two different preservatives are present; but for the most part I find that a single substance of the kind is employed.

The extensive use of chemical preservatives in perishable foods is one of the most noteworthy features of our time. That the use of antiseptics is very general, is proven by the result of our own experience, and by the various reports issued by the governments of civilized countries, which make official investigation of foods and drink sold in the open market.

This is illustrated in a forcible way by the report of A. E. Leach, of the State Board of Health, Massachusetts (Analyst, 1901, p, 289). During the summer months of 1898, 1899 and 1900, 5,169 samples of milk were examined for preservatives, and 179 samples, or 3·5 per cent. of the whole number, were found to contain such. Of this number 142 contained formaldehyde, and 30 contained boracic acid.

In the Report of the Conn. Agri. Expt. Stn., for 1899 (p. 139) after a summary of reasons for condemning the wide-spread use of chemical preservatives in food, occurs the following:—

The Station has secured a considerable number of the advertised preservatives, and these have been qualitatively and as far as possible quantitatively analyzed. Results of analysis are as follows:—

'Freezine'—B. Helier & Co., Chicago—A 5·19 per cent. solution of formaldehyde.
'Iceline'—Heller Chemical Co., Chicago—is 1·92 p.c.; formaldehyde.
'Special M. Preservaline'—A solution of formaldehyde, 1·99 per cent.
'Rex Magnus, Snow Flake Brand'—Contains 78·15 per cent. boric acid.
'Rex Magnus, Pearl Brand'—Contains 95·72 per cent. boric acid.
'M. Preservaline'—Contains 97·81 per cent. boric acid.
'B. B. Preservaline'—Contains 65·42 per cent. boric acid.
'Preservaline Butter Powder'—Is merely bi-carbonate of soda.
'Cream Albuminoid'—Contains 50·4 per cent. boric acid.
'Preservaline for Cider'—Is salicylic acid only.

'Blue Seal Preservative'—Contains 70·24 per cent. salicylic acid.
'Forman's Cider Preservative'—An alcoholic solution of beta-naphtol.
'Preservite'—Contains 96 per cent. benzoate of soda.
'Forman's Preservative for Wine'—Contains 36·13 per cent. formaldehyde.
'Compressed Preserving Powder for Beer'—Contains 49·01 per cent. of salicylic acid.
'Emken's Preserving Cakes'—Contained 32·09 per cent. salicylic acid.
'A Boake Roberts and Co's., K.M.S.'—Tablets containing 84·35 p.c., bisulphite.
'K. M. S. Preserving Powders'—Contained 25·47 per cent. bisulphite.
'Rex Magnus, Viandine Brand'—Contained 81·77 per cent. boric acid.
'Sportsman's Rex'—Same composition as last.
'Ocean Wave Brand'—Contained 88·85 per cent. boric acid.
'A' preservaline for sausages—Contained 68 per cent borax.
'Freeze-Em'—Contains 29·19 per cent sulphurous acid.
'Maas and Waldstein's Preserving Salts'—Six samples contained from 29·05 to 35·16 per cent boric acid.

Sulphurous acid has been reported in dried fruits, chiefly American, by Beythien and Bohrisch (Zeit für Untersuch. der Nah. und Genussmittel, 1902, 401)—California apricots contained from 0·216 to 1·158 per cent, (calculated as crystallised sodium sulphite) peaches, 0·992 per cent, pears 0·2399 per cent—Italian prunes contained 0·264 per cent.

The most largely used preservatives are undoubtedly salicylic acid, formaldehyde and boracic acid; but new substances are being added to this list from time to time. Thus sulphurous acid and sulphites, benzoic acid, fluoride of sodium and many other articles of an antiseptic character are quite frequently reported and according to A. H. Allen (Analyst, 1902, 178)—the use of silico-fluoride of sodium as a preservative is patented in England, and the compound is manufactured to a considerable extent at Warrington.

The following extract is from the Report of the Massachusetts State Board of Health, 1899—p. 614:—

'The manufacturer of a largely used preservative, known as 'Freezine' (which is a weak solution of formaldehyde) issues an attractive pamphlet in which he makes the following remarkable claims.' It is not an adulterant.—It immediately evaporates, so that no trace of it can be found, as soon as it has rendered all the bacteria inert. No chemical analysis can prove its presence in the milk quantitatively or otherwise.' Its use in milk is also claimed by the manufacturer to be beneficial to the health of infants, many of whom have been saved from sickness and even death, he alleges, by a liberal use of 'Freezine' in the milk.'

Probably the newest suggestion for a preservative for milk is that of Jablin Gonnet—(Ann. Chim. Analyt., 1901, 129—through the Journ. Soc. Chem. Indust., 1902, 420) who states that '1 c.c. of a 12 per cent. solution of hydrogen peroxide added to 1 litre of milk, prevented spoiling for two days; 2 c.c. for four days and 6 c.c. for six days, at a temperature of 20° C=68° F. The hydrogen peroxide cannot be tasted in the milk, and according to a series of physiological experiments, is harmless to the human system.'

National attention in England was drawn to the matter in 1897 by the 'Lancet,' which issued a circular letter to certain very eminent physicians, for the purpose of securing expert opinion on the whole subject.

This circular proposed the following questions:—

(1) Is the presence of small quantities of salicylic, boric or benzoic acids or formaline in food, in sufficient quantities to preserve it, injurious to health?
(2) Should the use of antiseptics for this purpose be forbidden by law altogether?
(3) Could legislation be brought to bear on the restriction of the amount?
(4) Should the law insist that when preservatives are used the fact should be stated on the label?

Sir Henry Thompson wrote that 'he had long held that the addition of antiseptics was undesirable, though unable to produce evidence that any one of them had given rise to deleterious action owing to the impossibility of isolating the precise influence of the

drug. He objects strongly to the dietetic use of drugs, and is of opinion that the name and quantity of the antiseptic employed should be on the label, or on a paper setting forth the maker's or vendor's name.'

Dr. PAVY wrote that 'he did not consider our knowledge sufficiently extended to permit of its being taken for granted that no injury is producible, though there is no evidence of injury to health. He points out that it is the vendor, and not the consumer, that is benefited. He considers that, notification of the fact of antiseptics being employed, and their nature and amount would be sufficient; any deviation from the notification should be liable to prosecution. With the public interest thus safeguarded, he thinks that advantage might be taken of the power of antiseptics in preserving articles of food.'

Dr. F. J. ALLEN points out the possibility of daily accumulation of antiseptics quite sufficient to produce a gradual lowering of the standard of health, and is of opinion that the fact of an antiseptic being added, and its nature, should be required by law to be announced at the time of sale.

Dr. SIMS WOODHEAD draws attention to idiosyncracy and cumulative effect, and dwells upon our ignorance of the action of certain drugs (*e.g.*, formalin) on food stuffs. He points out that by the use of preservatives foods of inferior quality may be doctored. He would make the use of antiseptics illegal unless their nature and quantity be made known.

The late Sir B. W. RICHARDSON considered that antiseptics are not only necessary at this moment, but when used in proper form and quantity cause no injury whatever. There ought to be a license given permitting a certain fixed, and not a dangerous, quantity of antiseptic, and it ought to be stated on the label what the antiseptic is and its quantity.

Dr. T. LAUDER BRUNTON writes that 'one must remember that poisons are formed in foods by spontaneous decomposition, which may take place after purchase. The question to be decided comes to be whether antiseptics are likely to be more injurious to health than the natural products of decomposition. His own belief is that preservatives are the less injurious. His answers are: (1) The use of antiseptics should not be forbidden by law. (2) It is doubtful whether legislation should restrict the amount, as the makers will probably use the minimum amount found sufficient. (3) The fact of preservatives being used, and their amount, should be stated on the label.'

Sir W. ROBERTS says that 'there is no reliable information available, and an inquiry is needed.'

Dr. W. D. HALLIBURTON is not able to give information as to injurious effects from his experience, but quotes F. J. Allen as mentioning cases of ill health in children due to boric acid.

Dr. J. R. BRADBURY thinks that 'it is not necessary to forbid antiseptics, but that the amount should either be restricted, or the fact of their addition stated on the label.'

Dr. WHITELEGGE cannot speak positively, though it is clear to him that the law should insist upon a plain statement on the label if any preservative be added.'

I am tempted to make one remark in connection with the report of Dr. Brunton. The claim that antiseptics should be used in perishable foods because they are less injurious to health than the poisonous products of the spontaneous decomposition of these foods, seems to me quite untenable. The decomposition of food should be a fact of exceptional occurrence, and such food should be rejected altogether; whereas the systematic addition of an antiseptic to food, in order to prevent decomposition, would result in the habitual dietetic use of a powerful drug.

Recognizing the national importance of the problem, a departmental committee was appointed in July, 1899, to report to the British Parliament upon the following subjects:—

1. Whether the use of such materials (preservatives and colouring matters) or any of them, for the preservation and colouring of food, in certain quantities, is injurious to health, and if so, in what proportions does their use become injurious.

2. To what extent, and in what amounts, are they so used at the present time.

The committee consisted of the Right Honourable Sir H. E. Maxwell, Bart., M.P.; Professor T. E. Thorpe, C.B., D.Sc., F.R.S.; Dr. T. H. Bulstrode and Dr. F. W. Tunnicliffe.

The committee reported to parliament in the following year; and as the evidence taken represents the knowledge of the scientific world upon the subject of preservatives, up to the year 1900, it may be well to make some extracts from the report as presented. This report together with the minutes of evidence and appendix, forms a closely printed volume of 497 folio pages. 'From the evidence brought before the Committee it would appear that, at the present time, the only artificial or chemical antiseptic agents other than oils, spirits of wine, vinegar, salt, sugar, etc., employed, or said to be employed, in the preservation of food are:—

Boric or boracic acid and borates; so-called 'boron preservatives'.
Sulphurous acid and sulphites.
Fluorides.
Salicylic acid.
Benzoic acid or benzoates.
Formalin or formaldehyde.

'As regards fluorides, benzoic acid and the benzoates it may be said at once that, if employed at all, their use must be extremely limited. Mr. Leonard Bossley, Analyst to Messrs. Keiller and Son, Limited, stated that he believed that a firm in Dundee were trying to get benzoate of soda taken up as a preservative for jams.

'The boron preservatives are generally sold in the form of a white powder (sometimes however coloured with a coal tar dye) under a great variety of fanciful names, which as a rule afford no clue to their real nature. They are used largely for dairy produce, for margarine, ham, bacon, sausages and preserved meat foods generally, and to a much smaller extent in beverages.

'Salicylic acid comes next in the extent to which it is used. It is employed chiefly in beverages and in foods derived from fruit.

'Formalin, which is of comparatively recent introduction consists of a 40 per cent. solution of formaldehyde in water. The solution is diluted to various strengths, and sold as a preservative for milk chiefly, and to a less extent for other foods.

'Sulphites are used for very much the same purposes as salicylic acid, especially by brewers. They are also employed by butchers, and to a less extent by game and poultry dealers.

'As the result of an inquiry among a large number of farmers and dairymen, 110 replies were received, and 65 of these admitted the use of preservatives.

Of 4,251 food samples examined for the Committee in the government laboratory, 1,659 samples (=39 per cent.) were found to contain preservatives, as follows:—

Boric acid	1,247 samples.
Salicylic acid	320 "
Formalin	20 "
Sulphites	143 "

(71 samples were found to contain two preservatives of different kinds.)—

Of 290	samples of	cream,	77·9	p.c. contained preservatives.
" 364	"	butter,	57·1	" "
" 210	"	bacon,	70·5	" "
" 185	"	ham,	82·7	" "
" 226	"	sausages,	66·4	" "
" 48	pork pies,		70·8	" "
" 150	samples	jam	44·0	" "
" 78	"	lime & lemon juice	88·5	" "
" 769	"	temperance drinks	26·1	" "
" 100	"	imported beers	39·0	" "

'A comparison of the percentages of preservatised foods in the poorer districts and the wealthier districts of London, respectively, shows that they are practically identical, being 42·9 per cent in the former and 43·4 per cent in the latter.

'Preservatives are extensively used in certain foods imported into the United Kingdom from the colonies and foreign countries, especially in butter from Australia, in ham and bacon from Canada, and in butter and margarine from France, Holland and Belgium.

'Of the temperance beverages received from all parts of the United Kingdom, 83·5 per cent of those sold as temperance 'wines' and cordials, contained preservatives, chiefly salicylic acid, and to a less extent sulphites,

'With regard to the amount of the several preservatives, it appears that the boracic acid in the milks varied from 1·3 to 9·1 grains per pint; in cream from 10 to 57 grains per pint; in sausages, potted meats and brawn, from 15 to 66 grains per pound; in butter from 18 to 65 grains per pound; in bacon from 8·6 to 46 grains per pound. The amount of salicylic acid in jams varied from 1·7 to 8·5 grains per pound; in temperance drinks and cordials from 1·5 to 19 grains per pint; in herb beers and similar beverages from 0·5 to 8·1 grains per pint; and in imported beers from 1·3 to 3·4 grains per pint. Sulphites were found to be contained in lime juice, ginger wine, lemon syrup, raspberry and peppermint cordial in amount (estimated as sulphur dioxide) varying from 0·1 grain to 4·5 grains per pint.

'Mr. Vasey, who has been employed for upwards of ten years to examine foods and beverages on behalf of the 'Lancet', stated that he had found boric acid in meat peptone and beef jelly intended for invalid use, and that practically all the samples of invalid foods which he had occasion to analyze contained chemical preservatives.

'Dr. Vœlcker testified from personal observation, to the casual and haphazard manner in which both farmers and vendors add preservatives to milk.'

COLOURING MATTERS.

'The crude and gross sophistication of foods with mineral colouring matters, known to be more or less poisonous, appears to be a thing of the past.

'Sulphate of copper is, however, still extensively used in the colouring of peas and other green vegetables.

'The most commonly used colouring matter for dairy produce is annatto. This, and certain other yellow colouring matters of vegetable origin (turmeric, saffron, etc.) have generally been considered harmless in the quantities employed, but they are gradually being superseded by coal-tar yellows, the action of which upon the human system is not fully known.

'The colours to be obtained from coal-tar are practically unlimited in variety, and their tinctorial power is so great that very small quantities suffice to produce the required tint. They are consequently coming into increasing favour to replace the red, yellow, orange, green, blue and violet colours required for jams, temperance drinks, sweets and confectionery. A mixture of an azo-red and a brown allied to Bismark brown is used for imitating the smoke colour of hams.'

The report continues as follows:—

'Convinced as we are of the very general and increasing use of chemical preservatives by traders in the more perishable articles of food, we desire now to focus the evidence which has been placed before the committee, as to whether such preservatives may be expected to be attended with any risk to the public health.

'The evidence given before the committee bearing on this question, may be classified as that of:

A. The public analyst.
B. The medical officer of health.
C. The physician and surgeon.
D. The physiologist and pharmacologist.

A.—THE EVIDENCE OF THE PUBLIC ANALYST.

1. Prosecutions have exercised an inhibiting effect upon the use of preservatives.

2. Maximum amounts found must be regarded as exceptional and unnecessary: yet there is no guarantee that such excessive amounts may not continue to be used.

3. With regard to the precision with which limits could be determined, there was some difference of opinion; and as regards formalin, the evidence was unanimous that the estimation of such minute quantities as may be present in foods, is attended with great difficulty.

4. As to colouring matters the general testimony was to the effect that the nature and amounts of the substances in general use at the present time is such that but little danger is likely to accrue to the public health therefrom.

B.—THE EVIDENCE OF THE MEDICAL OFFICER OF HEALTH.

1. The medical officers of health were practically unanimous in their opinion that all preservatives should be prohibited in milk.

2. They saw danger in the unknown administration of drugs in morbid conditions of the body; and pointed out that such drugs are used at times, in amounts far in excess of those sanctioned by the B. P.

3. When more attention is paid by medical men to the use of preservatives, obscure conditions such as indigestion, malaise, faintness, &c., which at present receive no adequate explanation, may be made clear.

C.—THE EVIDENCE OF THE PHYSICIAN AND SURGEON.

1. Was not very conclusive, and it is evident that the question of food preservatives had not, at the time of inquiry, received special consideration by the medical profession.

2. Dr. Anderson had found that daily doses of 10 to 20 grains of boracic acid is generally followed by dyspepsia "sufficiently pronounced to make life miserable while it lasts, and at times it causes distinct gastritis, with repeated vomiting."

Sir Lauder Brunton considered that boracic acid was capable of exercising an injurious effect upon pregnant women.

3. On the other hand, an assistant physician at the London hospital described extended experiments as to the effects of borax and boracic acid upon himself, which resulted in "no sort of stomach irritation or intestinal irritation or trouble, or anything of that sort at all."

The consulting surgeon to Westminster hospital had administered borax to hundreds of patients in doses of 10 grains, 3 times a day, and up to 40 grains a day, and never found any evil or unpleasant effects, except in those patients who having kidney disease could not void the drug readily.

3. In so far, however, as expression of opinion went, the profession was almost unanimous in its condemnation of the present unrestricted use of preservatives. The medical profession was clearly impressed with the importance of at least intimating by a system of labelling, the nature, and when practicable, the amount of the preservative used. In the opinion of Sir Lauder Brunton and other witnesses, it is a serious matter that a medical man should prescribe a daily dose of any drug to a patient who may, unknown to himself and the physician, be consuming an indefinite quantity of the same drug in his food. He also pointed out that by the indiscriminate employment of drugs there was a possible danger that the action of certain drugs might be, if not entirely nullified, at least reduced in effect.

4. There was, however, another aspect of the question to which certain witnesses referred. They were of opinion that there are certain conditions of the human economy in which the administration of drugs, such as boracic acid and salicylic acid, are held to be contra-indicated. Among such conditions, specific reference was made to inflammatory states of the digestive tract, and of the reproductive organs.

D—EVIDENCE OF THE PHYSIOLOGIST AND THE PHARMACOLOGIST.

1. All these witnesses strongly deprecated the unregulated use of preservatives, at least those at present known, and of any colouring matter having a possible deleterious effect upon the human system; and were generally agreed that formic aldehyde was a dangerous substance, even in very dilute solution.

2. An opinion inimical to the use of preservatives was also held by some of these witnesses on the ground that these substances were added to food for the purpose of destroying or preventing the development therein of living organisms, and hence that these same substances when introduced into the highly organized animal, could not

behave indifferently to living matter, but must also tend to exert upon it some influence. Especially, they maintained, was this the case since the secretion of the digestive juices was dependent upon the activity of cells not differing sufficiently from microorganisms to render it probable that substances affecting deleteriously the one would be indifferent to the other.

3. Other objections offered by the physiologists applied especially to one preservative, viz., formalin, and were based upon the fact that this substance actually enters into combination with the proteid constituents of the food, the compound formed being less digestible than the original substance, thereby entailing a nutritive loss to the consumer.

4. Other witnesses testified to the value of chemical preservatives in protecting consumers from the evils of tainted or decomposing food. One witness said that in his opinion the use of preservatives, even in milk, under certain conditions, was in the public interest.

5. Dr. Attfield found, from experiments upon himself, that pharmacopœial doses of boric acid taken with his meals, had no appreciable action upon the digestion of his food. He found also that salicylic acid did not interfere with digestion.

6. Experiments on digestion in glass vessels were concerned with formic aldehyde, borax and boracic acid. Speaking generally, the results of these experiments may be regarded as showing that each of these substances had a retarding effect upon certain digestions; this amounting in the case of strong solutions of formaldehyde, to marked inhibition.

7. Experiments on animals (kittens) gave contradictory results.

8. The evidence was contradictory as to the harmfulness of copper 'greening' in peas and other vegetables.

The general conclusions of the committee are contained in the paragraphs numbered 103 to 135 of the Report to Parliament, and are exceedingly interesting and important.

Upon these conclusions are based the following recommendations:—

Recommendations.

(*a.*) That the use of formaldelhyde or formalin, or preparations thereof, in foods or drinks, be absolutely prohibited, and that salicylic acid be not used in a greater proportion than 1 grain per pint in liquid food, and one grain per pound in solid food. Its presence in all cases to be declared.

(*b.*) That the use of any preservative or colouring matter whatever in milk offered for sale in the United Kingdom be constituted an offence under the Sale of Food and Drugs Acts,

(*c.*) That the only preservative which it shall be lawful to use in cream be boric acid, or mixtures of boric acid and borax, and in amount not exceeding 0·25 per cent expressed as boric acid. The amount of such preservative to be notified by a label upon the vessel.

(*d.*) That the only preservative permitted to be used in butter and margarine be boric acid or mixtures of boric acid and borax, to be used in proportions not exceeding 0·5 per cent, expressed as boric acid.

(*e.*) That in the case of all dietetic preparations intended for the use of invalids or infants, chemical preservatives of all kinds be prohibited.

(*f.*) That the use of copper salts in the so-called 'greening' of preserved fruits be prohibited.

(*g.*) That means be provided either by the establishment of a separate court of reference or by the imposition of more direct obligation on the Local Government Board to exercise supervision over the use of preservatives and colouring matter in foods, and to prepare schedules of such as may be considered inimical to the public health.

Dr. Tunnicliffe, while agreeing on all other points, took exception to the prohibition of the use of copper in colouring vegetables, holding that in a proportion not exceeding half a grain of metallic copper per pound the presence of copper is quite harmless.

The evidence heard before this committee was concluded May 14, 1900, and it may be safely regarded as a full statement of the case to that date.

In the abstracts which follow I have sought to give an account of work done upon this subject since the date mentioned; and, in a few cases, to do this for important work which was not brought to the notice of the committee.

Leo. Goldsmith (thesis for B. Sc. degree. Abstract by Prof. Mayberry in Jour. Am. Ch. Soc;, 1897, p. 889) made several series of experiments on the digestion of blood fibrin in presence of alum, boric acid and formalin. The results are summarized as follows:—'While all the substances tested show some influence on the digestive action of pepsin only alum exhibits a marked effect.'

E. Laborde (Jour. farm. Chim, 1899, 484. Through the Analyst, 1900, 154).

Small quantities of isobutyl alcohol, glycerol and malic acid favoured peptic digestion; also methyl alcohol in very slight degree; ethyl and propyl alcohols, lactic and tartaric acids and mannitol and glucose on the other hand retarded peptic digestion.

With trypsin (pancreatic digestion) methyl and isobutyl alcohols, glycerol and glucose accelerated, while ethyl and propyl alcohols, lactic, malic and tartaric acids and mannitol, retarded the process.

Otto and Charles W. Heiner (Analyst, 1902, 173) give the results of experiments which show that 'salivary action is prevented by a solution containing 0·04 per cent of sodium fluoride, or its equivalent in ammonium fluoride, and that as little as 0·02 per cent solutions of fluoride greatly interfere with peptic digestion.'

Waldemar Koch (Am. Jour. Physiol., 325). The action of formaldehyde does not depend on active oxygen. Yeast made to grow anærobically is killed by it in 0·05 per cent solutions, but in 0·005 per cent solutions is unaffected. In cases of tryptic digestion, where the presence of formaldehyde has been observed to interfere with digestion, the reason may be discovered in the fact that the formaldehyde acts upon the proteids and renders them indigestible.

H. Leffmann (Journ. Franklin Institute, 1899–97. Through 'The Analyst,' 1899, 102).

From the results of a large number of experiments on the artificial digestion of arrowroot starch, the author concludes that 'beta-naphthol is injurious to malt-diastase, but does not seriously affect the starch-converting capacity of taka-diastase or pancreatic extract. Boric acid, borax and boroglyceride interfere but little with either starch or proteid digestion. Salicylic acid interferes with the action of most of the enzymes, especially those that convert starch, but does not seriously affect proteid digestion. Sodium benzoate has no appreciably injurious influence on any of the enzymes. Sodium fluoride interferes but little with the digestion of starch, but sodium silico-fluoride has a considerable influence on pancreatic extract.

In his opinion, if the use of any preservative is to be permitted in food, boric acid and sodium benzoate are the least objectionable since they appear to have less tendency to disturb the digestive functions than the other preservatives commonly employed.

F. Berlioz (Chem. Zeit. 1900, 416)—The author's experiments confirm the statement of Nencki, that saccharin, at least in small amounts, does not interfere with gastric or pancreatic digestion.

Lebbin and Kallman (Zeits. offentb. Chem. 1901, 324)—From numerous experiments carried out on animals and on human beings, the authors have come to the conclusion that our present notions as to the toxicity of normal sulphites are wholly erroneous. With acid sulphites, however, the action is quite different, for most of them are as corrosive as free acids.

The following medical testimony regarding the use of milk containing preservatives, was given in a case brought before the English courts, and is reported from the British Food Journal, 1901, p. 110.

Dr. Charles Jackson, medical officer of health for Fulham, 'had seen cases where children using milk containing boracic acid, exhibited serious digestive disturbances.'

Dr. L. B. Diplock said, 'four years ago he had attended a large number of children suffering from marasmus, and on testing the milk with which they were fed, he found

in each case that it contained boracic acid. Upon the infants being fed on pure milk direct from the cow, they recovered without the aid of any medicine, yet before he discovered the cause of the symptoms several of the infants died.'

The following notes on the use of boric acid and its salts are taken from the Zeit. für Untersuch der. Nahr., and Genussmittel, 1902, 678-682 (through 'Analyst,' 1902, 271).

E. Rost 'As the antiseptic action of boric acid is small, comparatively large quantities are necessary to preserve articles of food, and it is quite possible for a person to take as much as 3 grammes daily in his ordinary food. Meats, sausages, milk, butter, margarine, white and yolk of egg, fish, caviare, shellfish, &c., are frequently preserved by the action of boric acid. The author found 3·87 per cent, in dry salt meat and 2·8 per cent. in shrimps. Boron compounds are stated to have no specific action on the enzymes of the stomach and intestines, except as regards their acid or alkaline properties. Borax retards to a small extent the coagulation of milk by rennet; the addition of borax to milk especially when the latter is intended for infant's food, is therefore injurious. Darge doses were found to cause local irritation and inflammation in dogs, cats and rabbits, and also affected the action of the bowels. In two experiments on men it was found that doses of 1, 2 and 3 grammes of boric acid retarded the assimilation of albuminoids, the nitrogen contents of their urine being determined hourly before and after taking the boric acid. By taking the temperature of various dogs fed on borated meat, it was demonstrated that assimilation of the food was delayed. Experiments on other dogs showed that only large doses caused a loss of corpuscular albuminoids. It may be here mentioned that no essential difference was noticed between the action of boric acid and borax. A striking loss of weight in the animals was noticed. As this was not due to destruction of albumen or loss of water, it must be put down to oxidation of fat. Apparent increase in the digestion of albumen, shown when very large doses of borax were given, was due to the 'salt' action of the borax, similar results being exhibited by large doses of common salt and potassium nitrate. A large comsumption of water prevented these effects.

'Assimilation experiments in the presence of boric acid were carried out on four assistants. During a preliminary period of 5 to 17 days the men were brought into a state of 'nitrogen equilibrium' followed by administration of boric acid (3 grammes per diem) for 12 days. Two of the men then, for a time received no boric acid, and afterwards underwent a second treatment. Finally, some days were devoted to studying the after symptoms of the experiments. Two of the men showed a loss of weight due to loss of fat. The final observations also showed less secretion of urine and absorption of food materials. The two other assistants also showed a loss of weight. These two latter were also chosen for Rubner's experiments (see below) in which the amounts of expired carbon dioxide and water were determined. One of them diminished so suddenly in weight after taking 3 grammes of boric acid daily, that the experiment had to be discontinued. The weight of the other also decreased, but increased when the boric acid was discontinued, and fell again when the latter was readministered. It was not demonstrated by the above experiments, that boric acid affected the appetite. No influence upon health and appetite were noticeable. Boric acid was not found by the author to influence the temperature, blood pressure or kidneys. As the elimination of boric acid by the urine takes from 8 to 14 days, its action is probably cumulative. The author comes to the conclusion that the use of boron compounds in food should be forbidden.'

Rubner.—According to the author, who comes to the conclusion after numerous experiments, boric acid has an important latent action on the digestive process. Not only the digestive organs themselves, but the whole alimentation is affected. The change produced, which may amount to a loss of 22 per cent. of energy and 30 per cent of the utilization of nitrogen free food, is a very important fact, and undoubtedly means injury to health, as the amount of fat in the body may be of the greatest importance, and the reduction of the fat must be followed by a rapid fall in albuminoids. Serious results may follow in infant feeding, to invalids, old people or convalescents by borated foods.

R. O. NEUMANN.—The experiments carried out by the writer on himself consisted of a preliminary period of 4 days, during which various observations were taken; then 10 days with daily doses of 3 grammes of borax, followed by 4 days without borax; and concluding with daily doses of 5 grammes of borax for 3 days. During the first period nitrogen equilibrium existed; the secretion of nitrogen decreased during the first borax treatment, also in the intermediate 4 days, but was not further diminished by the larger doses of borax. His weight fell 1,200 grammes in seven days of the borax period. The flow of urine was somewhat increased, and boric acid could be detected for 18 days after the last dose of borax had been taken

A. HEFFTER made four series of experiments on himself, alternately fasting for 18 to 20 hours, and then feeding on milk and eggs for 48 hours. In two of the series he used food without borax; in the other two he used 1 and 4 grammes borax daily. The boric acid was found to increase the solids and nitrogen in the excreta, probably due to the diminished absorption of albuminoids as a result of the injurious effect of the boric acid on the mucous membrane of the intestines. The conclusion is that boric acid is not without objection when used as a preservative.

G. SOUTAG found by experiment that 3-gramme doses of boric acid required 5, 8 and 9 days, respectively, for elimination by the urine, in the cases of three healthy individuals.

A. WEITZEL.—Experiments on the coagulation of milk by rennet, in presence of various substances, as follows:—Group (1) Alkaline: Borax, sodium hydroxide, sodium carbonate and sodium bi-carbonate. (2) Salts capable of precipitating lime: Sodium oxalate, sodium fluoride and sodium oleate. (3) Other salts having an alkaline reaction: Sodium sulphite, salicylate, benzoate, propionate, acetate and formate. (4) Neutral salts: Sodium chloride, lithium chloride, sodium nitrate, perchlorate, tartrate, sulphate, ammonium sulphate and magnesium sulphate. (5) Acid salts: Sodium hydrogen tartrate, sodium hydrogen sulphate and sodium persulphate. (6) Acids: Boric, carbon dioxide, oxalic, benzoic, salicylic, protocatechuic and gallic. (7) Formaldehyde, saccharin and cane sugar.

The following results were obtained:—

(1) Borax retarded the coagulation when present in only small quantities (0·01 to 0·04 per cent), and the amounts usually employed (1 gramme per litre of milk) stopped the action of the rennet altogether. All other alkaline salts acted similarly.

(2) Coagulation was checked by those salts which precipitated the lime compounds. When the reaction became alkaline, the influence of alkalinity also showed itself.

(3) The neutral salts generally had a retarding action. Some (sodium and lithium chloride), principally in concentrated solution, more feebly when present in small quantities. Magnesium sulphate, in both concentrated and dilute solution, had considerable influence.

(4) Small quantities of the acids aided the coagulation. After carbon dioxide, boric acid had the most feeble action. The acid salts acted in the same manner as the acids.

(5) The action of formaldehyde was so powerful that it must be considered as a direct poison to the rennet enzyme. Saccharin in small quantity had little influence, but stronger solutions greatly hindered the coagulation. Sugar, up to 20 per cent of the weight of the milk, had no action.

E. POLENSKE showed experimentally that fresh and smoked hams, when packed in borax, dry, for periods of three and four weeks, absorbed into the interior of the ham quantities of borax varying from 0·076 to 4·05 per cent.

L. PORTES AND A. DESNOULIÈRES, (Ann. Chim. Anal. Appl. 401) "have found, by the examination of fresh strawberries, that salicylic acid, probably as the methyl ester, is a normal constituent of this fruit. The amount in the fresh berries is about 1 mgr. per kilog. (i.e. about 1 part per million or 0.0001 per cent.)"

E. O. V. LIPPMAN (Chem. Zeit. 1902–465) found a deposit in a vacuum pan, which had been used for concentrating lemon juice. On analysis this gave about 0.5 per cent of boric acid. Various commercial samples of lemon juice were then examined, as well as lemons and oranges, and in nearly every instance strong boric acid reactions were obtained. In the lemons, boric acid was detected both in the juice and in the rind.

H. A. Weber (Amer. Chem. Journal, 1896, 1092) made a series of experiments to determine the influence of coal tar colouring matter on the digestion (by pepsin and pancreatin) of blood fibrin. He reaches the following conclusions:—

Orodine yellow ("acid yellow" or "fast yellow" of the trade) has a marked and injurious effect on peptic digestion.

Saffoline (acridine red) slightly retards peptic digestion, but the author considers its effects to be practically *nil*.

Magenta—does not appear to interfere with peptic digestion.

Orodine yellow—does not retard pancreatic digestion.

Saffoline—has a strong retarding effect on pancreatic digestion.

Magenta—acts like saffoline towards pancreatic digestion.

Methyl Orange—acts like saffoline and magenta in retarding pancreatic digestion.

From the examination of these four colours, it appears that while none interfere with both peptic and pancreatic digestion, all interfere with one or the other, and are therefore very undesirable in food or drink.

Frentzel. (Zeit. für. Untersuch. der. Nahr. und Genussmittel, 1901–968.)—In this paper are given the results of a considerable number of experiments, consisting in feeding rabbits, dogs and human beings with food mixed with the colours "mandarin" (obtained by diazotizing sulphanilic acid and B. naphthol) and "metanil yellow" (prepared by diazotizing meta-benzene-sulphonic acid and diphenylamine). The conclusions arrived at are that the colours can scarcely be considered poisonous in the small quantities in which they are used in foods. Long continued, large doses, however give rise to some injurious effects: but this quantity is never, in the natural course of things, even approximately reached.

Chlopin. (Zeit für Untersuch. der Nahr. und Genussmittel, 1902–241) finds that "metanil yellow" is harmless, even when given in daily doses of 2 to 3 grammes to dogs, and 0·2 gramme to human beings. On the other hand he does not agree with the statement of Frentzel that "mandarin" is innocuous in moderate quantities. Given in daily doses of 2 grammes to a dog it caused uneasiness, vomiting and diarrhœa. The author himself took 0·2 gramme, and the symptoms were so alarming (dizziness, headache, &c.) that the substance had to be removed from the system by means of a purgative.

The following concise summary of Food Laws, as regards preservatives, is taken from a bulletin issued by the United States Department of Agriculture, through the *Jour. Soc. Chem. Industry*, 1901, p. 774:—

'Prohibition of the use of chemical preservatives and aniline dye stuffs as colouring agents for liquors is almost universal, while the employment of all foreign colouring matter is often prohibited. The use of chemical preservatives and foreign colouring matter with beer is usually prohibited. The sale of foods containing saccharin, sucrol, and similar preparations is prohibited in Belgium, France, Germany, Italy and Roumania. The importation of saccharin, except for medicinal use and under prescribed conditions, is prohibited by Belgium and Greece. All countries permit the dyeing of confections and similar articles which are themselves colourless, but are customarily coloured artificially. Belgium permits mustard to be coloured artificially when properly labelled. Salicylic acid and boric acid have been used so much more commonly than other preservatives, that legislation is usually directed against them, whilst local bodies often extend the prohibitions to benzoic acid and other substances as they come into use.

'The sale of foods containing preservatives is prohibited in Austria, France, Hungary and Roumania, and that of beverages containing preservatives in Belgium, Germany and Switzerland. The addition of salicylic acid to food is prohibited in France. Holland does not not permit the sale of beer containing salicylic acid, and Spain forbids its addition to wine. Italy permits the addition of 0·2 per cent. of boric acid to butter, but forbids the use of other preservatives.'

While I cannot say that I have, in the preceding pages, given a resumé of all the important work that has been done upon preservatives and colouring matters, I believe that I have referred to and summarized all the important researches which have come

under my notice. It will, I think, be conceded by anyone who reads the subject carefully, that the balance of evidence is decidedly against the use of any preservative in food. At the same time it must be granted that there are degrees of danger to health among the chemical substances which find favour as preservatives among manufacturers and vendors of food; and it may be that, in certain cases, less harm may result from the preservative than would result from deterioration of the food-stuff, were this kept for a length of time without an antiseptic. In order to decide the question as to whether, in certain cases, such as long voyages, travelling in out-of-the-way regions, supplying stores to soldiers on the march, mining camps, &c., as well as in the distribution of food-stuffs to the great centres of population, far removed from the places where such foods are produced, it might not be preferable to employ chemical preservatives rather than consume food which had suffered natural decomposition, or pay the high prices necessitated by quick transit, or such costly methods as cold storage, hermetical sealing, &c., it is evident that experiment must determine the extent of the injury to health which results from the use of food preserved from decomposition by antiseptic chemicals.

Experiments having this object in view, were recently made in the Imperial Health Office at Berlin; but the most interesting series of such experimental work is only now being inaugurated at Washington, D.C., under the management of the Bureau of Chemistry, of which Dr. H. W. Wiley is chief. I have just received the following communication regarding this matter from my friend Dr. W. D. Bigelow, chief of the Food Laboratory at Washington: 'The experiment is being undertaken very seriously, and on a somewhat extensive scale. In fact we consider it the most important inquiry we shall have on hand this year. About a dozen men, almost all from the Department of Agriculture, have volunteered, and will be divided into two equal lots, one of which will eat preserved food, while the other will receive only food that is known to be pure. The conditions will be controlled as carefully as possible, and the presence of nitrogen, phosphoric acid, and energy expressed as heat of combustion, will be determined. The preservative used will be determined in the food, as well as in the excrement and urine, and careful observations will be made daily regarding the physical conditions of the men. A "clinical" sheet will be kept for each man. The work will be very similar to that recently conducted by the Imperial Health Office at Berlin, but will be more extensive and will also differ from it in the fact that we shall employ largely young men of scientific training instead of Labourers. We are just entering upon this work now. The first table will be started the beginning of next week, and the analytical work will begin early in December.'

The above extract is from a private letter, dated 19th instant; so that when this memorandum is before the public, the experiment will be well in progress. I am sure that everyone interested in the subject with which I have been dealing will await with eagerness the results of Dr. Wiley's investigation. And in the meantime, until we are made aware of the amount of injury which may ensue from the use of 'preserved' food, the part of wisdom will be to eschew, as far as possible, every article which we suspect to be so treated.

As to artificial colouring matters, we have seen that the British Food Commission did not find itself justified in making a decided pronouncement. These articles are employed in such minute amounts that it is naturally very difficult toobtain certain information as to their specific physiological effects, when used along with food. The experiments of Weber, Frentzel and Chlopin, show that the most commonly occurring colouring matters interfere with digestion, but in all their experiments the quantities employed were very largely in excess of any that occur in food stuffs. I find that the red colour given to ketchup by coal-tar dyes is so different from the natural colour of a home-made ketchup, that I am surprised at the saleability of the artificial article. The demand for a deep yellow colour in cheese is another example of false taste on the part of the public. It seems to me rather surprising that the highly coloured articles of food should not, by that very fact, warn purchasers against them.

A. McGILL.

RESULTS of examining 27 samples

Date of Collection.	Description of Sample.	Name and Address of Vendor.	Name and Address of Manufacturer or Furnisher, as given by Vendor.	Serial Number.	Departmental Number.
1902.					
July 31	Lime Juice, bottled by vendor.	A. W. Puddin, Charlottetown, P.E.I.	Simpson Bros., Halifax, N.S..	1	4310
" 31	" " ..	Stewart & Gates, Charlottetown, P.E.I.	" "	2	4315
" 30	Lime Juice.....	A. Hendry, Winnipeg, Man.	Blackwood Bros., Winnipeg, Man.	3	17421
" 31	"	The A. McDonald Co.....	The Bole Drug Co., Winnipeg, Man.	4	17422
" 23	" bottled by furnishers.....	E. C. Brown, St. John, N.B.	Simpson Bros., Halifax, N.S..	5	17846
" 25	West India Lime Juice, from bulk.	W. C. R. Allan.	Hattie & Mylius, Halifax, N.S.	6	17848
Aug. 6	Lime Juice, Sovereign Brand.	F. W. Davison, Wolfeville, N.S.	Simpson Bros., Halifax, N.S..	7	20228
" 7	Lime Juice, Sterling Brand.	Dimock Bros., Windsor, N.S.	Hattie & Mylius, Halifax, N.S.	8	20229
July 25	Lime Juice..	W. McMillan, Brockville, Ont.	Turner & Co., Toronto.....	9	21234
" 25	"	J. A. Johnston, Brockville, Ont.	F. A. Lytle & Co., Toronto....	10	21236
" 25	"	Peoples' Supply Co., Toronto.	Crown Manufacturing Co., Toronto.	11	21238
" 25					
" 28	"	Swan Bros., Toronto	Simpson Bros. & Co., Halifax, N.S.	12	21239
" 30	"	Geo. Wagg, Vancouver, B.C.	Kelly, Douglas & Co., Vancouver, B.C.	13	21677
" 23	"	F. Filion, Vancouver, B.C.	West India Lime Juice Co., St. Thomas, W. I.	14	21682
" 23	Lime Juice made by Bottger & Co., England	J. W. Irwin, Clinton, Ont.	Rose & Laflamme, Montreal...	17	22038
" 22	Crown Lime Juice	John S. Roberts, Seaforth, Ont.	Lyman Bros. & Co., Toronto ..	18	22042
" 24	Lime Juice	J. C. Downs & Co., Stanstead, P.Q.	Brayley & Sons, Montreal.....	19	23334
	"	Pagnuelo Freres, St. Hyacinthe, P.Q.	Kenneth, Campbell Co., Montreal.	20	23338
	Lime Juice, Crown Brand	Obtained in Toronto	... ...	21	Spec'l
	" Montserrat...	Purchased in Ottawa	....	22	" .
	" Standard Brand.	" .. .	... .	23	" .
	Lime Juice, Dominion Brand.	"	....	24	" .
	Lime Juice, West Indian Brand.	"	....	25	" .
	Natural Lime Juice, as imported.	... .	....	26	No. 1.
	" " ..	.. ..	....	27	" 2
	" " ..	....	.. . .	28	" 3
	" " ..	....	Clarified in Halifax..	29	" 4

of Lime Juice, by A. McGill.

Specific Gravity.	Dissolved Solids. Dry at 100° c.	Acidity per 100 cc. In terms of normal soda.	Acidity as Citric Acid.	Organic Acids, in terms of normal soda.	Organic Acids, calculated as Citric Acid.	Combined org. acids as Citric.	Optical rotation in 2 dm. tube.	Phosphoric Acid as P_2O_5 per 100 cc.	Alcohol, as proof spirit.	Preservatives.	Remarks.
p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	S.V. Scale.	p. c.	p. c.		
1·0289	5·36	84·0	5·88	90·3	6·36	0·48	0·0	None.	None.	None ..	
1·0366	8·86	108·4	7·59	116·0	8·12	0·53	0·0	„ .	3·09	Salicylic acid.	
1·0237	5·59	74·4	....	77·6	.. ..	.....	+1·2°	„ .	1·74	„ ..	
1·0196	4·46	63·6	4·45	66·0	4·62	0·17	0·0	„ .	0·23	None...	Contains 0·029 % SO_3.
1·0262	7·70	79·6	5·57	82·4	5·77	0·20	0·0	„ .	0·70	„ ..	
1·0335	8·52	116·0	8·12	122·4	8·57	0·45	0·0	„ .	2·09	Salicylic acid.	
1·0123	7·48	102·5	7·18	107·2	7·50	0·32	0·0	„ .	1·74	None...	
1·0384	8·47	106·9	7·48	114·8	8·04	0·56	0·0	„ .	0·12	„ ..	
1·0330	6·43	75·0	.....	44·8	.....	.....	0·0	1·28	1·51	Salicylic acid.	Contains 0·120 % HCl, and tartaric acid.
1·0222	4·91	66·0	.....	64·3	.....	....	+2·8°	0·1	1 04	„ ..	Contains tartaric acid.
1·0316	5·70	68·4	.. ..	32·8	.....	.....	−1·4°	1·40	0·70	„ ..	Contains 0·141 % HCl, contains tartaric acid and is coured by a green dye.
1·0379	8·29	113·2	.7·92	119·6	8·37	0·45	0·0	None.	0·35	None...	
1·0243	4·69	76·4	.....	78·8	.....	. ..	0·0	Trace.	0·58	„ ..	
1·0363	7·97	105·3	7·37	110·0	7·70	0·33	0·0	„ .	0·23	„ ..	
1·2421	51·74	44·0	3·08	42·0	2·94	None.	−60·0°	None.	0·70	Salicylic acid.	Contains much sugar.
1·0352	7·64	114 8	8·04	120·4	8·43	0·39	0·0	„ .	0·58	None...	
1·0417	9·68	118·8	8·32	124·8	8·74	0·42	0·0	„ .	0·35	„ ..	
1·0292	8·08	101·6	.7·11	108·0	7·56	0·45	0·0	„	3·99	„ ..	
1·0328	6·27	70·3	.....	.....	....	.....	−1·0°	1·264	1·16	.....	Contains tartaric acid.
1·0318	7·94	98·5	6·90	102·5	7·18	0·28	0·0	None.	None.		
.... .	2·14	28·4	1·99	29·2	2·04	0·05	0·0	„ .			
.....	8·22	110·8	7 76	115·2	8 06	0 30	0·0	„ .			
.....	8·24	113·6	7·95	116·0	8·12	0·17	0·0	„ .			
1·0398	... .	116·0	8·12	121·6	8·51	0·39	0 0	„			
1·0393	.....	110·0	7·70	116·8	8·17	0·47	0·0	„ .			
1·0363	.....	105·0	7·35	108·4	7·59	0·24	0·0	„ .			
1·0370	.....	108·0	7·56	110·0	7·70	0·14	0·0	„ .			

Results of Examining 26 samples of

Date of Collection.	Name and Address of Vendor.	Name of Article as sold and Name of Furnisher when given by vendor.	Serial Number.	Departmental Number.	Name of Brand.
1902.					
July 31	J. D. McLeod, Charlottetown, P.E.I.	Tomato Catsup	1	4313	Mrs. Jones'
" 31	" "	Tomato Ketchup	2	4314	Heinz
" 29	J. Mullen, Winnipeg, Man	Catsup	3	17419	Ice Castle
" 29	W. W. Stone "	Chutney Ketchup	4	17420	Chutney Ketchup
" 29	C. D. Phelps, St. John, N.B.	Tomato Ketchup	5	17852	Beefsteak
" 29	P. Nase & Son, St. John, N.B.	Tomato Ketchup. Deerborn & Co., St. John, N.B.	6	17858	Bar Harbour
Aug. 6	DeWolfe & Lamont, Kentville, N.S.	Tomato Ketchup	7	20227	Butler's
" 7	J. Scott & Co., Halifax, N.S.	Mushroom Catsup	8	20232	Mushroom
July 24	J. Downeys, Belleville, Ont.	Tomato Catsup	9	21229	Queen
" 24	Hovey & Son, Coburg	"	10	21231	Monarch
Aug. 5	A. Paquette, Montreal	"	11	21241	English Spiced
" 5	Richard et Frère, Montreal	"	12	21242	Tomato Ketchup
July 28	Geo. Wagg, Vancouver, B.C.	Ketchup. Paupe Vinegar Works, California	13	21676	Gold Medal,
" 28	H. Albert "	Ketchup	14	21678	Pure Catsup
			15	21709	Pure Gold
			16	21710	
July 22	Sturday & Co., Goderich, Ont.	Tomato Catsup. Pure Gold Mfg. Co., Toronto.	17	22035	Club
" 22	J. W. Irwin, Clinton, Ont	Catsup	18	22037	Anglo-Saxon Eclipse
" 21	A. L. Brown & Son, Lennoxville, Que.	Catsup. Pure Gold Mfg. Co., Toronto.	19	23329	Pure Gold
" 21	D. P. Matheson & Co., Lake Megantic, Que.	Ketchup. Tip Top Ketchup Co., Cincinnati, O.	20	23332	Butler's
			21	Special	Pure Gold
			22	"	Homemade
			23	"	"
			24	"	Stirling
			25	"	Suider
			26	"	Club

Ketchup or Catsup by A. McGill.

Manufacturer, as given on the label.	Coal Tar Dye Stuff.	Dry Solids, per cent.	Preservative.			Acidity per 100 cc.		Remarks.
			Sulphurous Acid or Sulphites.	Salicylic Acid.	Boracic Acid.	Stated in cc. normal soda.	Calculated to Acetic Acid.	
Williams Bros. & Charbonneau, Detroit.	Present.	24·4	Doubtful.	None.	Present.	17·2	0·877	
H. J. Heins Co., Pittsburg.	"	19·2	None.	"	"	18·0	0·918	
J. W. Windsor, Montreal	"	12·3	"	Present.	None.	15·6	0·796	
and St. Eustache. Blackwood Bros., Winnipeg	None.	18·3	Trace.	"	"	42·8	2·183	
J. Campbell Preserve Co., Camden, N.J.	Present.	21·3	Present.	None.	Present.	20·0	1·020	
.....	"	12·7	None.	"	"	11·4	0·581	
Tip-top Ketchup Co., Cincinnati.	Doubtful.	19·5	Trace.	"	Trace.	14·4	0·734	
Crosse & Blackwell	None.	17·2	None.	"	None.	1·8	0·551	
Belleville Canning Co ...	Present.	19·3	Present.	"	Present.	21·4	1·091	
J. M. Lowes Co., Toronto.	None.	19·8	None.	Present.	None.	16·2	0·826	
Montreal Canning and Preserving Co.	Present.	8·7	Traces.	None.	Present.	20·8	1·061	
H. Bourque, Montreal. ...	"	7·6	None.	"	None.	23·0	1·380	
.....	"	9·1	"	Present.	"	12·0	0·612	
VanCamp Packing Co., Indianapolis.	"	23·5	Traces.	"	"	12·0	0·612	
.....	"	25·3	Present.	"	.....	.....	.....	
Garden City Canning Co., St. Catharines, Ont.	None.	18·0	Trace.	None.	.....	.....	...	
.....	Present.	25·7	Present.	"	Present.	23·6	1·204	
P. M. Card, Guelph...	Doubtful.	35·4	"	Present.	None.	33·6	1·714	
.....	Present.	24·0	"	"	"	13·6	0·694	
See No. 7	Trace.	18·2	"	None.	"	16·2	0·826	
....	Present.	29·7	Trace.	"	Present.	28·0	1·428	
Mrs. G., Ottawa.....	None.	... ..	None.	"	None.	.....	... ..	Samples 22 and 23 were furnished by friends for purposes of studying reactions.
V.— "	"	30·2	"	"	"	....	...	
T. A. Lytle & Co., Toronto.	Present.	18·3	Present.	"	Doubtful.	21.6	1·102	
Snider Preserve Co., Cincinnati, O.	"	19·3	None.	"	Present.	11·2	0·571	
....	"	15·5	Present.	"	Doubtful.	22·2	1·132