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The Analyst,

INCLUDING THE PROCEEDINGS OF

THE "SOCIETY OF PUBLIC ANALYSTS."

A MONTHLY JOURNAL DEVOTED TO THE ADVANCEMENT OF THE ANALYSIS OF FOOD AND DRUGS, AND OF GENERAL ANALYTICAL AND MICROSCOPICAL RESEARCH.

EDITED BY

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THE ANALYST.

JANUARY, 1884.

INTRODUCTION.

In commencing this year's issue of The Analyst we beg to call the attention of our readers to the fact that the Journal is necessarily of a dual nature. As its title implies, it is not simply a record of the proceedings of the Society, but is a general Journal, devoted to the propagation of the knowledge of chemical and microscopical analyses, containing specially the proceedings of the Society of Public Analysts. Thus the Society is in no way pledged by the opinions of the Editors; and, on the other hand, the latter are not bound by those of the Society. Any other papers published or abstracted are not thereby furnished with the *imprimatur* of the Society.

In future it is intended to print all Society affairs under the definite heading of "*Proceedings of the Society of Public Analysts*," and to place at the end of such matter the words "*conclusion of the Society's proceedings*," and the names of publication committee and abstractors will be omitted.

The Editors earnestly invite the co-operation of all interested in analysis, and will accept suitable papers, on the usual terms, from gentlemen not members of the Society. The Editors reserve to themselves the sole right of judging as to the suitability of all matter thus submitted, while they do not in any way interfere with the Society's papers, but publish, as a matter of course, all read before that body, unless specially requested by the Council not to do so. Good *succinct* abstracts from foreign journals will also be received and paid for on a reasonable scale, and members of the Society are earnestly requested to cut out and forward (addressed to the Editors, care of Messrs. Baillière, Tindall & Cox, before the 21st of each month) all reports of legal cases in which they may be interested, especially when any novel point may arise.

The Society of Public Analysts have taken what promises to be an exceedingly important step in appointing a committee to deal with the vexed question of milk, and to obtain, if possible, a real agreement between all those interested, whether members of the Society or not. As is common in such discussions, many acrimonious remarks have been made, which in cooler moments would have been left unsaid, and we trust that in the new year all such feelings will be set aside. An earnest of the coming *rapprochement* was given by Dr. Voelcker's interesting remarks at the last meeting of the Society. If Mr. Bell and his colleagues could only now see their way to aid the committee with their views—not as officials, but purely as scientific men assisting their *confrères*—we feel sure that a result would be arrived at as to milk standards as would redound to the credit of British chemistry. The investigation and discussion will of course be purely in committee, and so not a public matter; but we are certain that all analysts will await the result with impatience, and agree to bow to the decision of a body of men representing all shades of present opinion, as the proposed committee promises to do.

PROCEEDINGS OF THE SOCIETY OF PUBLIC ANALYSTS.

MEETING, November, 1883. Mr. WIGNER, President, in the Chair.

AT the close of the reading of papers on Milk,* the members and visitors present joined in a discussion, of which the following is an abstract:—

THE PRESIDENT, in opening the discussion, trusted that no personal matters would be introduced into it. He indicated the main points raised by the papers of Messrs. Estcourt, Dupré, Hehner and Allen, and asked those following to keep as close to the matters thus brought forward as possible. He called upon Dr. Voelcker, as a visitor interested in the subject, to open the discussion.

DR. VOELCKER made some preliminary remarks directed to dispel the idea that he was an abettor of adulteration and an enemy to public analysts generally. He had not thought it worth while to meet these insinuations before, because he felt convinced that the ideas of all as regards the composition of milk would undergo before long important modification. The question really arose was milk a fluid of such constant composition as Mr. Wanklyn had originally asserted it to be and did not the feeding of cows upon brewers' grains or immature produce of a succulent nature produce a considerable increase in the per-centage of water? Taking up first the question of *ash*, which as a rule might rise as high as ·8, but the general average of which was ·75, yet he had found 1·15, both in the morning and the evening milk of the cow. In this result he had since been corroborated by Dr. Hoffman, who had found an ash of 1·17 in the mixed milk of a herd of Jersey cows. To show the possible variations in the ash he found in the same chemist's report on agricultural chemistry, such numbers as 1·17, ·91, ·92, and ·72. Referring now to the *solids not fat* he contended that although not so uncertain as the amount of fat, yet they still varied to a considerable extent in genuine milk. His analyses made in 1863 (with no other object than that of securing good milk for the Professor's table at Cirencester) strongly supported this view. He believed with most public analysts that the per-centage of solids not fat in milk approached as a rule very much nearer 9 than 8, but he was at the same time bound to assert that you might have most excellent milk and yet having the proportion of solids not fat sunk down to 8·8 or 8·7. Last October he had a fresh case in point where he examined the milk of the cow which had just taken the prize given by the Farmers' Association, both for quality and quantity. The milk gave 14·25 total solids and 5·54 fat, thus leaving 8·71 solids not fat. In support of his general views on this point, he again referred to the latest annual report just issued by the eminent authority on agricultural and dairy chemistry already mentioned. In this there is the account of experiments on the milk of a herd of 104 cows, which were not specially fed. From January 1st till May 25th, the total solids were 11·8 in morning, and 11·1 in evening milk, while from May 25th to October 29th, they were 12 in morning milk, and from October 29th to December 31st they were 12 in morning and

* See ANALYST, for December, 1883.

12·14 in evening. Taking the whole year, so as not to weary the meeting by details, the cows gave as an average :—

	Morning	Evening
Total solids	11·93	11·97
Fat	3·24	3·25
Solids not fat	8·69	8·72

while on no single occasion during the whole year did the solids not fat amount to 9. Alluding next to the process of analysis he considered that any mere drying for so many hours was not reliable, but that it was better to actually dry the milk till the weight was constant, irrespective of time, and he considered that many of the small discrepancies between analysts had occurred through occasional imperfections in drying. Turning to the subject of the analysis of sour milk he expressed a strong opinion that no analyst was entitled to come to any definite decision as the original composition of decomposed milk. Coming, in conclusion, to the really practical question of what should be the standard for the judging the quality of milk, he suggested that the limit of the future should simply be that all milk sold must contain *a minimum of three per cent. of fat.* In his opinion this was all that was required to insure to the consumer an article of fair quality, and at the same time it would not press unduly on the milk producer, and he trusted that public analysts as a body would take this suggestion into serious consideration.

Dr. Muter reminded the meeting that they were there not so much to dispute over the past as to concert what was to be done in future. Taking first the method of analysis, it should be carefully reconsidered on the basis of (1) Drying the residue to a constant weight, and (2) Extracting the fat either by Soxhlet's method, Bell's method, or by evaporating upon plaster of Paris, powdering and extracting with ether, which latter was his customary manner of working before the establishment of the Society of Public Analysts. He did not at the moment express any opinion as to which was best, but they should all be tried, and the most accurate and scientific method should be chosen for future universal use by all public analysts. Coming to the matter of the standard he considered that the whole difficulty had arisen by the slavish method of judging milk by the solids not fat alone. He had never permitted himself to be bound by such an idea and had more than once pointed the danger out in the course of discussions. His experience was that whenever he got solids not fat appreciably below 9, then his fat was proportionately high. For want of a better term he had mentally classed such milk as being naturally diluted with fat. His suggestion for the change in the standard of milk would be this :— (1) To adhere to the limit of 9 per cent. solids not fat, provided the fat did not exceed 3 per cent., but if the latter were over 3 then he would take the limit of 8·5. So far he had always gone with Mr. Bell when the milk was excessively rich in fat, but he diverged entirely from him in the method of calculating the probable dilution. He held that, given a departure from the above limits, the dilution should always be calculated on 9 solids not fat as representing fair average milk and not on the abnormally low limit of 8·5. Referring to the analysis of decomposed milk, he considered, and had proved many times, that any attempt to lay down a true allowance was impossible. Many years ago he had tried his hand at such allow-

ance and had then come to one which sometimes held good, and which was similar to that afterwards worked out by Mr. Bell, but subsequent experience had shown the absolute futility of such attempts. In some few cases he had found a very close agreement between himself on the fresh milk and Mr. Bell on the stale; but again only last week a case occurred where the analyst on the fresh milk, using the 8·5 standard, found *not less* than 5 per cent. water, while Mr. Bell, using his allowance and the same standard, found not less than 14 per cent. It was to be remembered that the legislature, in compelling the Somerset House chemists to give an opinion on what they themselves must admit to be very uncertain grounds, had placed them in a most invidious position, and he questioned whether some amendment of the Act was not necessary to enable them to state (as the public analyst would be entitled to do) that the article they received was not really in a fit state for analysis, and thus to decline to give an opinion in doubtful cases.

Mr. Heisch, after some preliminary remarks on the methods of analysis, commented unfavourably upon Dr. Voelcker's suggested standard. The relative values of fat and of non-fatty solids depended entirely upon what the milk was intended to be used for. In the case of young children, for example, the solids not fat were of much higher importance than the fat; and in fixing a standard this important consideration should not be lost sight of. When milk was put into coffee, the fat was the important factor; but when actually taken as nourishment then the solids not fat were the desirable constituents. In addition, the judging of adulteration on fat would be a matter of decimal fractions only—that was always undesirable. He strongly urged, in conclusion, that no allowance for decomposition could ever be fairly applied to any sample of stale milk, as no such thing as a constant factor could be obtained.

Mr. Angell, after pointing out the undesirability of taking fat as a standard, and giving the reasons for his opinion, took up the consideration of the effect of feeding on milk. He agreed with Dr. Voelcker that by special feeding the quantity of fat in milk might be materially increased; but he entirely questioned the influence of feeding in the other direction.

Mr. Dyer, referring to certain analyses of his which were brought forward in the Manchester case, said that it was true they showed averages of 8·77 and 8·74 solids not fat; but then, on the other hand, there was respectively 3·33 and 3·51 of fat, an amount far exceeding the Society's limit; and this was a point which had been entirely lost sight of.

Dr. Bostock Hill strongly supported the present standard. During the last 18 months he had analysed 360 samples, all mixed milk of dairies of over 10 cows, and the average was—*solids not fat* 9·3, and *fat* 3·2. They should be very careful in consenting to lower the limit, because he was firmly of opinion that genuine healthy milk never gave less than 9 per cent. non-fatty solids. After supporting his contention by several experimental facts, he turned to the question of the analysis of sour milk, which he showed was perfectly unreliable, and that no analysis, however corrected by allowances, could ever be satisfactory; and he detailed experiments he had made in support of this contention.

Mr. Baynes supported the Society's limit, and denied that the British milk standard was to be judged by the continental cows. He knew from practical experience that a quantity of Dutch milk was proposed to be sold in this country, and samples were submitted to him for his opinion. He found that in only one case did the solids, not fat, reach 9, while the fat very seldom came up to 3. He had certified that he would not allow such milk to come into his district.

Mr. S. Harvey, in the course of his remarks, also in favour of sustaining the present limit, stated incidentally that he never met with a really genuine milk under 9 solids not fat. He would for every reason totally decline to ever certify upon the fat alone, as the difference between purity and adulteration would be far too narrow in figures to be safe.

Mr. Johnstone made some personal remarks upon the processes of milk analysis, calling attention *inter alia* to the fact that some analyses of his, based upon a system of prolonged drying, had been received doubtfully at first by those who now appeared to be coming round to his way of thinking.

Mr. Hehner also followed with similar remarks, in which he commented upon observations by Mr. Johnstone and Dr. Muter.

Mr. Allen, in the course of his reply, said he considered they had reason to complain of the form of the Somerset House certificates, which did not state the probable amount of water which had been added to the original milk. He also thought it wrong that they did not state all the data upon which they based the opinion given. With regard to the fat in milk, he was inclined to consider that its average amount was much higher than some analysts seemed to think, being more like 3·5 than any lower number.

Dr. Dupre, in replying on the discussion, remarked that it was an unfortunate fact that although the public benefited by the Act, it never assisted the public analysts. The only proper solution of the difficulty would be to cause all milk sold at a certain price to have a corresponding strength. As to the figures he had brought forward in his paper, although based upon four very carefully conducted analyses, he did not consider them final, and they were possibly destined to be modified to some extent.

The President, in summing up the discussion, made some remarks showing the entire unreliability of the analysis of stale milk. He was then elaborating an extensive series of experiments on the subject which he hoped soon to make public.

It was unanimously resolved that a committee be appointed to consider the whole question.

An Ordinary General Meeting of the Society was held at Burlington House on Wednesday, December 19th, 1883, the President, Mr. Wigner, in the chair.

Papers were read by

Mr. Kingzett on "Rape Oil, Beef Fat, and Mutton Dripping;" and by

Mr. Hehner on "Honey."

These papers will be published in our February number.

Conclusion of the Society's Proceedings.

REVIEWS.

PLANT ANALYSIS: QUALITATIVE AND QUANTITATIVE. *By G. Dragendorff, Ph.D.* Translated from the German by H. G. Greenish, F.T.C. London: Baillière, Tindall, and Cox.

AT the present time, when plant products have become of such vast importance, not only to pharmacy, but also to many of our large manufacturing industries, this work will be received as a valuable addition to chemical literature, especially by those who are called upon to make estimations of the *active ingredients* of vegetable preparations, or the general examination of raw products.

There is, probably, no branch of chemical literature that has received less attention than the general analysis of plants for their proximate principles, for what has been written on the subject is distributed over such a large area that few would undertake, or be capable of, collecting and revising the work in a satisfactory manner. Another great difficulty of the subject is, that hardly any new plant can be examined that will not require a special method of procedure or a modification of the processes at present in use; and fresh products turn up which are frequently only separated and purified after the greatest labour; and then the tests for many well known principles are most unsatisfactory, and difficult of application.

The author has, however, simplified matters as far as possible, giving the most important methods of separating, estimating, and testing a very large number of vegetable products. Due reference is given to papers from which methods of estimation, &c., have been taken, and when these have been translated or abstracted into English journals they are fully noted, in many instances a very useful reference. We regret, however, to note how few English chemists are quoted, yet much good work has been done in this branch of chemistry in Great Britain. The first part of the work is devoted to the separation of the constituents into groups; a weighed quantity of the substance is extracted—

1st. With petroleum spirit not boiling above 45°: which extracts fixed oils, volatile fat acids, vegetable wax, together with a small quantity of chlorophyll, and some alkaloids.

2nd. With ether free from alcohol and water: which dissolves resins, some acids, and chlorophyll.

3rd. With absolute alcohol: which dissolves tannin, glucosides, bitter principles and alkaloids.

4th. With water: which dissolves mucilagenous substances, dextrin organic acids, glucoses, sacharoses, &c., albuminoids, ammonium salts, nitric acid and amido-compounds.

5th. With dilute caustic soda, ·1 to ·2 per cent.: which dissolves metarabic acid, albumen, phlobaphene, &c.

6th. With dilute hydrochloric acid, 1 per cent.: which dissolves calcium, oxalate, pararabin, &c., or if starch is present the substance is boiled for four hours with the acid and the glucose estimated.

7th. The residue, which consists of cellulose, lignin and allied substances.

These various groups are then submitted to a searching examination. The second part is a sort of supplement to the first and gives full instructions when possible for the quantitative estimation, and qualitative examination, reactions, &c., of the constituents. The work finishes with two very useful tables; the first giving the percentage composition of the constituents of plants, arranged alphabetically; the second the composition of the more important constituents arranged according to the percentage of carbon.

We can confidently recommend this work to all who are interested in chemical agriculture, or plant analysis, as one from which can be gathered an immense amount oi useful information not to be found in any other published English work.

NOTES FROM OTHER JOURNALS.

VOLUMETRIC ESTIMATION OF LEAD ACETATES.

In the course of a paper on "Volumetric Analysis," read by Mr. Peter MacEwan at a meeting of the Edinburgh Chemists' Assistants' Association, the tediousness of the pharmacopœial process for the above was referred to in the following words:—

There is a special difficulty with lead acetates, due to the fact that they react with the oxalic acid to form insoluble lead oxalate and acetic acid; consequently litmus and the other saturation indicators do not indicate the final reaction. The only indication is cessation of precipitation, but the oxalate subsides very slowly in the cold, and it is so bulky that one is apt to run in too much of the oxalic acid solution. By reversing the process and employing the heat of a water-bath to aggregate the precipitate, I find that the process can be conducted more expeditiously. The following are details:—

Plumbi Acetas.—The burette is filled with a 10-per-cent. aqueous solution of the salt (10 grammes in 100 c.c.), containing a little acetic acid to keep it clear; 20 c.c. of oxalic acid solution, and about 2 oz. of warm water are put into a flask, then 38 c.c. of the lead solution are run in and the flask placed on a water-bath. This quantity of lead solution contains 3·8 grammes of the salt, which is the amount allowed by the British Pharmacopœia to combine with 20 c.c. of acid solution; if, therefore, the salt contain impurity, we shall require to pour more lead solution into the flask. It will be found that the heat of the water-bath causes the precipitate to subside more quickly than that of the naked flame; as soon as there is a fair amount of clear superstratum the flask is removed and a few drops of lead solution added; if a precipitate form proceed cautiously, adding the solution, heating between each addition, until the last drop ceases to cause a precipitate. Note the number of c.c. used and calculate the percentage of real acetate (B.P.) in the sample from the following formula (x=number of c.c. used):—

$$\frac{38 \times 100}{x}$$

Liq. Plumbi Subacetatis.—Twenty grammes of this solution should be made up to 100 c.c. with a little acetic acid and distilled water, the burette being filled with the solution. Ten c.c. oxalic acid solution and two oz. of warm water are put into the flask, and about ten c.c. of the lead solution added; then place on the water-bath after agitating the contents thoroughly. After subsidence continue the addition of the lead solution, and proceed *secundum artem* until the final reaction is attained.

Calculation.

10 c.c. oxalic acid solution = 1·37 gr. $Pb_2O(C_2H_3O_2)_2$
V = number of c.c. diluted lead solution used, then

$$\frac{1{\cdot}37 \times 100 \times 5}{V} = \text{p. c. of } Pb_2O(C_2H_3O_2)_2 \text{ in sample.}$$

Working by the ordinary method, namely, by adding the acid to the lead solution, heating of the mixture does not appear to be advisable, because the precipitated normal lead oxalate reacts partially with the basic acetate to form basic lead oxalate, thus giving results which are slightly low. The following are percentages which I have obtained by both methods:—

A sample of liq. plumbi subacetatis estimated—

I. By ordinary process. Ten grammes required 19 c.c. oxalic acid solution (mean of three titrations) = 26·03 per cent. Pb_2O $(C_2H_3O_2)_2$.

II. By reversed method. Ten c.c. oxalic solution required 25 c.c. of 20-per-cent. solution (mean of three) = 27·4 per cent. Pb_2O $(C_2H_3O_2)_2$.

III. By precipitation as chromate found 27·2 per cent.

In I. and II. the mixtures were filtered after titration; both remained perfectly clear after cooling; I. gave a very slight indication of lead with potassic chromate, and II. less so.

Another point worthy of observation is that in the ordinary method (using heat) the superstratum is charged with minute crystals, while in the reversed method it is perfectly clear until the final reaction is reached, after which (if more lead be added) it becomes similar to that of the ordinary method. This fact would seem to strengthen the supposition that basic oxalate is formed in presence of basic acetate.—*Chemist and Druggist*, December, 1883.

PREPARATION OF PURE CHLOROPHYLL.

A. Tschirch states that until now absolutely pure chlorophyll has never yet been obtained. The assumption has always been that chlorophyll is a comparatively stable substance, whereas Tschirch finds it to be readily decomposed even by carbonic acid, with formation of chlorophyllane. He considers that only that substance which gives exactly the same absorption spectrum as is yielded by the living leaf can be considered pure chlorophyll. He has obtained such a substance by the reduction of chlorophyllane by powdered zinc over the water-bath. In alcoholic solution this substance has a beautiful emerald-green colour, and yields the following absorption spectrum:—

Band.	I.	II.	III.	IV.	End Absorption.
Thin layer ..	λ = 68 to 63	62 to 59·5	58·3 to 55·7	54·0 to 52·5	50
Thick layer ..	λ = 68·5		55·5	53·5 to 52·0	51

Absorption Spectrum of Living Leaves.

Band.	I.	II.	III.	IV.	End Absorption.
Two leaves ..	λ = 70·65	63 to 61	60·57	55 to 54	52
Three leaves ..	λ = 70·5		57	55 to 54	52

Pure chlorophyll thus prepared is a dark green liquid which has as yet resisted all attempts to crystallize it. It is easily soluble in alcohol, ether, and in fatty and essential oils, and very soluble in benzine; it is difficultly soluble in melted paraffin, and insoluble in water. It is converted by dilute acids into yellow chlorophyllane, and by concentrated hydrochloric acid into phyllocyanine. A solution of caustic potash decomposes it into a fluorescent emerald-green substance, soluble in water, and resembling chlorophyll in its external appearance, and into a yellow substance soluble in ether.—*Berichte der deutschen chemischen Gesellschaft*, November 23, 1883, translated for *Chemist and Druggist*.

A NEW METHOD OF OBTAINING PULP.

G. Archbold macerates wood or straw, cut into suitable pieces, in dilute milk of lime: after twelve hours introduces them into a suitable digester and saturates with sulphurous acid, the pressure amounting to four or five atmospheres. In two hours the material is so loosened up that, after washing with water and further treatment under pressure with three per cent. chloride of calcium and half a per cent. of aluminium sulphate dissolved in a little water, the stuff obtained without any further operation has the appearance of cotton, and can serve for the manufacture of fine qualities of paper.—*Scientific American*, December 1st, 1883.

ESTIMATION OF THE SULPHURIC ACID IN SULPHATE OF ALUMINA.

This salt is taking the place of alum for many purposes; it is used considerably for paper making, and for this industry it is necessary that it should be free from acid, since the presence of a small proportion of free acid destroys ultramarine, and injures the sizing by causing transparent spots.

Oscar Miller has reported the results of his experiments in the *Berlin Berichte*, which show that methyl orange is the safest and best test for free acid. With pure sulphate of alumina it produces only an orange colour, but is very sensitive to free acid with which it produces a rose colour or pink. Ethyl orange is more sensitive, but turns pink with some neutral sulphates. Tropæoline is not sensitive enough. By extracting the acid with alcohol the solution may be titrated, using methyl orange an an indicator.—*Scientific American*, December 1st, 1883.

LAW CASES.

On Monday, the 10th December, an important case was heard at Manchester, before the stipendiary magistrate. The hearing occupied about five hours.

The defendant was Mr. R. Melling, a dairy farmer, of Levenshulme. Mr. Cottingham appeared for the defendant, and the prosecution was conducted by Mr. Hudson.

On the 31st October the inspector purchased from a local dealer a pint of milk, which Mr. Estcourt certified as containing 5 per cent. of added water. As the dealer declared that he sold the milk as purchased, giving the names of the farmers who supplied him—the defendant being one—the inspector thereupon procured a sample of this farmer's milk, which was adulterated with 12 per cent. of added water. In his examination he stated that he had paid a visit to Mr. Melling's dairy and seen the operation of milking—taking every possible precaution to guard against any tampering with the milk—and procured a sample of the mixed milk, which he forwarded to the analyst.

Mr. Estcourt gave evidence to the effect that the dairy sample contained 12·53 per cent. total solids, the non-fatty solids being 10·13 per cent. He considered that the milk was of very high quality, and comparing it with sample 52, which contained 10·45 per cent. total solids, and 7·91 per cent. solids not fat (purchased from the defendant), the latter would contain 21 per cent. of added water instead of 12.

The stipendiary stated that it was not necessary for him to express any opinion of the relative merits of the processes of analysing; because, even according to the standard adopted at Somerset House, this milk was below the limit fixed there, and below that of Wanklyn. The only question he had to consider then was whether a satisfactory explanation had been given of its low quality

He must confess that he was not satisfied of that, but was of opinion that water had been added; therefore he must fine the defendant.

The assistant clerk then read out a list of seven convictions, ranging from February, 1875, down to August, 1880, and varying in amounts from £5 to £20; the latter amount occurring twice.

The magistrate imposed a fine of £20 and costs.

At the Bradford Borough Court, on Tuesday, Mr. William Mawson, grocer, of Manchester Road, was summoned for selling to one of the Corporation inspectors a pound of butter not of the nature of the substance demanded by the inspector. The Town Clerk prosecuted, and stated that the defendant was a dealer in provisions, and was found selling an article he called butter which had not a single grain of butter in it. A pound of butter was asked for by the inspector, and, when analysed by Mr. Rimmington, not a grain of butter was found in the article. The inspector stated that he visited the defendant's shop on November 8, and asked for a pound of butter, for which he paid 1s. 2d. He told the defendant for what purpose he had bought

the article, and divided it into three parts; one he left with the defendant. The magistrate's clerk read the analysis, which stated that the article contained 12·6 parts of water and salt, and 87·4 parts of fat other than butter. The defendant said that he had fallen short of butter, and had got the other article as a substitute. Defendant was fined £5, and costs, or in default two months' imprisonment.

Important Decision.

In the Queen's Bench Division of the High Court of Justice, on Wednesday, Mr. Justice Mathew and Mr. Justice Day had before them the case of Chappell *v.* Enson, an appeal against the decision of the justices sitting in petty session at Keynsham, near Bristol, convicting the appellant of an offence under the Food and Drugs Adulteration Act, 1875. Mr. Poole, who appeared in support of the appeal, said that the point raised in the case was a very short one, viz., whether the condition precedent had been performed on the part of a person who applied for a sample of food in order that it might be analysed. By Section 14 of the Food and Drugs Adulteration Act, 1875, it was provided that if any person purchased any article with the intention of submitting the same for analysis he should, after the purchase had been completed, forthwith notify to the seller or his agent selling the article his intention of having it analysed by the public analyst; that he must offer to divide the article into three parts; that he must then and there separate the article; that each part must be marked and sealed or fastened up in such a manner as the nature of the article permitted; and that he must hand one part to the seller or his agent. In the case, the purchaser notified to the seller that it was his intention to have the article analysed by the public analyst, and offered to "divide" it, but he did not offer to "divide it into three parts" according to the statute. Mr. Justice Mathew: The time had not come for him to offer to divide it into three parts, because when the respondent offered to divide it the appellant refused to have it done. Mr. Poole: I submit, my lord, that the respondent was bound to conform with the strict words of the Act. The respondent only offered to divide it. Mr. Justice Mathew: He offered to divide it. That meant to divide it in accordance with the Act. Mr. Poole: I admit that my objection is strictly technical. I contend that the very words of the Act ought to be notified to the seller. Mr. Justice Mathew: Is there any provision which says that a certain form of expression should be adopted, and that no other will suffice? Mr. Poole cited a case which, accordance to his contention, entitled him to have a conviction granted in this case. Mr. Justice Mathew: I am of opinion that the justices were right in convicting, and that the appeal should be dismissed with costs. Mr. Justice Day: I am of the same opinion. Appeal dismissed with costs.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No. 1883.	Name of Patentee.	Title of Patent.	Price
4440	C. Semper	Removing both Iron and Manganese from certain solutions	4d.
5975	J. Sellers	Manufacture of a new Ærated Water, containing Bismuth, to be employed for medicinal purposes	2d.
377	T. Copper	Method and Apparatus for producing Combustible Gaseous Fluids	4d.
441	A. M. Clark	Composition to be used as a Substitute for Hard Indiarubber, Celluloid, Ivory, &c.	4d.
465	A. H. Lake	Separation of Lime from Crude Phosphates	2d.
466	A. M. Clark	Manufacture of Varnishes	2d.
472	J. F. Lackenstein	Distillation	2d.
480	W. White	Apparatus for the Manufacture of Gas	2d.
482	A. L. Nolf	Construction of a Secondary Battery, or Accumulator of Electricity	2d.
513	W. R. Lake	Manufacture and Packing of Mixtures, or Compounds of Alkaline, and Oily, Fatty, or Resinous Substances for Soap Making	2d.
519	A. Jay & C. Hook	Apparatus for the Manufacture of Gas from Oils	2d.
551	W. H. Harrison	Manufacture of Artificial Hard and Soft Indiarubber and Gutta Percha	4d.
554	H. Simon	Coke Ovens, &c.	6d.
577	N. Bauer	Manufacture of Pure Spirits of Wine	6d.
584	H. L. Doulton	Manufacture of Crucibles	6d.
587	E. P. Potter & W. H. Higgin	Process for Manufacture of Bichromate of Soda	4d.
589	W. Crossley	Producing Combustible Gas for Steel Making, Glass Making, and other purposes	6d.
595	J. B. Tompson	Blacking, &c.	6d.
660	W. R. Lake	Combustible Compound of Carbonaceous and other Materials	4d.
732	W. F. Strype	Treatment of Mineral Phosphates to obtain Products therefrom	2d.
2781	J. S. Muir	Apparatus for Carburetting Air, and Delivering or Distributing the same for Lighting and Heating purposes	6d.
170	Loder	Treatment and Manufacture of Coloring Matters	4d.
497	C. D. Abel	Manufacture of Ligneous Compound, and of Articles Moulded therefrom, in imitation of Wood and other Carvings	2d.
553	H. L. Pattinson, junr.	Obtaining Products from Coal	2d.
560	A. J. Boult	Manufacture of Sugar, and Apparatus therefor	2d.
586	E. P. Alexander	Treatment of Brine employed in the Manufacture of Salt	2d.
593	E. Sonstadt	Obtaining and Treating certain bases from Coal Tar, Naphtha, and Oils	2d.
620	J. Walker	Treatment and Application of certain Materials after having been fouled in the process of Purifying Coal Gas, for the Protection of Plants or Trees from the Attacks of Insects	4d.
625	W. L. Wise	Manufacture of Material suitable for use as a Substitute for Leather, Cloth, Horn, Tortoiseshell, &c.	4d.
718	G. W. Von Nawrocki	Manufacture and Treatment of Crystallized Sugar from Starch	4d.
731	J. H. Johnson	Preparing Malt, and other Amylaceous Substances, for Brewing and other purposes	6d.
747	A. Adair & W. Tomlinson	Treating Iron Ores and other Mineral Substances for Extracting Sulphur and Phosphorus, &c.	4d.
748	J. H. Johnson	Manufacture of Bichromates of Potash and Soda	4d.
750	T. Griffiths	Manufacture of a White Pigment	4d.

No. 1882.	Name of Patentee.	Title of Patent.	Price
752	J. Hickisson & H. W. Langbrek..	Manufacture of Colored Marking Inks.	4d.
715	L. Mond	Apparatus for Extracting Ammonia from such Solutions as are produced in the Manufacture of Soda by the Ammonia Process	6d.
716	L. Mond	Manufacture of Soda	6d.
765	A. B. Rodyk..	Purifying Gum Copal	2d.
830	L. Howell	Treatment of the Mast Liquor produced in Pickling Iron..	2d.
844	P. J. Walley..	Treatment of Sulphuretted Hydrogen, so as to obtain Sulphur therefrom	2d.
864	J. C. Martin..	Apparatus for the Manufacture, Drying, and Packing of White Lead, parts of which are also applicable to the Packing of other Substances	6d.
875	J. Clark	Reducing Metals from their Ores or Chemical Compounds..	6d.
897	T. Twynan	Production of Phosphoric Acid and Phosphates, and Utilization of Slags	4d.
915	C. A. Meinert & P. Jeserich	Utilizing Raw Vegetable Fats and Matters for Artificial Butter	2d.
942	J. H. Johnson	Testing Metallic Ores, &c., for the Separation of the Metals therefrom	8d.
944	Annie Eliza Scott	Separation of Gold and other Metals from their Ores ..	4d.
945	L. Gaulard	Tanning Leather by Electricity	4d.
949	A. A. Nesbit	Manufacture of Ink and Printing Material for use in Printing Postage Stamps, &c.	4d.
916	W. Arthur	Manufacture of Gases and Vapours for Heating and Illuminating purposes	1/4
956	E. G. Brewer	Production of Bases for Coloring Matters	4d.
969	W. Weldon	Manufacture of Precipitated Phosphate of Lime and Recovery of Sulphur from Alkali Water	2d.
995	J. T. McDougall	Purification of Coal Gas, and Preparation and Treatment of Materials employed therein	4d.
1017	I. S. McDougall	Furnaces, or Apparatus for Burning, Calcining, or Roasting Sulphur Ores, Spent Oxide of Iron, and other Materials, and Apparatus for Separating Dust and Solid Impurities from Gases obtained	2d.
1045	W. W. Pattinson	Manufacture of Coke	4d.
1055	L. Brumleu	Apparatus for Manufacture of White Lead	6d.
1117	W. R. Lake	Manufacture of Alcohol and Food for Animals from Amylaceous Substances	4d.
3111	Dr. J. Weiler	Separating Orthotoluidine from Paratoluidine, Orthotoluidine from Aniline and Paratoluidine, by means of Phosphates and Arsenates..	2d.
1077	W. Smith	Plastic Compound, suitable to be rolled into sheets and used as a Substitute for Ebonite	2d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Science; The Inventors' Record: New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; Cowkeeper and Dairyman's Journal; Sugar Cane; Country Brewers' Gazette; The Medical Record; The Grocers' Gazette; London Water Supply, by Crookes, Odling and Tidy; Chemical Review; Independent Oil and Drug Journal and Paint Review; Science Monthly; Journal of the Society of Chemical Industry; Tobacco.

THE ANALYST.

FEBRUARY, 1884.

THE annual meeting of the Society of Public Analysts took place on the 16th January, when the New Council were elected with the result of obtaining the entrance of several influential and, we expect, hard-working members. Although the Society must, from its very nature, be always numerically small, yet no one who has not experienced it can conceive the numerous questions of importance coming before the Council. At present of course the subject of milk is in the foreground, and we trust that the gentlemen now put into office will before the termination of their term present the Society and the Public with a result which will be universally accepted and acted upon.

After the meeting the members and their friends dined together at the Holborn Restaurant, the President in the chair. A capital dinner following after a most harmonious gathering, made the evening pass in an extremely pleasant manner. At the dinner, although the usual speeches were made over the "walnuts and the wine," yet all scientific discussions were wisely put aside, and several members showed their proficiency and powers of entertainment in a vocal direction. From the lateness of the hour at which the guests dispersed we should think that all present felt contented with themselves and with the Society.

PROCEEDINGS OF THE SOCIETY OF PUBLIC ANALYSTS.

THE ANNUAL MEETING of the Society was held on Wednesday, 16th January, at Burlington House. The President, Mr. Wigner, in the chair. The meeting was numerously attended.

The minutes were read and confirmed.

The meeting then proceeded to elect officers and council for the ensuing year. On the ballot papers being opened, the Scrutineers reported the result of the election as follows:—

President.

G. W. WIGNER, F.C.S., F.I.C.

Vice-Presidents.

C. HEISCH, F.C.S., F.I.C.
A. HILL, M.D., F.I.C.
A. WYNTER BLYTH, M.R.C.S., F.C.S., F.I.C.

Treasurer.

C. W. HEATON, F.C.S., F.I.C.

Hon. Secretaries.

BERNARD DYER, F.C.S., F.I.C.
OTTO HEHNER, F.C.S, F.I.C.

Other Members of Council

J. BAYNES, Jun., F.C.S., F.I.C.
C. ESTCOURT, F.C.S., F.I.C.
R. H. HARLAND, F.C.S., F.I.C.
A. SMETHAM, F.C.S., F.I.C.
T. STEVENSON, M.D., F.R.C.P., F.C.S., F.I.C.
J. W. TRIPE, M.D.

The names of those members of council whose term of office has not yet expired, and who consequently, do not retire this year, are M. A. Adams, F.R.C.S., F.C.S.; A. Ashby, M.B., Lond., F.R.C.S.; A. Dupré, Ph.D., F.R.S., F.C.S., F.I.C.; C. T. Kingzett, F.C.S., F.I.C.; J. Muter, Ph.D., M.A., F.C.S., F.I.C.; and P. Vieth, Ph.D., F.C.S.

The following gentlemen were balloted for and elected. As members, A. J. Bernays, Ph.D., Lecturer at St. Thomas's Hospital; E. G. Clayton, F.C.S., Analytical and Consulting Chemist; John Hughes, F.C.S., F.I.C., Agricultural and Analytical Chemist; W. O. Nicholson, Analytical Chemist; F. B. Last, F.C.S., Public Analyst. As associates, G. H. Allibon and H. J. Horton.

After the results of the ballot had been announced, the president formally returned thanks on behalf of himself and the new members of the Council.

A vote of thanks to the Council of the Chemical Society for permitting the use of their rooms for the society's meetings, was carried by acclamation.

The Treasurer and Secretaries also received hearty votes of thanks.

After a similar compliment, the president, Mr. Wigner, then delivered his annual address, of which the following is an abstract:—

President's Address.

The customary address by the president affords an excellent occasion for a review of our year's work, and of what is in store for us in the ensuing year, and in no society is such a review of more importance, or of more value, than in ours.

Although we are only a small society, and not a very wealthy one, our strength lies in this: that by our very constitution itself, every member is a working member, who brings not only a fee, but actual work, into the Society.

During the year just passed we have elected 13 members and 5 associates, and I have only received information of the loss of one member by death

Our total membership is now 141 members and 24 associates. Unless we relax the qualifications for admission, which I hope we shall not do, we cannot, as a society, grow much larger, because we shall not be able to find many more candidates for election.

Our accounts, which have been audited and laid before you this evening, show that, although we cannot boast of wealth, we are able to show a balance in hand quite enough to bear any unforeseen expense we may be put to.

Our published work during the past year has consisted of 25 papers, all useful and some of great value, containing new well-considered processes of analysis, which will take rank as standard processes. Our unpublished work does not show to the public, and they fail to comprehend to the full, how much they owe to the operation of the much-abused Sale of Food and Drugs Act.

In this coming year, two or three matters of importance will have to be considered. The society has appointed a committee of a very strong character to deal with the milk question, and has taken the wise course, as I venture to think it, of inviting some well-known outsiders to join them in the work. This committee ought to settle the much-disputed milk analysis question once and for all, and if so, and the results

are such as to justify it, then it will clearly be our duty, as a society, to urge on the Government the necessity for an amending bill, which will also afford the opportunity for the introduction of a few more amending clauses which are still needed. It would not be proper for me to say what are the lines which I think such legislation should take, but one point is clear, that it should tend towards making public analysts more directly responsible for their work, and the referee chemists, whoever they be, responsible instead of irresponsible.

The Auditors reported that they had examined the accounts and found them correct. The balance sheet will be posted to each member.

The following papers were then read and discussed:—

"A new Test for Lead," by A. W. Blyth, M.R.C.S., &c.

"On the Decrease in the use of Coffee as a Beverage," by Dr. Wallace.

"On the Estimation of Peroxide of Hydrogen," by H. S. Carpenter and W. O. Nicholson.

The dates of meetings for the ensuing year, were then fixed as follows:—

Wednesday,	February 20th,	Wednesday,	June 18th,
,,	March 19th,	,,	November 19th,
,,	April 16th,	,,	December 17th,
,,	May 14th,	,,	Jan. 27th, 1885, Annual Meeting.

The papers will be printed in our next number.

The meeting then adjourned for the Annual Dinner.

The following paper was read at the December meeting:—

NOTES ON RAPE OIL, BEEF FAT, AND MUTTON DRIPPING.

By C. T. Kingzett, F.I.C., F.C.S.

Read before the Society of Public Analysts, December 17th, 1884.

Some years ago I commenced an investigation of a number of fats and oils, with the view of obtaining more precise knowledge of their various constituents and the proportions in which they are respectively present. It was only, however, in the case of cocoa butter that I was able to bring my observations to completeness, and these have been already published.* The following notes are of a very imperfect character, but as I see no chance of resuming the investigation, I record them for what they are worth.

Rape Oil.

The specific gravity of a carefully selected sample was determined and found to be ·915.

50 grms. of the oil was saponified by long boiling with caustic soda solution. The soap was entirely dissolved in hot water and precipitated by chloride of barium: the precipitate being washed and dried at 100° C. It fused, when dry, and weighed 61·5 grms. Assuming the compound to have been one of brassate of barium with the composition $Ba(C_{22}H_{41}O_2)_2$, its weight would correspond to 51·2 grms. of brassic acid

* *Jour. Chem. Soc.*, 1878, p. 38.

$C_{22}H_{42}O_2$, as against 50 grms. oil employed. This barium compound was soluble in ether, benzene and carbon disulphide. It was dissolved in ether, and precipitated therefrom by alcohol.

In this state the reprecipitated compound was, from necessity, allowed to remain some weeks, but then it was found to be entirely insoluble in ether. It was now extracted by boiling methylated spirit, and the nearly white salt deposited upon cooling of the extract was dried and examined for barium.

0·202 grms. gave 0·063 grm. $BaSO_4$ = 18·33 per cent. barium.
Oleate of barium contains 19·59 per cent. barium.
Brassate of barium contains 16·86 per cent. barium.

The bulk of the preparation which remained undissolved by the methylated alcohol, was then decomposed by hydrochloric acid in the presence of ether. The mahogany coloured ethereal solution of fat acid was washed and the ether distilled off, leaving the acid behind; this solidified on cooling.

Five grms. of the free acid was melted and inclosed in a measured tube containing air standing over water. It absorbed no oxygen during a month, showing that the text-book statements as to the ready oxidisability of brassic or erucic acid are unfounded.

Beef Fat.

A quantity of this substance was freed from tissue by heating it in a hot air bath, and then subjecting the mass to pressure.

84 grms. of the fluid oil was saponified with caustic soda. The excess of alkali was partly neutralised with dilute sulphuric acid, and the soap which then separated was freed from mother-liquor, which was retained for further investigation.

The soda soap was converted into lead soap, which, when dry, weighed 158 grms. It was next powdered and extracted with ether to doubtful perfection. The ethereal extract was distilled to dryness, the lead compound decomposed by hydrochloric acid, and the free fat acid taken up with ether. The ether solution was washed with water and then distilled to dryness; the oleic acid taken up with dilute ammonia, and the solution precipitated with chloride of barium. The barium compound was isolated, washed and dried: it then weighed 29·5 grms. Assuming the lead soap to have been perfectly extracted with ether, then we find that the 84 grms. of beef fat employed consisted of 23·8 grms. of oleic acid and 60·2 grms. of solid fat acids.

The lead salt insoluble in ether was decomposed by hydrochloric acid, in the presence of ether; the ether solution was distilled, and the fat acids were dissolved in, and crystallised from alcohol.

The mother liquor obtained after separation of the soda soap, was acidified with dilute sulphuric acid, and then subjected to distillation. The distillate had a faint odour, and was feebly acid. After exact neutralisation with soda, the salt obtained upon evaporation to dryness was unweighable. It was dissolved in water and the solution subjected to certain tests as follows:—

With nitrate of silver it gave a white precipitate, which was entirely reduced upon boiling. The original white precipitate was soluble in ammonia, and was not reprecipitated by nitric acid. It was therefore not chloride.

With sulphate of copper, it gave a precipitate which did not dissolve upon boiling the mixture.

With alcohol and strong sulphuric acid, it developed a powerful ethereal odour.

With calcium chloride it gave a precipitate.

With barium acetate it gave a precipitate.

Mutton Dripping.

A quantity was twice fused over water, to free it from salts, and was then freed from water by fusion and decantation.

85·8 grms. of the white fat was saponified by boiling, during several hours, with excess of caustic soda solution. When thoroughly saponified, the caustic solution (which was free from soap, as proved by the fact that sulphuric acid in excess produced no precipitate in it) was drawn off, but to do this perfectly, it had first to be partly neutralised by sulphuric acid. This solution was kept for further examination.

The soda soap, which became white and hard upon cooling, was dissolved in much water, and precipitated by acetate of lead. The precipitate was washed with hot water, and then dried at 200° F., at which temperature it partially fused. The dry lead salts weighed 136 grms. The mass was powdered and extracted with ether, with the view of entirely dissolving out the oleate of lead. This, however, was found to be impracticable, although the operation was continued over several days, using more than 8 litres of ether.

The lead salt dissolved by the ether was decomposed with hydrochloric acid in presence of ether; the ether solution was washed and distilled to dryness; the yellowish oil which was left weighed 28·7 grms. (while moist). It was converted into ammonia soap, and then into barium salt, which, when washed and dried, weighed 34 grms. (It is to be noted that 34 grms. of barium oleate correspond to 27·4 grms. oleic acid.) It was, therefore, presumably nearly pure oleate of barium, and this inference was confirmed by recrystallising a quantity of it from alcohol, and determining the amount of barium present in the purified preparation. 0·198 grm. gave ·068 grm. $BaSO_4$ = 19·69 per cent. of barium against 19·59 per cent. demanded by theory.

The lead salts insoluble in ether were treated as were those obtained from beef fat.

The mother liquor remaining after removal of the original soap, was also treated as the corresponding product from beef fat. That is to say, it was acidified with H_2SO_4, and distilled. The distillate had the odour of dilute butyric acid, and was acid in reaction. It was exactly neutralised, and the solution evaporated to dryness. Product weighed 0·053 grm. It was dissolved in water, and upon testing the solution it was found to give all the reactions described under the notes on beef fat. It is to be remarked, however, in connection with the fact that the solution gave precipitates with various reagents, that the butyrates are freely soluble.

Oleic Acid.

Five grms. of the oleic acid, obtained respectively from the beef fat and mutton dripping, were in each case sealed up with a measured quantity of air, standing over water during a month (June), but in neither case was any oxygen absorbed*. A

* See *Journ. Soc. Chem. Industry*, 1883, p. 100.

similar experiment was made with the oleic acid which I had obtained from cocoa butter, with a similar result.

The fact that oleic acid obtained from oil of almonds, and also that prepared from brain lecithine, do not absorb oxygen from the air, had been previously observed by Thudichum*, and more recently Mr. W. Fox † has shown that oleic acid and linoleic acid from linseed oil do not, when pure, absorb oxygen.

CONCLUSION OF THE SOCIETY'S PROCEEDINGS.

DRUG ADULTERATION IN THE UNITED STATES.

By THOMAS STEVENSON, M.D., and F.R.C.P. Lond.

RECENTLY several prosecutions have been instituted against vendors of adulterated drugs in Massachusetts under the Legislative Act of 1882. In the matter of drugs, the policy of the Massachusetts Board of Health has been to prosecute the manufacturers, who must know what they send into the market, rather than the retailers, who in these days rarely manufacture their own articles, and hence may unwittingly violate the law.

Two charges, which may be regarded as test cases, were made against two firms of wholesale druggists in Boston. Tincture of opium was the drug selected as being one of the most important and general in use. Under the Act of 1882, a drug is declared adulterated (1) if, when sold under or by a name recognised in the U.S. Pharmacopœia, it differs from the standard of strength, quality, or purity laid down therein; (2) if, when sold under or by a name, not recognised in the U.S. Pharmacopœia, but which is found in some other pharmacopœia or other standard work on materia medica, it differs materially from the standard of strength, quality, or purity laid down in such work; (3) if its strength or purity falls below the professed standard under which it is sold. The State Analyst of Drugs found that one of the samples of tincture of opium in question contained only 0·81 per per cent. of morphia instead of 1·2 per cent., according, as he said, to the Pharmacopœia of 1880; the other was even more deficient in morphia, containing only 0·72 per cent., or less than two-thirds of the prescribed amount.

For the defence, it was in each case asserted that the public issue of the pharmacopœia in October, 1882, was not made till two months after the law came into force in the preceding August; and the defendants claimed the right to take any preceding pharmacopœia, even the first one of 1820, inasmuch as the Act of the Legislature does not specify any particular pharmacopœia. Counsel for the prosecution contended that either the pharmacopœia of 1870, or that of 1880, must be in force, and according to the testimony of the State Analyst, Dr. Davenport, one of the compilers of the U.S.P., 1880, the tinctures fell below the quality of a preparation prepared according to either of these pharmacopœias. Eventually it was ruled that the pharmacopœia of 1880 fixed the standard under which the government could proceed. Practically the change made

* Report of Med. Off. Privy Council; New Series, No. 8 (1876), p. 130.

† ANALYST, 1883, p, 116.

in the strength of tincture of opium, as it should be under the pharmacopœia of 1880, is that the quantity of opium is raised as compared with the pharmacopœia of 1870, in the proportion of 9 to 10, according to an appendix to the U.S.P.; but according to my calculations, in the proportion of 8 to 9.

The board proved its case against both the firms, but one escaped a conviction on a technical point, and a conviction was obtained in a third case. The Boston Druggists' Association is naturally aggrieved, and has, we are told, addressed a remonstrance to the board on its present process, emphasising the propriety of warning a delinquent firm before proceeding against it. It is hardly to be supposed, however, that manufacturing firms can be ignorant of the quality of the goods they send out to the retailers. The Boston Board of Health is doing good service by striking at the fountain head of a pernicious system.

I am indebted for the above facts to an editorial article in *The Boston Medical and Surgical Journal*. In connection with the above case it is interesting to note the comparative strengths of the U.S.P., 1880, tincture of opium, and that of the B.P. The U.S.P. undergoes decenninal revision, and the issue of 1880 made the material alteration of ordering all preparations to be made by weight. The tincture of opium, U.S.P., 1880, is made by extracting 10 ounces of opium with so much alcohol sp. gr. ·92 as is required to make the filtred product weigh 100 ounces. Hence it contains the extractives of exactly 10 per cent. of its weight of opium, or 9·2 parts by weight in 100 by volume. Approximately—for the specific gravity of the tincture must be variable—11·9 of an English minim correspond to a grain of opium. It is evident from the above cases that an opium yielding 12 per cent. of morphia is expected to be used in the preparation of the article; whereas the B.P. requires only 6 to 8 per cent. of morphia. If the mean, 7 per cent., be taken, the U.S.P. tincture of opium in a given volume contains nearly twice as much morphia as the B.P. article.

Since Mr. Wynter Blyth's valuable book on "Poisons" is, no doubt, in the hands of many public analysts, it may be well to point out that he states incorrectly the strength of several of the most important opiates. Tincture of opium is stated to be one grain of opium in 14·8 min., *i.e.* about 6·7 parts by weight in 100 by measure. It should be 1 grain in 14·6 minims, or exactly 7·5 parts by weight in 100 by measure. Ammoniated tincture of opium is stated to contain 1·04 instead of 1·14 parts of opium by weight in 100 by measure. Wine of opium is stated to contain 4·5 instead of 5; as it should be of opium extract in 100 parts by measure. Lastly, the extract of opium is said to have its strength about the same as opium itself, whereas good opium yields about half its weight of extract, which should contain practically all the morphia in the opium. A good opium extract should not be less than half as strong again as opium itself.

CHEMICAL NOTES FROM OTHER SOURCES.

THE following paper was sent to us last month, but unfortunately too late for publication. Since then it has appeared in the *Pharmaceutical Journal*, but as we think that in the present state of matters everything relating to the analysis of milk should appear

in the ANALYST, we now present it to our readers, after having been revised and improved by the author:—

NOTE ON THE ESTIMATION OF FIXED OILS AND FATS WITH SPECIAL REFERENCE TO MILK.

BY A. C. ABRAHAM, F.C.S.

THE plan generally followed for the estimation of fixed oils in such things as linseed meal has generally been maceration and percolation, or the latter alone, with ether, benzol, or some similar solvent. Anyone who has followed either course will, I think, readily admit the troublesomeness of it and the great care involved in preventing loss, especially when dealing with small quantities. To obviate these difficulties, I adopted a year or two ago for linseed meal the following plan, which I have since used for other substances and which I believe to be more accurate as it certainly is more easy, than those generally followed. The principle is simply that of macerating the substance to be estimated in the suitable solvent, taking half or a known proportion of the *total liquid resulting*, finding the amount of fat in it and calculating therefrom the amount in the whole.

To take linseed meal (or more correctly, crushed linseed, *i.e.*, the linseed crushed but not deprived of its oil) as an example. My procedure is as follows:—A tube is taken of about 1 inch in diameter and 14 inches in length, contracted at the neck and stoppered; in it is placed 100 grains of linseed meal and upon this is poured 2,000 fluid grains of spirit of wine less such an amount as will approximately represent the volume of the oil contained in a genuine and fair quality sample of the meal. The tube is now shaken to enable the spirit to expel all the air from the meal and when this has taken place the tube is graduated at the point at which the liquid stands. It is now ready for use. When it is desired to estimate a sample, 100 grains of the meal are inserted and ether added until it reaches the mark; it is then stoppered or corked and occasionally shaken during a sufficient time, when, if any loss has taken place by evaporation, or the volume has been apparently diminished by the loss of air from the meal, it is made up to the original point, again shaken and set aside. When it has completely subsided, 1,000 fluid grains of the clear supernatant liquid are removed with a pipette, evaporated and weighed as usual. By doubling the product so obtained, the amount of oil, together with such other matters contained in the meal as are soluble in ether, is arrived at.

It will be readily admitted, I think, that if the amount of matter soluble in ether were known before the estimation was commenced this process would be unexceptionable. I believe, however, that the error admitted by the want of this knowledge will upon consideration appear so trifling, even for an article containing so much oil as does linseed meal, as to be perfectly unimportant. Suppose, for instance, that the meal contains 20·2 per cent. of oil, &c., which we may assume to increase the bulk of the resulting solution to the extent of 20 fluid grs., now if no allowance at all were made for this the bulk of the solution would be 2,020 fluid grs. instead of 2,000, which is required. If only 1,000 of this were taken, that portion would be less than the remainder by 20 fluid grains, *i.e.* to say, supposing the 1,000 fluid grs. taken were found to contain 10

grs. of oil, the remaining portion would contain 10·2 grs., and by doubling the former amount we should get a result of 20 instead of 20·2, an error of one-hundredth of the product or 2 per cent., which if considered important can be neutralised by an allowance at the end of the operation. Or, if thought preferable, 2,000 fluid grs. of the solvent may be always used and an allowance made in proportion to the result found.

In this process it is assumed that all the solvent is capable of dissolving all of the matter to be dissolved, and that none of the latter will remain in a fixed condition, in or upon the tissues of the article containing it. Whether this assumption be absolutely true or not, I think it will be admitted, that if it is not, no process of percolation is likely to obviate it. In regard to milk, the case is somewhat different, because to follow the process, it is essential to evaporate the milk with either hydrated sulphate of calcium or powdered glass; the latter, perhaps, preferable on theoretical grounds, but the former what I have generally myself used.

The details of the process as applied to milk, are as follows :—

A 1,000 gr. specific gravity bottle is filled with the milk, the weight taken which gives the specific gravity. This is emptied upon 250 grs. of powdered glass or hydrated sulphate of calcium, and the flask either weighed or rinsed out with a few drops of distilled water, although practically, neither is necessary, as the amount of milk adhering to the flask, when once found, will be practically constant for all samples (unless sour). The milk taken is to be evaporated to dryness with the glass, and thoroughly powdered, when it is to be introduced into a tube; 2,000 fluid grs. of ether added from a pipette, so as to avoid loss by evaporation; the tube stoppered, shaken occasionally during some hours, after which 1,000 fluid grs. may be removed, dried, and weighed. This must not simply be doubled, as an allowance must be made for the fat dissolved by adding to the weight found $\frac{1}{9}$ (the specific gravity of butter fat being about ·900), deducting this from 1,000 and calculating the whole amount present therefrom, thus :—

Fat found, say	9
Add $\frac{1}{9}$	1
	10

∴ 990 fluid gr. of ether took up 9 grs. of fat, how much would 2,000 take up?

990 : 2,000 :: 9

11 | 200

18·18 Total fat present.

The difference between the amount which would be arrived at by simply doubling the weight found and that obtained as above will never amount to more than about ·005 per cent.

For this process of estimation it would be clearly much better, if possible, to extract the fat from the milk whilst still in a liquid condition, and if this could be done by simply boiling the milk down in a graduated tube, then adding the ether, making it up so that the ethereal solution should measure a convenient quantity, and drawing off half of this pipette, it would be much better; but I have not had time to try whether this can be done, although I believe it might.

There is another process which I have to mention, one which has been less tried than the one I have named, for, although it has suggested itself to my mind some time, I have not tried it until within the last ten days. It is applicable to all emulsions such as milk, and, as far as I have gone yet, may be described as follows:—

A piece of Parker's paper fibre lint, 4 inches by 2, is made into a roll, a piece of thin wire is passed through the centre, wound once or twice round the roll, and fixed into the stopper of a suitable weighing bottle, in such a manner that the roll may be sufficiently far from the sides, to enable it to be lifted in or out without any fear of touching the sides.* The roll is then taken out of the bottle, and dried in a water-oven with the bottle, until its weight is constant, 5 c.c. of milk are then dropped upon it from a pipette, when the stopper with the roll attached is re-inserted in the bottle, and the whole weighed. The stopper is then removed, and with its attachment, placed in a drying oven with the bottle, and kept there until it ceases to lose weight.

The excess of weight over the original weight gives the total solids. The stopper and roll are now removed and placed in another similar bottle—preferably ground to fit the same stopper as the first—sufficient ether added, so that the roll may be covered (about 50 c.c. is a convenient quantity) and allowed to macerate some hours; it is then transferred to another similar bottle, and again to a third, after which, the fat will be found to have been entirely extracted.† It is now removed and again weighed as before; the loss is fat.

If desired, the fat may be weighed directly by evaporation of the ethereal liquids, or the tubes in which they are contained may be graduated, the volume made up to the graduation, the liquid stirred with a pipette, and half, or a known proportion, drawn off from each. The latter method, I think in some respects preferable, as it does not involve the removal of the liquid from one vessel to another, which, if done, introduces an element of uncertainty, owing to the adhesion of a certain amount of the fluid to the vessel from which it is poured, and also involves the washing of the vessels to obviate the last-mentioned difficulty. It will be noticed that I have made no reference hitherto to the estimation of the ash, and this is because I have thought it impossible to expect anything like a small or possibly even a constant ash from an article not specially made for analytical purposes. I am not without hopes, however, that by means of washing with acids, even Parker's paper fibre lint may be so freed from ash, as to enable the whole four determinations of total solids, solids not fat, fat and ash to be made with very great accuracy from the one small sample of milk. The sugar may also be estimated by immersion in water, but great care is required to prevent portions of the lint from falling off.‡

If the ash cannot be estimated from the same sample as the solids and fat, I do not think that it renders valueless the whole process, because at the worst the ash can be easily estimated as hitherto; and, moreover, I do not see why a special preparation

* Messrs. Becker & Co. have had some very suitable bottles made for me.

† It is important that the lint should not be too near the bottom, because the fatty solution which can be seen falling from it, should have room to collect below.

‡ To obviate this difficulty and to prevent fermentation, some alcohol, say about 25 per cent, may be added.

such as mononitrocellulose, dinitrocellulose, or some other body which would be sufficiently absorbent, and yet leave no ash on incineration, might not be found or specially made for the purpose. I have only made one estimation of milk by this process, and this with rather unsuitable and improvised apparatus, but I subjoin the results, which seem clearly to show that it is capable with experience of producing very accurate results, and in some respects, more accurate than the processes generally followed.

The estimation No. 1 was made, as far as total solids are concerned, in the ordinary manner, but the solids not fat were estimated by difference, which is by no means an accepted method. The conclusions that I would draw from the figures are that the total solids can be estimated with much greater accuracy than by the ordinary method and in shorter time; and that it is impossible to dry the fat completely at a temparature of 212°. Dr. James Bell, the principal of the Somerset House Laboratory, says in his recent work upon "The Analysis and Adulteration of Foods," according to the ANALYST, in the first place, that the determination of total solids is a comparatively easy operation, but later on that it is difficult to get a constant weight for the total solids, and that, therefore, the items, solids not fat and fat *are generally more satisfactory*, which as I understand it, means that the total solids are *very difficult indeed* to obtain by direct estimation.

The total solids in column No. 1 were dried until the weight appeared to be constant (using the quantity and apparatus recommended by Dr. Bell) at 212°, and yet they stand very much higher than those in column 2, which were estimated until of constant weight on the paper fibre lint.

Dr. Bell recommends the drying of the fat in a water-oven, and, therefore, presumably at 212°; and it will be seen that the results arrived at (see columns 1 and 3, which were both obtained by direct weighing), after drying at this temperature, very closely agree, but that the weight lost by immersion of the lint in ether is more than ·10 less. In other words the fat lost was ·11 less than the same fat when dried at 212°. This I think at least shows that 212° is *not* sufficient to dry the fat. I think that if I were a milkman I should be disposed very much to question a method of analysis which does not enable the analyst to rely upon his estimation of total solids, but compels him to fall back upon his weighing of solids not fat and fat, both of which weights are arrived at after manipulation, which may entail a loss.

With regard to the drying of the fat I have not tried whether a temperature of 220° would enable an accurate weighing to be made, and with regard to the total solids I do not think it would be right to apply so high a temperature, because we do not know exactly what effect it may have have upon the constituents of milk.

	No. 1.	By difference. No. 2.	By direct weighing. No. 3.
Total solids	11·97	11·38	—
Solids not fat (by difference only) ...	8·95	8·48	—
Fat	3·02*	2·90	3·01

* By the first mentioned process.

In conclusion, I should say that in the one experiment which I have made, the time occupied was certainly rather long; but I believe that this was due to the fact the roll was rather tight and an ordinary drying oven was used, whereas an oven which would allow a constant and rapid circulation of air around and through the roll would probably have produced results comparable in point of time with those attained by other means.

ESTIMATION OF NITROGEN IN COMMERCIAL SUBSTANCES CONTAINING NITRATES.

In the *Chemiker Zeitung*, Dr. Paul Wagner, details a very simple apparatus for this purpose, which he has found very useful in the analysis of Chili saltpetre and nitrated manures. The actual principle of liberating nitric oxide by means of the action of a ferrous salt is, of course, not new, but the arrangement of the apparatus is so simple and inexpensive that we quote it for the benefit of any of our readers disposed to try the process and report their success or otherwise in its application.

The apparatus is simply a flask of 200c.c. capacity, fitted with an india-rubber cork and two glass tubes. One of these is an ordinary bent tube serving for the delivery of the nitric oxide formed, while the other is a funnel tube fitted with a glass stopcock and having the lower end somewhat narrow and *above* the liquid in the flask. A solution of ferrous chloride containing 200 grams of metallic iron per litre is employed and 400c.c. of this solution are placed in the flask. The air is expelled by boiling and then 10c.c. of a solution containing 33 grams of pure sodium nitrate per litre are placed in the funnel tube, and allowed gradually to drop into the solution in the flask. And nitric oxide which is formed is collected in a graduated tube holding 100c.c. When the sodic nitrate has nearly all passed into the flask, the tube is filled with HCl of 20 per cent. strength. This is allowed to pass into the flask. The funnel is once more filled with HCl, and when this has also passed into the flask, the gas tube is removed and put aside.

Without interrupting the boiling, 10c.c. of the solution to be tested are now poured into the funnel. This solution must be of such a strength that 10c.c. will evolve between 50 and 100c.c. of gas. The operation is conducted as before. The final rinsing with HCl leaves the apparatus ready for another estimation, and in this way six or seven estimations can be made before the ferrous salt is used up. It is advisable, finally, to repeat the analysis on the pure saltpetre. The tubes containing the nitric oxide are now adjusted in water in the usual way, and the volumes read off. As they are all under the same temperature and pressure no correction is necessary.

The calculation is very simple. Supposing the pure saltpetre gives 90c.c, of NO, then we know that 90c.c. represent ·33 grammes of pure $NaNO_3$ and 1c.c. = ·00366 grammes of $NaNO_3$ = ·000604 N.

REVIEWS.

POISONS: THEIR EFFECTS AND DETECTION. *A Manual for the use of Analytical Chemists and Experts. By A. Wynter Blyth, M.R.C.S., F.C.S., &c., Medical Officer of Health and Public Analyst for Marylebone.* London: Charles Griffin and Co., Exeter Street, Strand.

THIS is the second volume of Mr. Blyth's complete work and is intended as a companion to the volume on *Foods: their Composition and Analysis*, which has already been favourably reviewed in our columns. We may at once say that this book will prove as valuable as the other, and is a monument of research on the subjects of which it treats. The sub-title is perhaps not quite happy, because an ultra-critic might urge that, if a man were already an "expert," what use would he have for a manual? and again, it might be said that in issuing a work to instruct "experts," the author was assuming to himself the position of something more than an expert. It is well known, however, that perhaps the most embarrasing part of a book for an author is the inditing of a good title, and we dare say, when Mr. Blyth sees this, he will feel inclined to alter it in the next edition.

The work opens with a most excellent chapter on "Poisonlore," both interesting and well written, and the only matter for criticism offered by it is the use of the German phrase *poison-lehre* instead of plain English. Mr. Blyth is well known as a thorough German scholar, and such a reminder of the fact is unnecessary. Passing then to the consideration of what is the legal definition of a poison, and after discussing the present state of the law, both here and on the continent, Mr. Blyth offers the following, which may be worth the attention of those having in consideration the future penal code. He would define a poison thus:—"*A substance of definite chemical composition, whether mineral or organic, may be called a poison, if it is capable of being taken into any living organism, and causes, by its own inherent chemical nature, impairment or destruction of function.*" To attempt these definitions is always difficult, and the person making such an effort either generally stops short of the mark or overshoots it. In this case we would respectfully submit that the bullet has missed the bull's-eye from the latter cause. "Any living organism" is a very wide word and certainly includes plants as well as animals when strictly considered, and indeed it would be difficult to find anything which could not, by a little sophistry, be brought in as a poison under such a definition. But it is not our business to spilt straws with the author on such matters, which to us, as chemists, are of very secondary interest, and had better be left to the specially trained minds of lawyers, and so we turn with relief to the practical portion of the work. This is so complete and well put together as to make it a matter of regret that we have not space to more fully follow the author in the present notice, more especially as it is not a mere scissors and paste collection from other books, but has every now and then agreeable scraps of original matter, the result of personal experience, such as the curious case referred to on page 289, where a woman took a sleeping draught containing over one drachm of laudanum, and died in six hours, and yet no trace of either morphine or meconic acid could be found by him, either in her blood, liver or stomach, after a most exhaustive analysis. Again, on page 287, Mr. Blyth has the courage to confess, in the interests of science, that he subcutaneously injected $\frac{1}{6}$ of a grain of

morphine hydrochlorate into an old gentleman suffering from acute lumbago, but who was otherwise healthy, and in whom no heart disease had been discovered, and nearly killed him. All the portions of the book dealing with the action of poisons is most carefully put together, and the collection of topical experiments either *in corpore vile* by scientists; or on their fellow creatures by murderers is most complete. In dealing with the chemical detection of organic poisons, Mr. Blyth follows Dragendorf's method for general researches, using, however, special processes whenever there are symptoms or *post-mortem* appearances which point to particular drugs. The mineral portions are as complete as the organic, and the processes given are well considered and carefully, yet not too diffusively, described. In reviewing the same author's book on Food we called special attention to the exhaustive monograph on milk, which it contained, and in this volume we find a corresponding one upon the ptomaines or cadaveric alkaloids with a discussion upon which in Court we were threatened during the Lamson case. Selmi's investigations are carefully detailed, and in addition we have interesting chapters on the possible synthesis of poison in the living animal, and on poisoning by food in which a ptomaine has been produced by some peculiar decomposition of albumenous substances. On the subject of opium smoking and its attendant horrors to which our Indian merchants are so much blamed by a certain class of enthusiasts for contributing by sending opium to China, Mr. Blyth is evidently somewhat sceptical. He believes it to be impossible that any morphine could be found in the smoke, owing to its high subliming point, and quotes cases to show that opium smoking injures but little, the health of Asiatics, at all events. Taken as a whole, Mr. Blyth's book is one which should be found on the shelves of all persons interested in toxicology, and is one that Public Analysts may feel pride in pointing to as the work of one of that much abused body of men.

ANALYSTS' REPORTS.

To the Vestry of St. Giles, Camberwell.

Gentlemen,

During the past quarter eighty samples of food have been analysed.

Of 50 *Milks* analysed, fifteen were found to be sufficiently adulterated to come within the limits of prosecution. These were found to contain respectively, of added water, 8, 6, 9, 8, 16, 20, 6, 8, 10, 10, 6, 15, 8, 7, and 14 per cent.

One very interesting case was referred to Somerset House for reference. This milk, No. 114, had the following composition :—

Sp. gr. 1027. Cream, 8 per cent.		
Total solids	11·39 ..	11·19
Water	88·61 ..	88·81
Fat	3·26 ..	3·13
Solids, not fat	8·13 ..	8·06
	100·00 ..	100·00
Ash	0·70	
Salt	0·10	

Rigidly interpreted, according to the standard of public analysts, this milk has 9 per cent. of added water. I had given it as containing 6 per cent.

The milk, which had been sampled on the 18th September, was referred to Somerset House on the 31st October, a period of six weeks having elapsed. The result was as follows :—

Total solids	9·87
Water	90·13
Fat	3·17
Solids not fat	6·70
	100·00

And the conclusion is, "from a consideration of these results, and after making the addition for natural loss arising from the decomposition of the milk through keeping, we are of opinion that the milk contains not less than 14 per cent. of added water."

Now this milk, according to the Somerset House standard, contained 5 per cent. of added water, and affords further confirmation of what I have several times insisted upon in my reports, that it is almost guess-work to state by how much, *exactly*, a milk has deteriorated in keeping.

I explained the matter to the Magistrate, who listened most courteously, and I was well supported by your Vestry Clerk.

Besides the stated adulteration of milk, amounting to 30 per cent of cases of prosecution, a number of others are only just inside the border. We have milks carefully and skilfully watered down to a gravity which proves how reliable are the analyses upon which the Society of Public Analysts has based its standard; but this leaves no margin for further watering.

Of eight *Butters* examined, one was found to contain at least 80 per cent. of fat other than butter fat.

Of four *Breads*, only one was very suspicious as to the presence of alum. I was compelled to make a further analysis, and found an amount corresponding to 5½ grains of ammonium alum per four pound loaf. Its presence may have been derived from a baking-powder, and the quantity was within the allowed limits.

Two *Flours* were analysed, and both found to be good.

Two *Porters* and six *Ales* do not call for much notice. In two of them it would be difficult to account for the large amount of chlorides, except from the quality of the sugar employed; the other six were well within the allowed limits. In several, hops furnished the real bitter.

Samples of *Moist Sugar*, of *Loaf Sugar*, and of *Coffee* (2) were quite free from adulteration. The same may be said of a specimen of *Corned Beef*.

A tin of *Ox-tail Soup* showed most careful and cleanly preparation, and although the metal tin was distinctly present, soup of such character can be thoroughly recommended.

In conclusion, I may mention that all the Certificates are in the hands of the Inspectors.

I remain, Gentlemen, Yours faithfully,

ALBERT J. BERNAYS.

Chem. Laboratory, St. Thomas's Hospital.
December 19th, 1883.

THE Public Analyst for the county of Cheshire, Dr. Campbell Brown, reports that during the quarter ended December 31 he had examined 4 samples of coffee, 5 butters, 12 mustards, 4 teas, 1 lard, 10 peppers; and that he found 2 coffees, 6 mustards, and 1 butter were adulterated.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

To the Editor of "The Analyst."

Dear Sir,—By this mail I have forwarded to you copies of the "Adulteration Prevention Act," 1880, and "Adulteration Prevention Amendment Act," 1883. The latter has now become law, and you will see that the standards of "The Public Society of Analysts" have been adopted, together with the definition of an adulterated article as proposed in the essay by Mr. Wigner published in the Analyst of Jan., 1881.

I think I am right in saying that the Society's standards have thus become law for the first time in the British Dominions, and I shall have great pleasure in forwarding to you the results of its working from time to time.

Yours truly,

J. S. FORD,

Analyst appointed under the Act for the Auckland District.

Queen Street, Auckland, N.Z., Dec. 11, 1883.

A NEW INDUSTRY.

A new industry in Cleveland, Ohio, is that of manufacturing aniline dyes from petroleum refuse. This industry has heretofore been a close European monopoly, mainly confined to Switzerland, one firm alone annually exporting $30,000,000 worth. The company which proposes to go into this manufacture is composed of New York and Cleveland parties, a Swede of wide experience being the leading spirit. The particular work to be done will be to extract from the residuum of petroleum its anthracine tar and gas, and them to ship the chemicals resulting from this change to New York and Philadelphia, where the aniline dyes will be made. It is said that this company possesses a valuable secret in connexion with this manufacture. Should the company be successful in producing the dyes, the industry will soon grow in importance, as it will enable American manufacturers to cheapen the cost of producing these fabrics.

LAW CASES.

The Chicory and Coffee Question.—Important Appeal Case.—At the Durham Quarter Sessions, on Wednesday, the appeal case of Miller *v.* the South Shields Magistrates was heard. Mr. Walton and Mr. Dale were counsel for the apellant, and Mr. John Strachan for the respondents. On November 28 last, Mr. Frederick Miller, grocer, South Shields, was fined 10s. and costs for having sold to Mr. Hindmarch, the inspector appointed by the Corporation to carry out the Food and Drugs Act, 1875-79, three quarters of a pound of coffee, which was found on analysis to contain 33 per cent. of chicory. Mr. Strachan, for the respondents, contended that if a purchaser asked for coffee he had a right to be supplied with that article. The appellant said he protected himself by giving a notice in accordance with the terms of the Food and Drugs Act, but his (Mr. Strachan's) instructions were that, as a matter of fact, no notice whatever was given, and that the coffee, was not supplied with a label; as was required by the 8th section of the Act. Mr. Strachan quoted several cases in support of the magistrate's decision, and read the opinion of the late Mr. Justice Lush, which was that "he could not see how the label protected the seller." Mr. Hindmarch then detailed the circumstances of the purchase, and said he told the appellant's assistant that he had purchased the coffee for the purpose of having it analysed. Cross-examined by Mr. Walton: He did not in any way indicate that he wanted it unmixed. He did not mention the word "pure" at all. Mr. Walton here produced the paper on which the coffee was weighed, and said the Court would observe that there were printed thereon the words, "This is sold as a mixture of chicory and coffee." Dr. Munro, medical officer of health, South Shields, said that chicory did not

contain such stimulating and invigorating qualities as coffee. The infusion of chicory was mildly purgative, and tended to produce indigestion. Mr. Walton, after stating that the appellant did not mix the coffee with chicory for the purpose of producing a fraudulent compound, but because the customers wished to have it so mixed, raised the objection that Mr. Hindmarch did not inform the appellant's assistant that he intended to have the coffee analysed "by the public analyst," and quoted the case of Barnes *v.* Cripps, in which a conviction was quashed on account of this omission. Mr. Hindmarch said he did not inform the shopman that he intended to have the coffee analysed "by the public analyst." Mr. Walton thereupon called Mr. Murray, reporter, who was present when the summons was heard before the magistrates. His shorthand notes showed that what Mr. Hindmarch said was, "I told the man I had bought it for the purpose of having it analysed." The Chairman (Mr. John Lloyd Wharton) then said the Court felt they had no option to vary the decision in Barnes *v.* Cripps, and the conviction must be quashed. It would be well, however, if dealers would, by actual word of mouth, ask the buyers whether they required the article pure or mixed. Mr. Walton applied for the appellant's costs, but the Court ordered each party to pay their own costs.

THE RESULT OF DOING A FAVOUR.—Before the Newton Abbott magistrates, Mr. Robert Pidsley, grocer, was recently summoned for selling adulterated milk. On December 11, a constable purchased from the defendant half a pint of milk, which was divided into three portions, and a sample sent to the county analyst, who found that the milk contained 10 per cent. of added water. Mr. Pidsley stated to the Bench that he did not deal in milk, and that he sold the half-pint in question merely to oblige the person who bought it. The Bench inflicted a fine of 30s., inclusive of costs.

BUTTERINE.—On Monday, at the Borough Police-court, Wrexham, Messrs. W. Bertram and Son, provision dealers, were charged with selling adulterated butter. Mr. Thomas Bury (Town Clerk) prosecuted, and Mr. Ashton Bradley defended. Mr. Bradley submitted that there was no intention on the part of the defendants to defraud; that the sale was not to the prejudice of the purchaser, the price paid being 9d. per lb., while pure butter was at least 1s. 3d.; that the article was labelled in pencil "butterine"; and therefore that the information must be dismissed. After a retirement the Bench intimated that they had decided to convict, but would only inflict the small penalty of 5s. They thought it right to state, however, that the seller must supply to the buyer a notice or label, legibly written or printed, stating the nature of the article supplied, if not pure. Mr. Bury applied for costs, and the Bench granted the application, including the solicitor's fee.

HARRIS *v.* MAY.—*Sale of Food and Drugs Act*, 1875, *Sec.* 25.—*Written Warranty.*—The Secretary reported the decision of the Queen's Bench Division in this case, as follows:—Appellant was charged with selling milk which was proved to have been adulterated with water to an extent. The appellant had a written contract with the farmer who supplied the milk, which described the milk as new and pure milk, and he contended that he complied with the 25th Section, as he sold the milk in the state in which it was supplied to him. Held that the contract was not a specific warranty of the milk actually sold, but merely a warranty that pure milk would be supplied. That was no defence, and the justices were right in convicting. [47 J.P. 771.]

CHAPPELL *v.* EMSON.—*Sale of Food and Drugs Act*, 1875, *Sec.* 14.—The Secretary reported the decision of the Queen's Bench Division in this case as follows:—Appellant was charged with selling milk not of the nature and quality demanded. Drewett, a constable, purchased a pint from an agent of the appellant, and after the purchase forthwith told the seller that he intended to have the milk analysed, but he did not add that he would divide the milk into three parts and give one to the seller. The seller refused the offer, and on objection before the justices that no statutory offer had been made, the justices overruled the objection, and convicted. The milk was proved to be adulterated with 9·5 per cent. of water. Held that the justices were right in overruling the objection. [47 J.P. 804.]

A CASE of some interest was heard at the Lambeth Police Court on Friday, 18th instant, before Mr. Chance. The analysis of Dr. Bernays, made on the 30th November, 1883, and repeated on the 1st December on account of the unsatisfactory result, on the coagulated milk, was thus reported:—

Sp. gr. 1030. Cream 4½ per cent.

		Dec. 1st.
Total solids	10·78	10·64
Water	89·22	89·36
Fat	2·79	2·77
Solids not fat	7·99	7·87
	100·00	100·00
Ash	0·66	
Chlorides	0·13	

This milk has eight per cent. of added water. The case was referred to Somerset House, and the reply was as follows:—

Received on 22nd ultimo. Marked No. 181.

"We hereby certify we have analysed the milk, and declare the results of our analysis to be as follows:—

Non-fatty solids	7 83
Fat	2·65
Water	89·52
	100·00

"From a consideration of these results, and after making the addition for material loss arising from the decomposition of the milk through keeping, we are of opinion that the milk contains not less than four per cent. of added water.

"Jan. 9th, 1884."

Dr. Bernays was allowed to offer an explanation of the discrepancy. He pointed out that this milk, on the 1st December, contained 7·87 per cent. of solids not fat, and after keeping till nearly the end of January was only degraded by 0·04 per cent. From a great many experiments made in the Laboratory, he had found that there was no regularity in the loss arising from decomposition, and that it could not be depended upon. If milk were quite fresh and only mixed with pure water, it underwent but little change in a cool place; but, if mixed with stale milk and impure water the degradation was very rapid. Dr. Voelcker had lately said (and he quoted him as an independent authority, without siding with much that he had written upon milk) that no analyst was entitled to come to any definite conclusion as to the original composition of sour milk. This milk, strictly interpreted, contained 11 per cent. of added water. No milkman was summoned by the Camberwell Vestry, in whose milk the solids not fat were not below 8·4, so that a considerable margin was left. Dr. Bernays did not take this as a standard, but that of the Public Analysts, with an allowance according to circumstances. He had allowed 3 per cent., and had given the milk as having 8 per cent. of added water.

After this explanation, his Worship expressed his satisfaction and agreement with Dr. Bernays' statement. Considering the *bona fides* of the milkman, in that he sent the sample to Somerset House, and that he was not a cowkeeper, but only in a small way of business, Mr. Chance fined him 5s. and 12s. 6d. costs.

N.B.—The milk re-analysed (from the Inspector's unopened sample) on the 19th January, gave the following results:—

Solids not fat	7·66	7·71
Fat	2·68	2·68
Total solids	10·34	10·39

Dr. Bernays reported another case which was heard on the 23rd instant, before Mr. Slade, at the Southwark Police Court.

The analysis, in duplicate, was made on the 30th November, 1883.

Sp. gr. 1025. Cream, 5 per cent.

Total solids	9·97	10·03
Water	90·03	89·97
Fat	2·65	2·72
Solids not fat	7·32	7·31
	100·00	100·00
Ash	0·58	
Chlorides	0·10	

This milk has eighteen per cent. of added water.

The referees from Somerset House reported:—

Water	91·00
Fat	2·63
Solids not fat	6·37
	100·00

From a consideration of these results, and after making the addition for natural loss arising from the decomposition of the milk through keeping, we are of opinion that the milk contains not less than 15

per cent. of added water. After an explanation of the so-called discrepancy, the magistrate was satisfied that the opinion from the fresh milk was most reliable, and fined the milkman £1, and the costs of both analyses.

A further case was remitted to Somerset House. No. 198 from Lambeth Police Court.

On the 13th December, 1883, a milk was brought by a Camberwell Inspector, and was at once sent on for analysis in duplicate on account of its specific gravity and appearance. Dr. Bernays gave the following certificate:—

Sp. gr. 1028 Cream 5 per cent.

Total solids	11·34	11·40
Water	88·66	88·60
Fat	3·16	3·21
Solids not fat	8·18	8·19
	100·00	100·00
Ash		0·65
Chlorides		0·15

This milk has 6 per cent. of added water.

The report on this milk from the referees was as follows:—

"The sample of milk referred to in the annexed letter, and marked 198 was received here on the 1st instant.

Non-fatty solids	7·21
Fat	3·15
Water	89·64
	100·00

From a consideration of these results, and after making addition for the natural loss arising from the decomposition of the milk through keeping, we are of opinion that the milk contains not less than 10 per cent. of added water. As witness our hands this 9th day of January."

Milk Adulteration.—Several summonses were heard against shopkeepers proceeded against under the Adulteration Act by the Vestry of Shoreditch.—Mr. Abbott appeared to prosecute for the parish authority. The cases having been heard, the defendants stood before his worship, who addressed them before fixing penalties. He said he had been shown the worst case he had ever heard—one in which milk was not not only devoid of 80 per cent. of its usual qualities, but had been further watered. He believed milk of this kind would soon become too dilute for persons to use as nourishment.—*Rose Richmans*, of 66, Stean-street, Haggerston, was fined £10; *Elizabeth Rogers*, of 1, Provost-street, Nile-street, £5; *Jane Hughes*, 56B, Murray-street, £3; *John Jones* and *Edward Richards*, of 1, Tabernacle-row, 32s; *James Long*, 2, Cheshire-street, 42s.; and *Susannah Cockerton*, of 46, Fanshaw-street, £4 2s., these sums being apportioned according to the amount of adulteration proved.

At West Ham, James Perks, carrying on business at No. 1, Carlton-terrace, Barking-road, Canning-town, was summoned by William Horn, the chief sanitary inspector of the West Ham Local Board, for selling on December 5 last an article of food—to wit, butter, not of the nature, substance, and quality demanded by the purchaser. Mr. Woollitt, barrister, prosecuted; Mr. E. A. Dow defended. The evidence showed that Mr. Horn on December 5th last, instructed his assistant, Mr. Evans, and a Mr. Smith, to go and get some samples of butter, leaving them the choice of the place of purchase, for analysis. Smith went into the defendant's shop, and asking Mrs. Perks for a "pound of butter," Mrs. Perks asked "What price, one and four?" Smith answered "Yes." He was then served with a pound of the article, and after he had paid for it, Mr. Evans went into the shop and informed Mrs. Perks that the butter had been purchased for analysis by the public analyst. She then pointed to each corner of the paper in which the butter was wrapped, and said there was a label there, but Mr. Evans could not see it, and said that if it existed it must have been inside. The paper in which the butter was wrapped was a sheet covered with print and figures, the white corner of it having some illegible red marks on it. The defendant was present and he showed Mr. Evans a clean bit of paper with the "label" on it, but the inspector did not look at it, though he said it would be of no use, when the defendant said his solicitor had told him if he put a label on the paper he would be all right. In due course the butter was forwarded in bulk to Mr. Pooley, the public analyst for Essex, and his certificate showed that it contained 87·4 of fat of which at least 60 per cent. was other than butter fat. The article sold was stated to be worth but 9d. per lb. Mr. Dow's defence was that when Smith went into the shop he was

told their butter was at 1s. 8d. and 1s. 6d., and butterine at 1s. 4d. and 1s., and that he chose that at 1s. 4d. per lb.; and, further, that he knew well he was purchasing butterine. Butterine, he mentioned, Canon Barry had said was one of the greatest blessings ever introduced into England. The label had on it—"This is a compound, sold as imported." Mrs. Perks was called into the witness-box, but her evidence was declined as she said she could not identify the man who purchased the butter. Mr. Perks was then sworn, and he said that when Smith entered and asked for butter the question was put to him whether he wanted butter or butterine, and he said, "Something reasonable." Then Mrs. Perks asked, "One and four?" and he said "Yes." Mr. Phillips, in disposing of the case, said he was sorry for he line of defence that had been set up. It was impossible to believe that public officers would come to court and without any motive perjure themselves as the defence had alleged they had. It was about as bad a defence as he had heard in that court. He should fine the defendant £10 and the costs. Mr. Woollitt asked for his professional costs, and the magistrate granted them, subsequently mentioning that if the fine and costs were not paid distress would follow, and if that was not sufficient the defendant would be sent to prison for two months, in default.

ADULTERATED MILK.—At the Kensington special sessions, before Mr. A. S. Ayrton, Sir Sibbald Scott, Bart., Sir Henry Gordon, K.C.B., and other magistrates, William Hayes, in the employ of a firm trading in various parts of the metropolis under the name of the Condensed Milk Dairy Company (Limited), was summoned at the instance of the Kensington Vestry, for selling milk which was, according to the analyst's certificate, adulterated with 30 per cent. of water. The certificate also stated that the cream was extracted. The case having been proved by Inspector Gaylard, Mr. Hawksley, who appeared to defend the company, said the peculiarity was to sell what they called "condensed milk," which was sold as "separated milk" after the removal of the cream. The directors took every precaution and had printed bills setting forth what they sold. Mr. Ayrton observed that it must be condensed skim milk. It appeared to him that the company had been engaged in a public fraud on the metropolis. The Bench imposed a penalty of £5 with costs.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No. 1882.	Name of Patentee.	Title of Patent.	Price
1087	J. Barrow	Distillation of Coal, Shale, Ironstone, & Organic Substances	8d.
1096	C. F. Claus	Manufacture of Hydrates of Alkalies and Alkaline Earths, &c.	4d.
1099	G. Simpson	Calcining Cement and Kilns therefor	2d.
1112	G. Vigne	Manufacture of Ferrocyanides	4d.
1123	J. M. Harley	Manufacture of Maize Starch	2d.
1188	F. C. Glaser	Apparatus for the Manufacture of Chloride of Lime	4d.
1362	C. D. Abel	Manufacture of Colouring Matters, and their Sulpho-Acids, or Salts from Phtalic Anhydride	4d.
3299	W. R. Lake	Method and Apparatus for Preserving Ensilage, or Food for Cattle	6d.
426	E. A. Brydges	Preservation of Milk	1s.
667	C. Steffen	Extracting Sugar from Molasses, Syrups, and Juice of Plants	4d.
1169	T. Lichman	Apparatus for Purifying and Heating Water, &c.	2d.
1210	J. Woodhead	Process and Apparatus for Distilling Coal and other Carbonaceous Materials, in order to obtain Coke, Tar, &c.	2d.

BOOKS, &c., RECEIVED.

Poisons, by A. W. Blyth; The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Pharmaceutical Journal; The Sanitary Record; The Miller; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; The Inventors' Record: New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; Cowkeeper and Dairyman's Journal; Sugar Cane; Country Brewers' Gazette; The Medical Record; The Grocers' Gazette; London Water Supply, by Crookes, Odling and Tidy; Chemical Review; Independent Oil and Drug Journal and Paint Review; Science Monthly; Journal of the Society of Chemical Industry.

THE ANALYST.

MARCH, 1884.

It is whispered that the Council of the Society of Public Analysts have had under consideration the general question of the *status* and subscription of our Associates. This is undoubtedly a matter requiring careful revision, because, when the question is gone into, it will be seen that the present condition of affairs is somewhat anomalous. When the Society was first started, it was deemed advisable that, while the membership should be restricted to actual analysts in practice, the Associateship should be given to such of their assistants as should be from time to time recommended by the Council. It was contemplated that the advantages of becoming an Associate would comprise; (1) The opportunity of attending the meetings of the Society, and of receiving copies of all its published transactions; (2) The becoming, as it were, recognised as a qualified assistant, so that when the Associate entered business on his own account, he would, almost as a matter of course, become a full member. Thus our Associates have all the privileges of members except the power of voting at a general meeting or election of Officers. So as to encourage young men to thus make themselves known, the originators of the Society, in framing its constitution fixed the subscription for the Associateship at the ridiculously low fee of five shillings, while on the other hand, to prevent persons entering as Associates and still continuing as such after entering into business, it was provided that the Associate should only be elected for three years at a time. To these provisions time has shown that there are two well-founded objections. *Firstly*, the election of a man for a limited time is undesirable, as it gives him a very temporary standing only. If a gentleman is considered by his employer to be sufficiently accurate in his manipulation and sincere in his love for the science to warrant his asking the Council for a nomination, surely then he his worth electing in perpetuity. It is evident that no man would think of remaining an Associate, when, by entering business on his own account, he had obtained the necessary qualification for full membership. *Secondly*, the subscription of such a sum as five shillings per annum tends to lower the position of a qualified person. Chemical assistants in the scientific department are not, as a rule, impecunious persons, and indeed, if they were, we fear their chances of ever making a decent livelihood would be somewhat problematical. It is therefore not only needless, but positively humiliating, for gentlemen to take a position in which they to some extent pauperize themselves, by getting transactions costing the Society more to print than is covered by the present miserable subscription. We earnestly hope that, as a result of the deliberations of the new Council, the Society will be shortly asked to assent to a modification of the constitution in the double direction of increasing the annual subscription of Associates to ten shillings and sixpence, as well as giving them at once on their admission a permanent standing in the Society, so long as they remain assistants, and until they can take up their full membership.

CONDENSED MILK.

SEVERAL successful prosecutions have been conducted against the retailers of condensed milk in Liverpool, which will doubtless cause considerable consternation among the large milk condensing companies, who have up to the present time escaped the operations of the "Sale of Food and Drugs Act."

Condensed milk has been lately extensively employed in connection with what may be called a new industry, that of "milk blending," or in other words letting down rich dairy milk, so that the analytical results agree with the figures for solids not fat prescribed by the Society of Public Analysts. Large quantities are daily consumed in this way by milkmen, and to such an extent has the trade increased that condensed milk is imported in churns, especially manufactured for the convenience of dairymen. These churns being returned to the factory for a further supply.

The difficulties of condensing rich milk, although much scientific attention has been devoted to it of late years, are well known to those engaged in the trade, more especially when the milk is preserved without the addition of sugar, but there is now no difficulty whatever in preparing condensed milk of fair average quality containing the whole of the cream present in the milk previous to condensation. The excuse that a large proportion of the fat was mechanically carried over in the operation of condensing in vacuo has been repeatedly proved to be erroneous. In fact, it is not unusual to add to the milk during the first stage of concentration clear butter fact, in order to prevent the excessive frothing which takes place and causes considerable trouble, requiring great care to prevent the milk from rising over and mixing with the condensing water.

Manufacturers of condensed milk have therefore no more right to deprive the milk of its cream previous to condensation than the ordinary milkman; in fact the offence becomes in their case more serious, as instead of declaring the article as condensed skim milk, it is described as milk; guaranteed to be pure cows' milk, and is highly recommended for invalids' and infants' diet as being more wholesome and nutritious than fresh cows' milk, and especially milk from cows fed in cow-sheds in large towns; the milk is the richest and best, the water having been abstracted and pure loaf sugar added. The heinousness of selling condensed skim milk under cover of this guarantee is obvious, more especially as the offence is not committed by a small milkman in one of the poorer districts of our large towns, but by large companies, presumably with extensive capital and controlled by educated men, who, simply for the sake of underselling, put forward an article deprived of one of its most valuable constituents, and represent it to be richer in quality than genuine milk from cows fed in cow-sheds in large towns.

We think that the Society of Public Analysts would do well to consider the question of the purity of condensed milk in connection with the uniformity of milk analysis now being discussed by the milk committee. We have no doubt that if other prosecutions take place, and the subject is well ventilated, the condensed milk companies will speedily turn out an article approaching in substance and quality to the guarantees which they distribute broadcast as advertisements, and which are affixed to the tins.

PLUM JAM.

It is pretty generally known that cheap jams are mixed with the pulp of every cheap sort of fruit that happens to have been plentiful during the season when jam is made: there is no necessity, however, for manufacturers to label their goods "Plum Jam," when it is well known that the season for plums was unusually bad; this deficiency is made up with apple, an article both wholesome and nutritious, and probably to some, equally as nice as genuine plum jam. We are not surprised to see that Mr. Mallet, of Sittingbourne, has been successfully prosecuted for selling Steers' Plum Jam, an article containing 25 per cent. of apple. It is only necessary for Messrs. Steer to adopt the simple expedient of a label describing the nature of the jam, to prevent the recurrence of annoying prosecutions; the public will be equally satisfied, and the analyst will not be under the necessity of condemning an article which is a luxury and a boon to many.

PROCEEDINGS OF THE SOCIETY OF PUBLIC ANALYSTS.

An ordinary meeting of this Society was held at Burlington House, Piccadilly, on Wednesday, the 20th February. In the absence of the president, Dr. Wynter Blyth, Vice-president, took the chair.

The minutes of the annual meeting were read and confirmed.

The following gentlemen were proposed for election as members, and will be ballotted for at the next meeting in March:—

Mr. T. Boverton Redwood, of London.

Mr. E. W. Martin, of New York.

Mr. J. Laker Macmillan, of Calcutta.

The following papers were read and discussed:—

"Analytical Notes on Milk, Cream, Skim-milk and Butter-milk." By Dr. Vieth, F.C.S.

"Additional Note on the Solubility of Lactose in Ether." By Otto Hehner.

Owing to pressure on our space, we are compelled to postpone the printing of these papers until our next issue.

The next meeting of the Society of Public Analysts will be held at Burlington House on Wednesday, the 19th March next.

NOTE UPON THE ESTIMATION OF PEROXIDE OF HYDROGEN WITH SPECIAL REFERENCE TO THE COMMERCIAL PRACTICE OF SELLING UPON VOLUME STRENGTH.

By H. S. Carpenter, F.I.C., F.C.S., and W. O. Nicholson, F.C.S.

Read before the Society of Public Analysts on January 16th, 1884.

Roscoe and Schorlemmer in their Treatise on Chemistry (Vol. I, p. 261) give the following reaction as applicable for the volumetric estimation of Hydroxyl by means of potassic permanganate.

$$2KMnO_4 + H_2O_2 + 3H_2SO_4 = K_2SO_4 + 2MnSO_4 + 4H_2O + 3O_2.$$

Kingzett, in a paper read before the Chemical Society (J. C. S. xxxvii, 805), states it thus :—

$$K_2Mn_2O_8 + 5H_2O_2 + 3H_2SO_4 = K_2SO_4 + 2MnSO_4 + 8H_2O + 5O_2.$$

As this assigns to permanganate five times the value (in relation to hydroxyl) given to it by Roscoe and Schorlemmer, we were induced to make some experiments with the view of ascertaining which is the correct one.

The following reactions are theoretically possible :—

(1.) $K_2Mn_2O_8 + H_2O_2 + 3H_2SO_4 = K_2SO_4 + 2MnSO_4 + 4H_2O + 3O_2$,
from which 1 c.c. $\frac{N}{10}$ permanganate = ·00034 gram H_2O_2 and evolves a total of ·00096 gram O = ·67132 c.cs. at 0° and 760 m.m. pressure.

(2.) $K_2Mn_2O_8 + 2H_2O_2 + 3H_2SO_4 = K_2SO_4 + 2MnSO_4 + 5H_2O + 3\frac{1}{2}O_2$,
from which 1 c.c. $\frac{N}{10}$ permanganate = ·00068 gram H_2O_2 and evolves a total of ·00112 gram = ·78321 c.c. Oxygen.

(3.) $K_2Mn_2O_8 + 3H_2O_2 + 3H_2SO_4 = K_2SO_4 + 2MnSO_4 + 6H_2O + 4O$,
from which 1 c.c. $\frac{N}{10}$ permanganate = ·00102 gram H_2O_2 and evolves a total of ·00128 gram = ·8951 c.c. Oxygen.

(4.) $K_2Mn_2O_8 + 4H_2O_2 + 3H_2SO_4 = K_2SO_4 + 2MnSO_4 + 7H_2O + 4\frac{1}{2}O_2$,
from which 1 c.c. $\frac{N}{10}$ permanganate = ·00136 gram H_2O_2 and evolves a total of ·00144 gram = 1·007 c.cs. oxygen.

(5.) $K_2Mn_2O_8 + 5H_2O_2 + 3H_2SO_4 = K_2SO_4 + 2MnSO_4 + 8H_2O + 5O_2$,
from which 1 c.c. $\frac{N}{10}$ permanganate = ·0017 gram H_2O_2 and evolves a total of ·0016 gram = 1·1188 c.cs. oxygen.

We decided first to titrate some samples with permanganate; secondly to measure the gas liberated, and then in order to check these results, to employ the process used by Kingzett, viz. :—Measuring the iodine liberated by a known volume of solution of hydroxyl, with standard sodic thiosulphate.

For the titration 10 c.cs. of hydroxyl were taken, mixed with 40 c.cs. of sulphuric acid (1 : 3) and made up to 100 c.cs. with distilled water. The decinormal permanganate solution was run in until a faint pink tinge, permanent for a few minutes, became apparent.

The following results were obtained :—

Sample A, sold as 20 *vols.*—Slightly acid, contained H_2SO_4 and trace of HCl; 10 c.cs. left on evaporation ·012 gram residue.

10	c.cs.	of the diluted solution	required	31·8 c.c.	$\frac{N}{10}$ $K_2Mn_2O_8$.
10	,,	,,	,,	31·7	,,
10	,,	,,	,,	31·6	,,
10	,,	,,	,,	31·5	,,
10	,,	,,	,,	31·7	,,
10	,,	,,	,,	31·7	,,
10	,,	,,	,,	31·5	,,
10	,,	,,	,,	31·6	,,
			Average	31·63 c.c.	

According to the five equations, the gas liberated should measure respectively :—

Equation	1	..	31·63	×	·67132	=	21·2338 c.cs
,,	2	..	31·63	×	·78321	=	24·7729 ,,
,,	3	..	31·63	×	·8951	=	28·312 ,,
,,	4	..	31·63	×	1·007	=	31·8514 ,,
,,	5	..	31·63	×	1·1188	=	35·3876 ,,

Next 10 c.cs. of the diluted acid solution were introduced into a small flask, the cork of which was furnished with two holes, through one of which a delivery tube connected with a receiver passed, and through the other the nozzle of a burette containing permanganate solution, fitted tightly. A quantity of permanganate, just sufficient to colour the contents of the flask permanently pink, was then run in, and the gas collected over mercury, the volume of solution used being deducted from that of the gas obtained, the residue reduced to standard temperature and pressure, and to this was added an amount equal to the capacity of the fluid in the flask for holding oxygen in solution at that temperature. The figures given below have been thus corrected :—

10	c.cs.	of the dilute hydroxyl	evolved	..	34·518 cc.s. of gas
10	,,	,,	,,	..	35·384 ,,
10	,,	,,	,,	..	35·382 ,,
10	,,	,,	,,	..	36·65 ,,
10	,,	,,	,,	..	35·514 ,,
10	,,	,,	,,	..	34·6 ,,
10	,,	,,	,,	..	34·73 ,,
10	,,	,,	,,	..	35·75 ,,

It is therefore apparent that the equations 1, 2, and 3, do not represent the change which occurs.

Sample B, sold as 10 *vols.*, was neutral; 10 c.cs. gave ·0918 gram of residue containing KCl and traces of Na_2O and H_2SO_4.

Diluted and acidified as before :—

10	c.cs.	of the dilute solution	required	..	14·5 c.cs.	$\frac{N}{10}$ $K_2Mn_2O_8$
10	,,	,,	,,	..	14·4	,,
10	,,	,,	,,	..	14·4	,,
10	,,	,,	,,	..	14·5	,,
10	,,	,,	,,	..	14·4	,,
10	,,	,,	,,	..	14·4	,,
			Average	14·43 c.cs.		
By equation	4	..	14·43	× 1·007	=	14·531 c.cs. of gas
,,	5	..	14·43	× 1·1188	=	16·144 ,,
10	c.cs.	of the dilute solution	evolved	..	15·718 c.cs. of gas	
10	,,	,,	,,	..	15·921	,,
10	,,	,,	,,	..	16·249	,,
10	,,	,,	,,	..	15·793	,,
10	,,	,,	,,	..	16·173	,,
10	,,	,,	,,	..	15·758	,,

Sample C, sold as 20 *vols.*, was decidedly acid, contained SiO_2, K_2O, H_2SO_4, and traces of Na_2O and HCl; 10 c.cs. evaporated on a water bath, left ·0374 gram of residue.

Diluted and acidified as before :—

10 c.cs.	of the dilute solution	required	9·7 c.c.	$\frac{N}{10}$ $K_2Mn_2O_8$
10 c.cs.	,,	,,	9·6	,,
10 c.cs.	,,	,,	9·8	,,
10 c.cs.	,,	,,	9·8	,,
10 c.cs.	,,	,,	9·8	,,
10 c.cs.	,,	,,	9·7	,,

Average 9·73 c.cs.

By equation 4,	..	9·73 × 1·007 =	9·798 c.cs. of gas.
,, 5,	..	9·73 × 1·1188 =	10·886 ,,
10 c.cs.	of the dilute solution	evolved	10·749 ,,
10 c.cs.	,,	,,	11·29 ,,
10 c.cs.	,,	,,	10·858 ,,
10 c.cs.	,,	,,	10·754 ,,
10 c.cs.	,,	,,	10·749 ,,
10 c.cs.	,,	,,	10·453 ,,

Sample D, sold as 10 *vols.*, was slightly acid, contained Na_2O and HCl; 10 c.cs. left ·0056 gram residue.

Diluted and acidified as before :—

10 c.cs.	of the dilute solution	required	15·31 c.cs.	$\frac{N}{10}$ $K_2Mn_2O_8$
10 c.cs.	,,	,,	15.22	,,
10 c.cs.	,,	,,	15·22	,,
10 c.cs.	,,	,,	15·31	,,
10 c.cs.	,,	,,	15·22	,,
10 c.cs.	,,	,,	15·22	,,

Average 15·28 c.c.s.

By equation 4,	..	15·28 × 1·007 =	15·387 c.cs. of gas.
,, 5,	..	15·28 × 1·1188 =	17·095 ,,
10 c.cs.	of the dilute solution	evolved	17·357 ,,
10 c.cs.	,,	,,	16·986 ,,
10 c.cs.	,,	,,	17·034 ,,
10 c.cs.	,,	,,	16·944 ,,
10 c.cs.	,,	,,	17·134 ,,
10 c.cs.	,,	,,	16·898 ,,

The foregoing results tend to show that Kingzett's equation is the correct one, and this was further proved by employing the iodine re-action. For this purpose, 10 c.cs. of solution of hydroxyl were taken, acidified and diluted, as in the previous experiments, to an aliquot part, 5-10 c.cs. of solution of potassic iodide were added, decinormal sodic thiosulphate was then run in from a burette, until the colour was nearly discharged; some starch paste was then dropped in and the titration continued, until on standing for a considerable time, the blue colour did not re-appear.

By the equations,

$$\begin{cases} 2KI + H_2O_2 = K_2O + H_2O + I_2 \\ I_2 + 2Na_2S_2O_3 = 2NaI + Na_2S_4O_6 \end{cases}$$

1 c.c. of decinormal thiosulphate is equal to ·0017 gram of H_2O_2, and corresponds to the permanganate in equation 5; therefore to prove this equation to be the true one it is

only necessary to show that equal volumes of similar hydroxyl require equal volumes of the two reagents, and this we find to be practically the case, for—

Sample D, diluted as before:—

10 c.cs.	of the dilute	solution required	15·39 c.cs.	$\frac{N}{10}$ $Na_2S_2O_3$
10 c.cs.	,,	,,	15·1	,,
10 c.cs.	,,	,,	15·29	,,
10 c.cs.	,,	,,	15·2	,,
10 c.cs.	,,	,,	15·3	,,
10 c.cs.	,,	,,	15·1	,,

Average 15·23 c.cs.

Sample B, diluted as before;—

10 c.cs.	of the dilute	solution required	14·4 c.cs.	$\frac{N}{10}$ $Na_2S_2O_3$.
10 c.cs.	,,	,,	14·51	,,
10 c.cs.	,,	,,	14·62	,,
10 c.cs.	,,	,,	14·62	,,
10 c.cs.	,,	,,	14·62	,,
10 c cs.	,,	,,	14·31	,,

Average 14·51 c.cs.

These results lead to the conclusion that the re-action with permanganate should be represented thus:—

$$K_2Mn_2O_8 + 5H_2O_2 + 3H_2SO_4 = K_2SO_4 + 2MnSO_4 + 8H_2O + 5O_2$$

In addition to the above the action of potassic bichromate in presence of sulphuric acid was tried, in this case half the volume of oxygen liberated is derived from the peroxide, perchromic acid being formed as an intermediate step, as the following equation shows:—

$$\begin{cases} K_2Cr_2O_7 + 3H_2O_2 + H_2SO_4 = K_2SO_4 + Cr_2O_8 + 4\,H_2O + O \\ Cr_2O_8 + 3H_2SO_4 + Cr_2(SO_4)_3 + 3H_2O + 2\tfrac{1}{2}O_2 \end{cases}$$

In practice we find that hydroxyl may be quickly and accurately estimated volumetrically by means of decinormal potassic permanganate, the termination being well marked even by artificial light; that the method with iodine and thiosulphate is not to be recommended where rapidity is of importance, because the action is liable (even in presence of much free acid) to become exceedingly slow towards the last, and as the change appears suddenly and only after some time, there is a danger of taking it as complete prematurely.

The method of measuring the volume of gas is liable to several objections; it requires more manipulation and longer time for completion, involves more calculation, and there is always the liability of an unseen leakage taking place; also if an excess of permanganate be added, the gas evolved on standing may be in excess through decomposition of the acidified permanganate, whilst if sufficient time is not given, the fluid in the flask remains super-saturated with gas: this, however, may be overcome by frequent gentle shaking, or if the receiver is large enough to contain the heated gas by boiling. We are of opinion that this source of error accounts for the discrepancies in

our results, but believe that they are not sufficiently great to invalidate the deduction drawn. Collecting over water is inadmissible, as no proper correction can then be made for solubility.

Other methods are (1) adding an excess of standard arsenious acid solution, and measuring the excess with iodine; and (2) the titration of the sample upon a weighed quantity of ferrous ammonium sulphate, using potassic ferricyanide as an external indicator; in our hands the latter gives results a little low, as will be seen from the following figures, which are averages of 8 or 10 closely agreeing experiments.

One c.c. of hydroxyl acidified and diluted required 30·53 c.cs. of $\frac{N}{10}$ $K_2Mn_2O_8$ = ·0519 gram H_2O_2. 1 c.c. of the same sample had 40 c.cs. $\frac{N}{10}$ As_2O_3 solution added and required 9·63 c.c. $\frac{N}{10}$ iodine, therefore 40-9·63 = 30·37 × ·0017 = ·0516 gram H_2O_2. 1 c.c. of the same sample was diluted to 10 c.cs. with water containing 6 per cent. of H_2SO_4 (1:3). ·5125 gram of the ferrous salt required 4·8 c.cs. of this solution, therefore, from the equation:—

$$\underbrace{2FeSO_4Am_2SO_4,\ 6Aq}_{784} + \underbrace{H_2O_2}_{=\ 34} + H_2SO_4 = Fe_2(SO_4)_3 + Am_2SO_4 + 8H_2O$$

$$\text{then } \frac{34 \times 10 \times \cdot51252}{784 \times 4\cdot8} = \cdot0462 \text{ gram } H_2O_2$$

With reference to the term "volume strength," it is noticeable that dealers have somewhat vague ideas as to its significance.

The total volume of gas liberated by the action of potassic permanganate from unit volume of hydroxyl solution being the most lucid and definite explanation that we received. If this were the case it would give to most of our samples nearly double the strength they were stated to be and may therefore be at once discarded, it not being the usual practice in commerce to understate values.

Evidently the volume of oxygen available in unit volume of hydroxyl solution *only* is the proper meaning of the term.

We may say that the samples examined were procured from firms of good repute, and were sold to us as being of fair commercial quality, and nearly approximating to the strength stated.

It may, we think, be fairly anticipated that as the value of hydroxyl becomes more widely recognised, it will be produced at a cheaper rate, and become more extensively used, whilst, owing to its tendency to deteriorate, analysts may be called upon to undertake its estimation more frequently than has been the case hitherto.

Discussion.

Mr. Kingzett, after remarking that a full account of his investigation into the same subject is given in the last edition of *Sutton's Volumetric Analysis*, said that if in the titration by sodium thiosulphate, a great excess of sulphuric acid be employed, and particularly if the temperature be very slightly raised, the slowness of reaction ordinarily experienced disappeared, and the whole was over in two or three minutes.

He had constant occasion to make such determinations, and he now employed this method to the exclusion of all others, because, having tested it against all other processes, he knew that it was the most accurate. The essential point was to have a very large excess of sulphuric acid, and he employed equal volumes of that acid, and of the peroxide of hydrogen solution. In reply to a question as to his experience of the peroxide of hydrogen solution by various makers, he stated that what professed to be of ten volume strength, usually only showed seven or eight volumes, and he had met with cases of professedly twenty volume solutions which contained only six volumes. The per-centage of peroxide of hydrogen, evidently, depended to a great extent upon the age of the solution, and the conditions under which it had been kept.

A NEW TEST FOR LEAD.

By A. Wynter Blyth, M.R.C.S.

A solution of cochineal is prepared by boiling the ordinary commercial cochineal in water, filtering, and then adding sufficient strong alcohol to ensure its preservation from mould. A few drops of this solution added to a colourless neutral or alkaline solution containing dissolved lead, strikes a deep mauve blue to a red with a faint blue tinge, according to the amount of lead present. The test will distinctly indicate a tenth of a grain of lead per gallon in ordinary drinking water, and by comparison with a solution free from lead, much smaller quantities are indicated.

In searching for traces of lead in water, it is convenient to take two porcelain dishes; into the one place 100 c.cs. of the water to be examined and into the other, a solution of carbonate of lime in carbonic acid water, known to be lead free, and approximatively of the same hardness, as the water to be examined, then add to each an equal bulk of the colouring matter in quantity sufficient to distinctly tinge the water; the colours may now be compared; the slighest blue tint will be either due to lead or copper; for copper in very dilute solutions gives a similar tint, but in solutions of 1 to 1,000 or stronger the hue is so different as to differentiate the two metals.

The method is within certain limits applicable for quantitative purposes on the usual colorimetric principles. As a qualitative test, it is superior to hydric sulphide and more convenient.

Discussion.

Dr. Stevenson inquired if varying the amount of alkalinity in the water, or the presence of considerable quantities of carbonates, had any effect.

Mr. Blyth said that of course they altered the hue, but the blue was still very decided. He had tried all kinds of salts, but as it was a new test, he would be a bold man to say that it was really confined to these, although, as far as he knew, it was peculiar to lead and to copper, with the limitations he had mentioned. The tests were confirmed by other reactions.

ON THE DECREASE IN THE USE OF COFFEE AS A BEVERAGE.

By Dr. Wallace, F.R.S.E.

Read before the Society of Public Analysts, Jan. 16th, 1884.

Of all the stimulants employed by the people of this country, including alcoholic beverages, tobacco, tea, coffee, and cocoa, the only one the consumption of which has decreased of recent years is coffee; and I have thought it worth while to bring the subject before the members of the Society of Public Analysts, in order that I may endeavour to point out the cause or causes of this falling off.

I do not propose, in this paper, to discuss the question whether these stimulants are beneficial or injurious to the animal system, although I hold very strong views on the subject. I only wish, on the present occasion, to direct your attention to the anomalous position which coffee occupies as a member of the group of substances to which I have referred. I have been assisted in my endeavour to get at the truth of the matter by my friend, Mr. Michael Connal, who has procured for me a table, compiled by Messrs. Francis Reid and Co., Brokers, Liverpool, in which will be found a great mass of most valuable information. The statistics in this table go back in most cases to 1843, and are brought up to 1882, so that we have here a range of 39 years.

As the prosperity, or otherwise, of a nation has a marked influence on the amount of luxuries consumed, I propose, in the first place, to refer to the population of the United Kingdom, and the amount of property and money assessed for income tax, as indicative of the national prosperity. In 1843 the population amounted to 27,283,000, and it rose steadily till 1846, when it had increased to 28,189,000. Then the sad visitation of Ireland by the potato disease, and the enormous emigration from all parts of the United Kingdom, and particularly from Ireland, not only checked the natural increase of population, but caused a decided diminution, gradually augmenting till 1850, when the estimated population, as at 31st December, was 27,423,000. From that time till now, there has been a constant and, in some cases, very considerable annual increase. In 1856 it had about regained the figure of 10 years previously, the number for that year being 28,154,000; in 1865 it had reached 30,000,000; in 1870, 31,100,000; in 1873, 32,000,000; in 1877, 33,000,000; in 1880, 34,000,000; and in 1882, the astounding figure of 35,700,000. We have, in fact, increased 5 millions in the last 13 years. So far, then, as population is concerned, we are a most prosperous nation. Now let us see whether our material prosperity has kept pace with our increase in numbers. We get some insight into this from the amount of property and income assessed for income and property tax. Beginning at 1856, which is the date to which my statistics of the tax go back, although it was begun for Great Britain alone in 1842, the amount is 268 millions, or £9 10s. 7d. per head of population; and this included incomes down to £100. We find a perfectly steady increment till 1876, when the gross amount assessed was 503 millions, and represented property per head of population of £15 8s. 7d. The slight diminution which followed was probably due, not so much to a falling off in material prosperity, as to the incidence of taxation, which does not now include incomes

so low as those formerly assessed. However that may be, the amount assessed for property and income tax last year was 500 millions, or £14 0s. 1d. per head of population; although the number of those who pay the tax is comparatively small. Our researches, so far, then, amount to this, that, as a nation, we are rapidly increasing in numbers and in wealth.

The quantity of British and foreign spirits consumed in 1843 was ·87 of a proof gallon per head of population, and this, I am glad to say, has not increased very materially, the present consumption being 1·03 gallons, or an increase of nearly 19 per cent. But the consumption reached a similar figure so far back as 1850, which it fell to ·86 of a gallon in 1860—actually lower than in 1843. From this time (1860) there was a gradual rise to 1875, when it reached 1·31 gallons per head, since which it has fallen to 1·03. The case of wine is somewhat similar, but the increase is larger, being 82 per cent. In 1843 it was ·22 of a gallon per head, and it remained almost stationary till 1861, when it rose suddenly to ·37, from which it went on gradually increasing till 1876, when it was ·57, and it has since fallen as gradually to the present figure, ·40, or about 2½ bottles.

If we now inquire into the statistics of tobacco, the only true narcotic in which the Briton indulges, we find a much larger increase. In 1843 it was ·84 lbs. per head of population, and it rose steadily to 1877, the period of largest consumption, when it was 1·49 lbs. It has since fallen to 1·37 lbs., or an increase since 1843 of 63 per cent.

Now we come to the stimulating beverages, tea, coffee and cocoa. The most important of these is tea, for we are a distinctly tea-drinking nation. The quantity in 1843 was 1·47 lbs. per head, and it has risen steadily till in 1879 it was 4·8 lbs. It has since fallen slightly, viz: to 4·62, showing, as compared with 1843, an increase of 214 per cent. Cocoa is even more remarkable: beginning with ·09 of a pound in 1843, it is now ·34 of a lb., an increase of 277 per cent. The consumption of coffee was in 1843, 1·1 lb. per head and it increased up to 1848, when it was 1·37 lbs. It has since slowly but steadily declined, especially since 1853, and is now only ·89 lbs., a *decrease* since 1843 of 19 per cent., and since 1853 of 54 per cent. We have here, then, the remarkable fact that while spirits, wine, tobacco, tea, and cocoa, have increased to the extent of 19, 84, 63, 214 and 277 per cent., coffee has decreased to a very considerable extent. What is the reason of this? My opinion is that the people of this country are losing their taste for coffee, because of the difficulty of obtaining it in a pure state. Just about the time when the consumption was at its maximum, chicory began to be used, and now the use or rather abuse of this vegetable is so universal that comparatively few know the taste of real coffee. When the Briton goes to France, Belgium or Germany, he enjoys his coffee because it is coffee, and in many cases declares that if he could get it like that at home he would drink it daily. It is quite true that if you ask specially for pure coffee, the grocer is bound to give it to you; but he gives it with a grudge, for his profit is mainly in the chicory with which his ordinary coffee is mixed. It is a fact that in the best hotels and restaurants in Glasgow, the liquid you imbibe is not coffee but a mixture of that substance with chicory, the proportion of the latter being ¾ to ¼ of the whole. Indeed, the proportion of the adulterant is sometimes even more than three-fourths, and

the article may be correctly described as chicory flavoured with coffee. Chicory is bitter, and has three times the colouring power of coffee, hence it gives the liquor the appearance of great strength; but it contains no caffeine or other analogous alkaloid; it has no exhilirating properties; none of the effects upon the system for which coffee is prized; in fact its admixture with coffee is a pure and simple fraud. To show how the public are deceived in this matter of coffee adulteration let us take the case of a particular coffee sold in tins. It contains 1 part of coffee to 3 parts of chicory, and is sold at 1s. 4d. per lb. The coffee in a pound of it costs, retail, say 7d., the chicory say 4d., tins say 3d., profit 2d., total 1s. 4d. But the consumer gets no value except the 7d. worth of coffee, the chicory being worse than useless, so that he pays 1s. 4d. for 7d. worth of coffee.

Chicory is not the only adulterant used for making down coffee to an extent that will give sufficient profit to satisfy the grocer; the other articles employed being burnt sugar or caramel, dried and roasted figs, dried dates, date stones, decayed ships' biscuits, beans, peas, acorns, malt, dandelion root, turnips, carrots, parsnips and mangold-wurzel—all of them being roasted to imitate coffee. You have all, doubtless, heard of the Date Coffee Company, and how, after flourishing for a brief period in the credulity of the public, it has recently "come to grief." I regret to say, for the honour of the profession to which I belong, that a London chemist of some standing gave this Company a testimonial in favour of their trashy mixture, saying among other advantages it possessed, that it was less stimulating than the pure article. This is quite true, but we use coffee because it is a stimulant to a mild extent. What would we say of a professional man who advocated that a mixture of whiskey, with an equal bulk of water, the price being about the same as the whiskey itself, was preferable because it was less stimulating?

I think our Government acted unwisely in taxing chicory at the same rate as coffee and permitting it to be mixed in all proportions with that beverage, which when pure is so delicious, but when mixed is simply abominable. If admixture of coffee with chicory and other rubbish were absolutely forbidden in the same way as adulteration of tea, it would soon regain the high estimation in which it was formerly held, and the consumption, instead of diminishing, would increase in the same ratio as the other luxuries of which I have spoken.

Conclusion of the Proceedings of the Society of Public Analysts.

ANALYSTS' REPORTS.

At the last meeting of the Salisbury Town Council, Mr. Stoddart, of Bristol, the city analyst, sent in a report stating that twenty-four samples of food had been analysed during the last three months. One sample included under butter was sold as butterine. Mr. Leach: Why should it be sent to the analyst if sold as butterine? Superintendent Mathews explained that the butterine was purchased, but not by himself, and it was not sold as butter. Mr. Newton thought that the analyst had been occasioned unnecessary trouble. Mr. Moody remarked that although the article was not sold as butter, it might have had something in it that was injurious. Mr. Leach: If sold as butterine it ought not to have been sent to be analysed. Superintendent Mathews explained that he was ordered to purchase from a certain individual, and that was done, the samples being then sent for analysis. The subject was, after some further conversation, allowed to drop.

THE report of the Medical Officer of Health for the City of London on analyses made by him during the past year, states that mustard has been found to be genuine with the exception of some admixture of wheaten flour, and pickles had been found free from copper. Four samples of arrowroot and two of quinine submitted for analysis were found to be genuine, and the same remark applies to one sample each of brandy and whiskey. Out of 200 specimens of different articles submitted for examination, there was not one which called for the interference of the law.

REVIEWS.

BLEACHING, DYEING AND CALICO PRINTING (with Formulæ). London: J. and A. Churchill.

THIS is an addition to Messrs. Churchill's series of technological handbooks, and it may be at once admitted that it is a very excellent one. It is edited by Mr. John Gardner, F.I.C., well known in connection with his labours on Cooley's Encyclopœdia, and who has called to his aid Mr. T. F. Hodges, Junior, of Belfast, and Mr. T. Chadwick, of Manchester. While not pretending to the position of an exhaustive treatise it yet proves how much valuable information may be condensed into a handy little book of 200 pages, and for a practical busy man the advantage of being able to at once lay his hand on plenty of good receipts and short succinct descriptions without wading through a mass of scientific verbiage will be at once apparent.

THE DISCOVERY OF THE PERIODIC LAW, AND ON THE RELATIONS AMONG THE ATOMIC WEIGHTS. By *John A. R. Newlands, F.I.C., etc.* London: E. and F. N. Spon.

THIS is a collection of the author's writings on the subject dating from 1864, with the object of asserting priority of authorship of the idea over that of both D. D. Mendelejeff and Lothar Meyer. With the too great tendency on the part of English chemists to revere everything foreign and pass over in silence native efforts it is refreshing to see some one with the pluck to assert his rights, even at the cost of republishing in book form. A prophet is never honoured in his own country, and Mr. Newlands is no exception, and by no means the first victim. We could point to papers containing absolutely original processes which have appeared in our columns, but have been quietly ignored in the Chemical Society's Journal until long afterwards, when they have been abstracted from the German journals, which in turn copied from us! Every chemist interested in the support of native research should get a copy of Mr. Newlands' book, and having marked, learned and duly digested the same, cease to talk of the periodic law as a foreign discovery. So as to show the exact nature of Mr. Newland's claim we give the summary of the same in his own words:—"I claim to have been the first to publish a list of the elements in the order of their atomic weight, and also the first to describe the periodic law, showing the existence of a simple relation between them when so arranged. I have applied this periodic law to the following, among other subjects:—

"1. Prediction of the atomic weights of missing elements, such as the missing element of the carbon group = 73, since termed eka-silicium by M. Mendelejeff.

"2. Predicting the atomic weight of an element whose atomic weight was then unknown, viz., that of indium.

"3. Selection of Cannizzarro's atomic weights instead of those of Gerhardt or the old system, which do not show a periodic law.

"4. Predicting that the revision of atomic weights, or the discovery of new elements, would not upset the harmony of the law—since illustrated by the case of vanadium.

"5. Explaining the existence of numerical relations between the atomic weights.

"6. Where two atomic weights were assigned to the same element, selecting that most in accordance with the periodic law; for instance, taking the atomic weight of beryllium as 9·4 instead of 14.

"7. Grouping certain elements so as to conform to the periodic law instead of adopting the ordinary groups.

"Thus, mercury was placed with the magnesium group, thallium with the aluminium group, and lead with the carbon group. Tellurium, on the other hand, I have always placed above iodine, from a conviction that its atomic weight may ultimately prove to be less than that of iodine.

"8. Relation of the periodic law to physical properties—showing that similar terms from different groups, such as oxygen and nitrogen, or sulphur and phosphorus, frequently bear more physical resemblance to each other than they do to the remaining members of the same chemical group.

"It is not denied that I was the first to publish a list of the elements in the natural order of their atomic weights, and Wurtz has written, in reference to the periodic law, that 'it is a circumstance worthy of remark that such varied and unexpected developments arise from the simple idea of arranging bodies according to the increasing value of their atomic weights. This simple idea was a most important one.'"

Having thus set forth the author's views, we leave our readers to purchase the book and judge for themselves, because we feel certain that their verdict will support Mr. Newlands in his claim for priority.

NEW COMMERCIAL PLANTS AND DRUGS, No. 7. By *Thos. Christy, F.L.S., F.S.C.I., etc., price* 2*s.*

MR. T. CHRISTY'S publication is, as usual, full of interesting facts and information about tropical plants. The present number contains articles on pepper and nutmeg cultivation, and on Liberian coffee; space is also devoted to the consideration of new drugs; these are interesting to the public analyst, as a better acquaintance with the modes of cultivation and preparation of articles of food grown in the tropics may enable him to form an opinion as to the quality of the articles as met with here, and the likelihood of their being adulterated when viewed from a commercial standpoint, thus in one case a planter acknowledges that he sends his Liberian coffee over as Java, although the treatment of the berries produced by the Coffea Liberica, resembles that of cocoa rather than coffee. Much useful and general information will be found about fibres, and a drawing and description of Mr. H. C. Smith's machine for extracting fibre from the Rhea and other plants.

Altogether "Commercial Plants and Drugs" is a valuable publication, not so much for the detailed information as to processes, as for the general remarks on the properties of the plants dealt with, made by planters and others engaged directly in their production and cultivation.

THE TESTING OF PETROLEUM IN INDIA.

ABOUT eighteen months ago attention was directed to the subject of the testing of petroleum in India, in consequence of the detention by the Calcutta authorities of several cargoes of petroleum oil which were stated to be covered by certificates obtained before shipment in the United States, showing the flashing point of the oil to be not below the Indian legal standard. The matter was referred by the Indian Office to Sir Frederick Abel and Mr. Boverton Redwood, and the latter proceeded to Calcutta to test the oil. Eventually the cargoes were passed, but the detention having shown the insufficiency of the directions for testing prescribed by the Indian Petroleum Act, an inquiry was ordered. An investigation has accordingly been conducted by Sir F. Abel, Mr. Redwood, Surgeon-Major Lyon, of Bombay, and a committee sitting in Calcutta. The results arrived at, and the conclusions of the Governor-General in Council, are embodied in an official resolution, which has recently been published in the *Gazette of India*. It has been decided that an amendment of the law shall take place, and, with a view thereto, the Board of Analysts at Calcutta, and Surgeon-Major Lyon, of Bombay, are to prepare fresh instructions for the use of the Abel system of testing in India. These instructions are to be based upon the recommendations contained in the joint memorandum of Sir F. Abel and Messrs. Redwood and Lyon, and are to include a provision for correcting the results for barometric pressure. Moreover, a stricter definition of the length of time occupied in the application of a test-flame is to be given, the Indian Government considering the memorandum in question incomplete in this particular, since it points out the necessity for such stricter definition, but does not specify the manner in which it is to be provided. The Governor-General has also considered Sir F. Abel's proposal to raise the test standard from 73° to 78° Fahr. (in which Mr. Redwood did not concur), and has decided against any change. Inasmuch as it has been found that, even with the adoption of the proposed precautions, the Abel test will still be liable, in some cases, to show a depression of the flashing-point to the extent of 3° Fahr. in a tropical as compared with a temperate climate, it was suggested that a margin of variation to that extent might be allowed in the case of oil covered by an American certificate of 73° or over. The Governor-General, however, declines to accede to the suggestion, and accordingly announces that the trade must make arrangements to provide for this contingency—presumably by importing oil of 76° (Abel) flashing-point. In regard to the testing and passing of cargoes, an important concession is, however, made, for it is proposed to provide by law that in cases where none of the samples tested of a given parcel show a flashing-point below 70° Fahr. the whole parcel may be passed, provided that the numerical average of the tests of all the samples is not below 73°. If, however, any one of the samples flashes below 70°, then the parcel is to be rejected, notwithstanding that the average may be not below 73°. Moreover, in the testing of each individual sample the analyst is to be empowered to certify a flashing-point deduced from several experiments, by striking an average, or otherwise.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

To the Editor of "The Analyst."

Sir,—The following are the results of analyses of two samples of milk made by myself and by Professor Redwood. My own analyses were made upon the milk in its fresh condition, and Professor Redwood examined the milks after they had been kept in bottles for 18 days. As the milks were collected in the same town, namely, Aldershot, and on the same day, I have no doubt, seeing that their composition is practically identical, that they are from the same dairy, although purchased of different vendors.

No. 1.

Redwood.		Angell.
Sp. gr. ..	Sour	Not taken.
Total solids ..	11·3	11·38
Fat	1·8	3·07
Solids not fat ..	9·5	8·31
Ash ..	Not taken.	0·67
Certified skimmed.		*Certified* 10 *per cent. water.*

No 2.

Sp. gr.	Sour.	
Total Solids ..	11·61	11·38
Fat	2·96	3·17
Solids not fat ..	8·65	8·21
Ash ..	Not taken.	0·63
	Certified genuine.	*Certified* 10 *per cent. water.*

In my opinion, these figures of Professor Redwood's clearly show the absolute unreliability of analytical results obtained from decomposed milk, and should serve as a warning against giving a decided opinion in such cases.

Yours obediently,

ARTHUR ANGELL, Ph.D., F.C.S.

To the Editor of "The Analyst."

Sir,—I herewith send you a newspaper clipping shewing you the very unexpected results of one of our late trials in a suburban district of this city. In the central municipal, and all other district courts, however, conviction has followed each prosecution. Chief Justice Pennerton, of the central court, has upheld my proposed standard for cider vinegar, which you published in your reprint of my vinegar report, in your June, 1883, number—an acidity equivalent to the presence of not less than 5 per cent. by weight of acetic acid, and a fixed residue of not less than 1·5 per cent., at 212 degrees F., as this will allow of an average watering of 20 per cent. of the straight whole cider vinegar, as I have found it; this surely is not drawing the line too high. I hope a near number of your journal will contain the explanation about the sp. gr. of the Boston milk, which I asked Prof. J. F. Babcock, who made them, to send you.

Yours respectfully,

B. F. DAVENPORT,

Boston, Mass, Feb. 7th, 1884. State Analyst of Drugs.

[The following is the cutting referred to by our correspondent, and is taken from the *Boston Journal* of Saturday, January 26th, 1884.—"Guilty Knowledge must be Proven.—In the Somerville District Court, this morning, there was a hearing before Judge Story, on a complaint charging Amos Haynes, of 4, Chatham Street, Boston, with selling vinegar which had been adulterated with water. The case was brought in Somerville because the defendant's factory is situated there, and the particular sale upon which the case rested was made in that place. The adulteration was shown by the evidence of experts, but the defendant was discharged, the Judge stating that in all such cases he would require guilty knowledge to be proven. Dr. B. F. Davenport, Inspector of Vinegar, states that the law under which these prosecutions are made does not require such proof, and that under such a ruling no conviction can ever be secured."—Ed., The Analyst.

LAW REPORTS.

CONDENSED MILK.—At the Liverpool Police-court on Wednesday, 30th January, Mr. Thomas Frith, grocer, 77, Brunswick-road, Liverpool, was summoned for having sold a tin of condensed milk not of the nature and quality demanded. Mr. Marks, for the prosecution, stated that the only peculiarity about the case was that it was the first summons issued relating to this particular article. A tin of condensed milk was obtained in the usual way, a sample of which was sent to Dr. Campbell Brown for analysis, who reported that the cream had been removed from the milk before it was condensed, and that the value of the sample was less than half the value of ordinary condensed milk made from genuine milk. The tin was covered by a label upon which was the following:—"Guaranteed to be pure cows' milk from one of the richest pasture vales in England, and is highly recommended for invalids and infants' diet, as being more wholesome and nutritious than fresh cow's milk, and especially milk from cows fed in shippons in large towns. This milk is the richest and best, the water having been abstracted and pure loaf sugar added." Evidence was then given by Inspector Baker, who proved having purchased two tins of condensed milk from defendant on the 2nd ult., samples of which were sent to the public analyst. Defendant's assistant told witness that the condensed milk was the best, and was specially made for them. Mr. Segar, barrister, for the defence, said defendant had no personal knowledge of the quality of the milk, but upon the strength of the label sent him by the manufacturers, he placed upon the tin the guarantee referred to. The milk did not contain all the fats to be found in pure milk, but that was held by medical men to be more beneficial for invalids and infants. He contended that condensed milk was asked for, and it was supplied, and that there were several kinds of condensed milk manufactured.—Mr. Marks said that Mr. Segar could not, however, go beyond the certificate of Dr. Campbell Brown, which stated that the milk in question was only half the value of ordinary condensed milk. Mr. Raffles, the magistrate, remarked that the difficulty which appeared to him was that there were several kinds of condensed milk, and he certainly should impose a penalty; but if Mr. Segar wished to take a case upon the difficult point he could do so. Defendant was fined 20s. and costs.

CONDENSED MILK.—Mr. James Lees, grocer, 12, Elliot Street, Liverpool, was summoned on Wednesday, at the instance of the sanitary authorities, for selling adulterated condensed milk. Mr. Barber prosecuted, and Mr. Broadbridge appeared for the defendant. The milk was bought on the 9th ult., and on being analysed it was found that all the cream had been abstracted before it had been condensed. The case was similar to the one brought before the court a week ago, and as the milk had been brought before that conviction Mr. Raffles said he would only inflict a fine of 20s. and costs. Mr. Broadbridge stated that the company which had manufactured the article had issued notices withdrawing all their condensed milk from the market, in order that fresh labels might be put on the tins. Other grocers were fined for similar offences.

CONDENSED MILK.—At Liverpool Police Court, Mr. Charles Lancaster, grocer, 139, Kirkdale Road, Liverpool, was summoned for selling a tin of condensed milk, known as "Italian Cirio" brand, which had been deprived of half its cream before being condensed. A fine of 20s. and costs were imposed. A similar fine was imposed on Mr. Thos. Dunbar, grocer, Stanley Road, Liverpool, for selling a can of condensed milk deprived of the whole of its cream before being condensed. The brand is known as "Hooker's Cream Milk."

CHEAP JAM.—At the Sittingbourne Petty Sessions, on Monday, before F. Locke, Esq. (chairman), and Major Moore, Mr. George Mallett, grocer, Station Street, Sittingbourne, was summoned under the Sale of Food and Drugs Act, for having sold as plum-jam a certain compound, to wit, plum and apple jam, on January 29th. Mr. Strouts appeared for the defendant. George Cockburn Barringer, one of the constables stationed in Sittingbourne, stated that on the day named, he went to the defendant's shop and asked for a bottle of "Steer's plum-jam." He was served with it, and he afterwards told defendant he would take two more. He paid him 3s. for the three, and then handed them to Superintendent Mayne, who had just come in. Witness told defendant that he had bought the bottles of jam for the purpose of analysis by Dr. Adams, the county analyst. Superintendent Mayne stated that on January 29th, he received three bottles of jam from the last witness, one of which he now produced. It was labelled "Steer's genuine plum-jam." He left one bottle with defendant, retained the one which he produced, and handed the other to Dr. Adams, the county analyst, at Maidstone, on the following day. He had since received the certificate produced from Dr. Adams, which certified that the "plum-jam" contained 25 per cent. of apple. Mr. Strouts then addressed the Bench for the defence, and contended that, as the purchaser asked for "Steer's plum-jam," and was served with "Steer's plum-jam," there

could be no conviction. The Magistrates' Clerk (Mr. Tassell): Then, according to your argument, it would not have mattered if it had been all apple? Mr. Strouts: It was "Steer's plum-jam." The Chairman: No; it was plum and apple. Mr. Strouts (continuing), went on to say that his client never interfered with the jam in any way; he bought part of a bankrupt's stock at the beginning of the present year, and he sold the jam exactly as he received it. He produced the invoice which accompanied the jam. He contended that the Sale of Food and Drugs Act was never intended to apply to a case like this, but was intended to deal with cases where there had been adulteration by deleterious and injurious compounds. In this case the jam contained nothing injurious to health. He invited the magistrates to taste the sample in court. The chairman said it was not a question of whether it was injurious to health. The information was laid under another section, which he read. The question was whether the defendant sold plum-jam in accordance with the demand of the purchaser, or whether he sold a compound. Mr. Strouts said he still maintained that "Steer's plum-jam" was supplied. He supposed the purchase was made by the police because it was known that it had been a bad plum year, and there had been scarcely any plums at all, and that real plum-jam could not be supplied at 4d. per pound. There had been no fraud shown, nor anything to the detriment of the public or the prejudice of the purchaser, and therefore he asked the Bench to dismiss the case. Besides, even if there had been a technical infringement of the Act, he contended that under Section 25, the defendant was not liable, because he was protected by a warranty (produced) from the person from whom he purchased the jam. In reply to the Bench, Superintendent Mayne said this was the first time defendant had been summoned under this Act. Other goods purchased of Mr. Mallett were found on analysis to be perfectly pure. The Chairman said the magistrates were clearly of opinion that the defendant was liable, and he would be fined 40s., and 10s. costs. The maximum penalty was £20. The Chairman also intimated that it was a question for the defendant to consider whether he had any remedy against the wholesale merchant. The money was at once paid. It transpired during the hearing of the case that several tons of jam manufactured by Steer, of Maidstone, and labelled precisely in the same manner as were the bottles sold by Mr. Mallett, are held at the present time by tradesmen in Sittingbourne and Milton.

Refusing to Serve.—Amusing Case.—At the Reading Borough Bench yesterday, before C. Smith, Esq. (in the chair), and J. Simonds, Esq., Mr. John Simmonds, landlord of the Little Crown, Southampton Street, was summoned for refusing to sell a quantity of gin to Mr. W. H. Roberton, the duly appointed Inspector of Nuisances, whose duty it also is to obtain samples for analysis under the Food and Drugs Act. Mr. Roberton stated that on the 28th of December he went to the defendant's house and purchased 4d. of gin, which was served him by Mr. Simmonds, he (defendant) placing it in a bottle he handed him. Witness told him he wanted the gin for analysis, and offered to divide it with him. Defendant said he did not understand it, and witness repeated the words, and also told him that if he (defendant) doubted the analysis of the public analyst, the portion he kept, and that he (witness) kept, would be sent to London. Defendant then said "You have bought it, it is yours." Witness said "Then you don't want it divided?" Witness then took a label from his pocket, and wrote the name of the landlord and the house on it. Witness put the bottle on the counter, and Mr. Simmonds left the room, but returned with Mrs. Simmonds, who took up the bottle and read the label. She said to Mr. Simmonds "What is this?" and defendant replied "I don't know, but this man is going to do something with the gin." Mrs. Simmonds looked in his bag and said he had not been to any other houses, and what business had he there, adding "You shan't have the gin." She had the bottle in her hand, and witness said "Don't do that, or you'll be breaking the law." Mr. Simmonds then asked him what authority he had, adding "If you had come in like a man, and told me who you were, and not in this sneaking manner, you would have had the gin." Witness asked him several times for the gin, but he refused. Witness told him that if he did not give him the gin, he should call in a policeman, but defendant said he could call in whom he liked, he would have no gin there. Witness told him he was appointed by the Sanitary Authority to get samples. Mrs. Simmonds emptied the bottle into a glass. Witness called in a policeman.—Cross-examined; After the gin was emptied out he asked for the gin again. Mrs. Simmonds washed the label off the bottle, handed it back to him, and threw down the fourpence, saying "You'll have no gin here." He was positive he asked for the gin in the presence of the policeman.—P.C. Jordan corroborated Mr. Roberton as to his asking for the gin, and Mr. and Mrs. Simmonds refusing.—Mr. Creed, in defence, argued that no offence had been committed. There was a complete sale of the gin, and if any offence had been committed, it was by Mrs. Simmonds, who took unlawful possession of it. If the magistrates were against him, he hoped they would inflict a small penalty.—The Bench said they must convict, but as this was the first offence of the kind that had come before the Reading magistrates they would inflict the nominal penalty of 10s. and 9s. 6d. costs. Mr. Simmonds had rendered himself liable to a fine of £10.—*Reading Observer*, 2nd February, 1884.

CORK POLICE OFFICE.—(Before Dr. Wycherley, Messrs. A. M. Mitchell, R.M., and James Ogilvie). Mr. Deyos appeared on behalf of the Corporation to prosecute several persons under the Adulteration of Food Act (38 and 39 Vict.) for selling adulterated coffee. The first case was against Mr. George O'Brien, 123, Shandon Street, for selling coffee adulterated with 37 per cent. chicory. Mr. Deyos produced the certificate from Mr. Burrell, the analyst, stating that the coffee contained 37 per cent. of chicory and other foreign matter. The defendant said he had two assistants in his shop, one of whom attended to the grocery department on this particular day, and having no knowledge of what she was doing, sold the coffee without affixing the label. He always cautioned the young man who attended to write on the paper that it was a mixture. Their Worships decided, on account of the extenuating circumstances, to fine the defendant 2s. 6d., and £1 costs. Mr. Deyos pressed for a larger penalty, but the Court declined to increase it.

The next case was against Mrs. Leslie, 94, Lower Glanmire Road, for selling coffee adulterated with 50 per cent. of chicory and foreign matter. Mr. A. Julian appeared for the defendant and said that Mrs. Leslie's establishment till recently had been managed by a son of her's. The son had ceased to have any connection with the establishment, and Mrs. Leslie was an old bedridden woman. On the occasion of the visit of the Sanitary Officer there was no one in the shop but a little girl. Unless pure coffee was asked for, it was quite common for shopkeepers to give this mixture, as the small vendors did not mix the coffee, it was supplied to them in this mixed state. He felt certain the Bench were satisfied that there was no intention on the part of Mrs. Leslie to defraud. Mr. Deyos, for the Corporation, said he would leave the case in the hands of the Bench, and the course adopted by Mr. Julian would, no doubt, mitigate the offence. He should, however, state that on the day this sample and that from Mr. O'Brien's were taken, others were also procured; but none of these were adulterated. Mr. Ogilvie said that from the first, the Bench were convinced that there was no intention to defraud in either case. In the last case, in inflicting a fine of 2s. 6d., and costs, the Bench thought they were satisfying justice. They would impose the same penalty in the other cases. It was not, however, fair to state that coffee and chicory were sold to the small dealers for pure coffee, because it was bought from wholesale dealers in tins, each tin stating that it was a mixture if such was the case.

"PURE DUTCH BUTTER."—Henry Nicholson, grocer, carrying on business in Manchester Road, was charged with an offence against the Food and Drugs Act. Mr. W. T. McGowen (Town Clerk) prosecuted, and Mr. C. L. Atkinson defended. The Town Clerk stated that the case had been previously before the Court, when it was adjourned to enable Mr. Atkinson, on behalf of the defendant, to have the article in respect to which the summons was issued analysed by the Government officials at Somerset House. A sample was accordingly submitted for analysis, and the report was now before the Court. Mr. Mossman (Magistrates' Clerk) read the report, which was signed by Dr. J. Bell, Dr. R. Bannister, and Dr. G. Lewin, certifying that these gentlemen, having analysed the sample, found the result to be as follows:—"Water 13·00 per cent.; curd, 1·81 per cent.; salt, 1·71 per cent.; fat, 83·48 per cent.' "From a consideration of the results obtained from a full analysis of the fat," the analysts added, "we are of opinion that the sample is made up almost exclusively of fat which is not that of butter, and which has apparently been worked up with a little milk." Mr. Atkinson said he should plead guilty to the charge. The analysis received was asked for by his client, and, unfortunately for him, it agreed with the analysis of the local analyst. The Town Clerk: Yes, that is a case of butter without a particle of butter. Mr. Atkinson: The fat has not been found to be of a buttery nature. For the defence Mr. Atkinson said the defendant was perfectly ignorant that an offence had been committed; he was, in fact, quite taken aback when he was told that "the butter had been analysed and was found to be butterine." He had never caused butter to be analysed, and was perfectly ignorant of what butter was except from its appearance. The article in question was purchased from a respectable dealer in the town, the cask being branded "Pure Dutch Butter," and the defendant paid "pure butter" price for it. The price was 11¼d. per pound, the article being retailed at 1s. He (Mr. Atkinson) therefore contended that the defendant had not any intention of defrauding the public, and asked the Bench to take this fact into consideration in regard to the penalty imposed. The defendant was called and produced an invoice showing that the article was sold to him as "Pure Dutch Butter." The Town Clerk raised an objection, and said the invoice was not a warranty. Mr. Tankard: It is utterly impossible for butter sold at 1s. per pound to be pure. No butter dealer should ticket an article at that price as butter. You can't get pure butter for 1s. per pound. Mr. Atkinson; I beg to differ from your Worships. I know we can. The Bench imposed a penalty of £5, including costs.

At the Manchester City Police Court, William Chadwick, farmer, Donnockshaw Farm, near Burnley, was charged with supplying milk to John Mayall, of Manchester, retailer, showing by analysis 32 per cent. of fat abstracted. Inspector Edward had taken samples from two churns at Victoria Station on January 15th. One was cold, or evening's milk, and this showed the 32 per cent. of fat abstraction; the other was warm, or morning's milk, and though it passed the standard of the Society of Public Analysts, it showed 6 per cent. of water added when compared with a sample taken from defendant's fifteen cows at the farm by Edward subsequently. Defendant was fined £10 and costs.

At a Summary Court, Glasgow, on Wednesday, before Sheriff Balfour, Mr. David Wingate, provision dealer, 2, Kirk Street, Calton, Glasgow, was charged at the instance of the sanitary inspector with having on January 9th last sold to two of his officers 1 lb. weight of butter, which on analysis was found to contain 9 per cent. of fat other than butter fat; and he was, after lengthened evidence for the defence, convicted, and fined in the sum of £3. Sheriff Balfour, in his deliverance, pointed out that the prosecution had very clearly shown in their evidence that butterine was furnished to them for pure butter, which was asked for; and he emphatically laid down for the guidance of all dealers in butter that when butterine is exposed for sale the butter merchant should see that it be not only conspicuously labelled butterine on the butts in which it is contained, but also on the paper wrapper covering. Mr. Ross, of Patterson and Ross, acted for the prosecution; and Mr. Borland, of Messrs. Borland, King, and Shaw, for the defence.

FOOD ANALYSIS.

Analysis of Food.—The Manchester and Salford Sanitary Association have prepared a memorial for presentation to the Corporation of Manchester, in which they state that in 1879 they approached the Corporation through the Analyst Sub-Committee by a deputation which sought a reduction of the charges to citizens for analyses, with a view to inducing the public to resort more generally to this method of securing pure supplies of food, &c. The Nuisance Committee have as yet been unable to see their way to make any alteration in the system under which analyses are conducted. The memorialists submit that the present plan of affording facilities for analysis at small fees through the agency of the inspectors under the Sale of Food and Drugs Act only, is calculated to benefit the community to a very limited degree as compared with a system of allowing citizens to employ the analyst direct at small fees, to certify as to the purity or otherwise of articles of food or of domestic use suspected of adulteration or poisoning. They are of opinion that it is not only desirable in the interests of the public health, but as becoming the position of Manchester, that the city should possess a laboratory of its own, and that the whole time of the analyst, or at least that of one of his qualified assistants, should be occupied thereat. They ask the Corporation to take steps to provide a city laboratory, of which the public might avail themselves at the lowest possible fees.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No.	Name of Patentee.	Title of Patent.	Price
1217	J. F. Schnell, A. Haywood, Jun., & W. Darbyshire	Production of Gas, for Illuminating and other purposes, from Hydrocarbons, &c.	2d.
1296	A. S. Brindley & J. Worsnop	Apparatus for use in Crushing Sugar-canes, &c.	6d.
1323	W. W. Box & G. Waller ..	Apparatus used in the Purification of Gas	8d.

Correction.—By an error, Dr. Campbell Brown's name appeared in our last number as County Analyst for Cheshire; it should have been Mr. J. Carter Bell, F.C.S., F.I.C.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Pharmaceutical Journal; The Sanitary Record; The Miller; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; Cowkeeper and Dairyman's Journal; Sugar Cane; Country Brewers' Gazette; The Medical Record; The Grocers' Gazette; London Water Supply, by Crookes, Odling and Tidy; Chemical Review; Independent Oil and Drug Journal and Paint Review; Science Monthly; Journal of the Society of Chemical Industry; New Commercial Plants and Drugs, by T. Christy; The Periodic Law, by John A. R. Newland; Theoretical Chemistry, by Ira D. Remsen.

THE ANALYST.

APRIL, 1884.

AMONG the many attempts at amateur legislation frequently made by private members of Parliament, probably few have been so thoroughly futile as the Bill introduced by Mr. Warton to regulate the sale of patent medicines which has been so ignominiously thrown out by the House of Commons. Every now and then we hear of persons dying from poisons, purchased under the guise of universal remedies for all the ills that flesh is heir to, and it is admittedly an anomalous thing that, while the sale of, (say opium) as opium, is forbidden by any but qualified druggists, yet the very same drug can be purchased under the name of "So-and-So's cough elixir or soothing powders" at any general dealing grocer's shop. But there is a danger on the other hand of being led into foolishness in the desire to remedy the evil, and this is likely to be the case if such a Bill as Mr. Warton's were even to become law. By this measure the sale of patent medicines was to be restricted to such as have been analysed and found to contain no poison, and the duty of analysing the same was to be entrusted—to whom? Of course any sensible person would reply, To a representative board of scientific chemists appointed for the purpose; but no, it was to be put upon the shoulders of the Pharmaceutical Society! We do not for a moment dispute the standing of this Society in its own place, and admit that, by its examinations, it has done much to raise the status of those engaged in selling drugs; but, we ask, Where is its means of carrying out the duties thus proposed to be thrust upon it? True, it has a laboratory and a school, not to mention a staff of professors; but the manufacture and sale of proprietory remedies is a business in which large numbers of persons are interested, and immense sums of capital are invested, and any interference with such interests should be made by a commission of the highest chemical talent in the land. Passing away from this part of the happily defunct Bill, let us glance at the concluding piece of nonsense, evident at once to the understanding of all, in the hope of raising a warning mark for future would-be legislators. The proprietory article having been analysed by the Pharmaceutical Society, and found innocuous, is to have a certificate to that effect, and may forthwith be sold as a reliable and innocent nostrum for evermore. What then will be more simple than for proprietors to omit all poisons from their articles until the certificate is obtained, and then, under cover of this guarantee, put in and sell what they choose. No, if a Bill is to be of any use whatever, provision must be made for the appointment of a board of experts who shall be empowered to analyse and regulate the sale of patent medicines. The analyses being made not once for all but periodically, the samples being purchased in a similar manner to those under the Sale of Food and Drugs Act, as is done in Paris. As to the sale of powerful poisons under a Government stamp, it is agreed on all hands that something should be done to put a stop to an evil which is rapidly becoming—in a similar way to alcohol—a national calamity. In common fairness therefore to the pharmaceutical chemist who is not allowed to sell poisons except under stringent regulations, we think that Parliamentary interference is called for to supervise the retailing of any compound as a patent medicine, but the measure must be prepared and brought forward by persons who have a full knowledge of the subject in all its bearings. An excellent opportunity will be found when the projected amendment of the Sale of Food and Drugs Act is brought in, and we commend this occasion to Mr. Warton and those who act with him.

PROCEEDINGS OF THE SOCIETY OF PUBLIC ANALYSTS.

An ordinary meeting of this Society was held at Burlington House, Piccadilly, on Wednesday the 19th March.

In the absence of the President the chair was taken by Dr. Muter.

The minutes of the previous meeting were read and confirmed.

Mr. Harland and Mr. Fox were appointed scrutineers to examine the ballot papers, and reported that the following gentlemen had been elected as members:—Mr. T. Boverton Redwood, F.C.S., F.I.C., of London, Chemist to the Petroleum Association; Mr. E. W. Martin, of New York, Analytical Chemist; Mr. J. Laker Macmillan, F.C.S., of Calcutta Analytical Chemist.

The following gentleman was proposed as a member, and will be balloted for at the next meeting:—Mr. F. Woodland Toms, F.C.S., F.I.C., of St. Heliers, Jersey, Official Analyst to the States of Jersey.

The following papers were read and discussed:—

"On the Analysis of Butter," by J. A. Wanklyn and W. Fox.

"On the Analysis of Condensed Mares' Milk," by Dr. P. Vieth.

The meeting was then made special in order to consider certain alterations in the rules referring to Associates of the Society.

The Chairman said that, in laying before the meeting the ideas of the Council upon the subject in hand, he would first call their attention to page 10 of the rules of the Society relating to Associates where would be found the following words:—"Associates shall be recommended to the Society by the Council and shall be elected in the same manner as members, but for a period of three years only, at the expiration of which time they may be again recommended for election." This clause appeared to the Council to require alteration, as one could not easily understand why a gentleman competent to be admitted as an Associate should not be still more so after he had held that position for three years. It was therefore considered by the Council to be advisable that in future this re-election should be abolished, and indeed as a matter of fact no re-election had ever practically taken place. Associates entering business on their own account should also in future be elected members as a matter of course. Another point the Council desired to recommend to the Society was that the Associate's subscription should be raised from 5s. to 10s. 6d. The present small amount did not even cover the cost of an Associate to the Society. They had all the privileges of members, except voting, and received all proceedings and secretarial communications, and he did not doubt that their Associates would willingly consent to this small increase. Having thus laid the matter before them for discussion he left the rest in the hands of those present.

Mr. Allen suggested an addition to the proposed alteration, which would make Associates of a certain standing eligible for membership, as it seemed hard that a really competent chemist could not become a member merely because he was not in business for himself, but——

The Chairman ruled that to be a question as to the status of members, and the point before them was limited to that of Associates.

Mr. JOHNSTONE thought it would be a breach of faith towards the old Associates to alter the rules, and their consent to pay the increased subscription should first be obtained.

Mr. STEWART (one of the oldest Associates) said that he for one had never been re-elected an Associate, and therefore he supposed that, legally, he was not one now, although the Secretary had just taken his subscription of 5s. (Laughter.) He thought it was exceedingly unfair that Associates should be asked to double their subscriptions, and then be told that they had no vote upon the matter, and he considered that to be taxation without representation. However, he for one would not personally object to pay the increased subscription, as the Associates did not want to be considered as paupers upon the funds of the Society. He would earnestly press upon the Council the advisability of letting Associates of three years' standing be proposed and elected as members.

Some further discussion having ensued :—

MR. ALLEN moved, and DR. VIETH seconded, that all the words after "but" in the last paragraph but one on page 10 of the rules of the Society be struck out, and the following inserted in their place, viz.; "shall cease to be Associates on entering into practice on their own accounts."

Mr. STOKES moved, and Mr. Fox seconded, as an amendment, "That the Council consult, by circular, the Associates, and with the replies take into consideration the whole question of the *status* of both Associates and Members."

The CHAIRMAN, however, ruled that this was no amendment, but a totally fresh proposition.

Mr. HEHNER remarked that Associates might be satisfied with the assurance that the whole question of membership would shortly be considered, whereupon :—

Mr. Stokes moved and Mr. Fox seconded, "the previous question," which amendment was put to the meeting and negatived by a majority of 4, and Mr. Allen's proposal having been put as a substantive motion was carried.

Dr. VIETH moved and Mr. HEHNER seconded, that the words "five shillings" in the last paragraph on page 10 be altered to ten shillings and sixpence, whereupon :—

Mr. ALLEN moved and Mr. JOHNSTONE seconded, as an amendment, that the entire paragraph be omitted and the following inserted: "All Associates elected or re-elected after the 19th March, 1884, shall pay an annual subscription of ten shillings and sixpence."

On being put to the meeting this amendment was carried, and afterwards confirmed as a substantive motion.

Many Associates were present, but by the rules of the Society took no part in the voting.

The next meeting of the Society of Public Analysts will be held at Burlington House, on Wednesday, the 16th April. A special meeting will also be held to confirm the alterations in the rules as approved by the meeting just reported.

NOTES ON MILK, CREAM, SKIM MILK, AND BUTTERMILK.

By Dr. P. Vieth, F.C.S.

The following notes refer almost entirely to work done in the laboratory of the Aylesbury Dairy Company. As I have done in the previous two years, I should like, in the first place, to give you a summary of the work done, and the chief results arrived at, during the year 1883. No essential alterations have taken place, either in the controlling system carried out, or in the analytical methods employed, and as I have dwelt upon these points at some length in my former reports (The Analyst, April, 1882, and March, 1883), I shall speak rather briefly with regard to this part of my present paper.

I. The work done in the laboratory of the Aylesbury Dairy Company during the year 1883.

The total number of analyses made in 1883 is 15,005, against 8,817 in 1881, and 12,430 in 1882. This total comprises in round figures 14,000 milk samples, and 850 cream samples, the rest being made up by analyses of skim milk, buttermilk, butter, and some others.

Of all the milk samples analysed, 9,650 were taken on the arrival of the milk in the company's dairy, and before it was sent out. The monthly averages of these analyses are given in the following table:—

Table I.

Monthly Averages of Milk Analyses.

1883.	Spec. grav.	Total solids.	Fat.	Solids not fat.
January	1·0320	12·94	3·63	9·31
February	1·0320	12·89	3·57	9·32
March	1·0319	12·83	3·46	9·37
April	1·0320	12·69	3·32	9·37
May	1·0322	12·74	3·26	9·48
June	1·0324	12·67	3·28	9·39
July	1·0320	12·77	3·41	9·36
August	1·0319	12·91	3·48	9·43
September	1·0326	13·19	3·55	9·64
October	1·0329	13·34	3·63	9·71
November	1·0326	13·41	3·74	9·67
December	1·0325	13·20	3·67	9·53
Yearly average	1·0323	12·97	3·50	9·47

The average composition of the milk received in 1883 was, practically speaking, the same as in the previous year, the corresponding figures for 1882 being:—Spec. grav., 1·0319; total solids, 13·03; fat, 3·52; solids not fat, 9·51.

The specific gravity falls almost without exception between 1·030 and 1·034; in proportionately very few instances the total solids were below 12 per cent., the fat below 3 per cent., and the solids not fat, below 9 per cent.

There were 4,130 milk samples analysed, which had been taken by the company's own inspectors from the men, when working their rounds. The result of these analyses in almost every instance closely resembled those obtained by analysing the samples previously mentioned, proving that the latter had been properly taken, and that there occur

in very exceptionable cases only noticeable changes during the distribution of the milk, a work occupying from three to four hours. I had the averages drawn, of all the analyses of samples taken by the inspectors for the months of January, February, and March. They were found to be as follows:—

	Total solids.	Fat.	Solids not fat.		Total solids.	Fat.	Solids not fat.	
January	12·84	3·50	9·34	against	12·94	3·63	9·31	as given
February	12·79	3·41	9·38	,,	12·89	3·57	9·32	in
March	12·75	3·31	9·44	,,	12·83	3·46	9·37	Table I.

There are, however, exceptions to this rule, and you will remember that I brought such an exceptional case under your notice some time ago (THE ANALYST, January, 1883). To-day I am in a position to record a similar case. The milk, from a certain farm, was sent out with the morning delivery, having been well mixed previously. Its composition was then:—Total solids, 12·4; fat, 3·3; solids not fat, 9·1. A sample taken in the street by one of the company's inspectors at 7·10 o'clock contained:—Total solids, 11·3; fat, 2·2; solids, n. f., 9·1. On the following day the milk from the same farm, before being sent out, was of the following composition:—Total solids, 12·2; fat, 3·2; sol. n. f., 9·0; and a sample taken on the round at 7·20 o'clock contained:—Total solids, 11·2; fat, 2·1; sol. n. f., 9·1. When put aside in a cremometer this milk threw up quite a distinct layer of cream within the unusually short time of half an hour. The milk was not sent out any longer, but used for the production of cream.

The control over the cream, partly received from farmers, partly separated by centrifugal power in the company's own creameries, was much more extended during the last year. 530 samples of cream have been analysed after the same had been received in the dairy. The monthly averages of these analyses are given in Table II.

TABLE II.

Monthly Averages of Cream Analyses.

1883.	Tot. Solids	Fat.	Solids n. f.
January	39·8	32·8	7·0
February	41·6	34·7	6·9
March	39·8	32·8	7·0
April	41·7	34·9	6·8
May	44·6	38·1	6·5
June	46·8	40·5	6·3
July	44·2	37·6	6·6
August	47·4	41·1	6·3
September	42·9	36·2	6·7
October	40·4	33·4	7·0
November	39·2	32·1	7·1
December	38·9	31·8	7·1
Yearly Average	42·3	35·5	6·8

These figures include the analyses of cream, destined to be churned into butter and containing less fat, than the cream supplied to the customers. Of the latter 290 samples were analysed, and the fat was found to amount generally from 35 to 40 per cent.

So much about the general work done in my laboratory, and now to some special points.

II. Milk.

I have pointed out several times, that I think a great deal of taking the specific gravity of milk samples to be tested. In fact it is a test in itself, as it may be taken for granted that the specific gravity of dairy milk, *i.e.*, the mixed yield of not less than five cows in normal condition, always falls within the limits of 1·029 and 1·034. If ascertained by means of a lactometer, *i.e.*, a hydrometer with a short scale specially adapted to the purpose, the specific gravity of milk is found with the least possible amount of trouble and in the shortest time. It is true, that the specific gravity of milk is lowered down, not by the addition of water only, but that an abundance of cream has quite the same effect; but certainly very little experience is wanted, to distinguish between a super-rich and a watered milk. On the other hand, a normal specific gravity does not prove that the milk has not been tampered with; it may be, mereover, adulterated in two directions, skimmed and watered. That would be easily found out by knowing, besides the specific gravity, one item regarding the composition, the amount of total solids or of fat present. With regard to the latter, we have methods, which give very reliable results in the short time of fifteen or thirty minutes, and in fact this time suffices, to form a pretty correct opinion on any given sample of milk.

This is altered directly, when the milk has turned sour. Taking the specific gravity by means of the lactometer is rendered impossible, and the employment of the specific gravity bottle or the Sprengel's tube is, to say the least, in this case troublesome and time-taking. Again, taking proper samples for analytical determinations has become more difficult; in short, nobody would be prepared to pass an opinion on such a sample in so short a time as in the case of an undecomposed milk. As it is a very easy thing to separate the whey from sour milk, I thought it worth while to try, whether the whey, or more precisely speaking, the specific gravity of whey from sour milk, might be of some use in deciding the questions, whether the corresponding milk had been watered or not.

In the first place it was necessary to find out the normal specific gravity of whey obtained from sour milk. For that purpose one half pint of milk, contained in a tin can, was kept in the laboratory until it had become thick; this generally set in, after two days had elapsed. I may remark, that the experiments were carried out during the warmer time of the year. When the milk was coagulated, the tight fitting lid of the can was shut down and the can kept in hot water of about 150° F. until separation of the whey had taken place. The whey was then filtered off and its specific gravity ascertained.

In order to avoid the necessity of bringing the temperature to a certain point, four series of experiments were made, with a view to determine the influence of temperature on the specific gravity of whey, and it was found, that for every degree increase in the temperature the specific gravity decreases as much as 0·00017. A difference at higher or lower temperatures could not be noticed. All the following statements refer to a temperature of 60° F.

There were altogether sixty samples of milk treated in the manner described before. The specific gravity of the whey obtained varied from 1·0280 to 1·0302. Notwithstanding the rather extensive number of samples, they still suffer from a deficiency. All the milk

operated upon was rather rich, the total solids running up as high as 14·38 per cent, and in one single case only coming down below 12·5 per cent.; the specific gravity varied from 1·034 to 1·032.

I cannot say, that in every instance a variation in the specific gravity of the milk is reflected in the specific gravity of the corresponding whey; on the whole, however, it was found, that there exists some relation between the two specific gravities. Whenever the specific gravity of the milk is 1·033 or higher, the specific gravity of the whey is found to be on the average above 1·029, and a specific gravity of milk from 1·032 to 1·033 corresponds with a specific gravity of the whey of from 1·0285 to 1·0290. Continuing this, one may expect that in case the specific gravity of milk comes down to 1·030, that of the whey will be 1·028, but the latter will certainly not fall below 1·027.

Of course, the length of time the milk or whey has been kept, or more precisely the progress of the alcoholic fermentation, must influence the specific gravity as well. This influence was investigated into, side by side, with the influence of the addition of different quantities of water to the milk. Three series of experiments were carried out, all in the same manner, with the only exception that in two of them skim milk, in the third one whole milk, was employed. In each series the following six samples were operated upon:—

1. Milk, casein precipitated with acetic acid.
2. ,, without any addition.
3. ,, containing 5 per cent. of added water.
4. ,, ,, 10 ,, ,,
5. ,, ,, 25 ,, ,,
6. ,, ,, 25 ,, ,, casein precipitated with acetic acid.

After the milk had become sour and the casein coagulated, the whey was separated as described before, and the specific gravity of the whey thus obtained, determined several times during a fortnight's time. The following table contains the average figures of the three series:—

TABLE III.

Specific Gravity of Whey.

Sample	Determined on 1st Day	3rd Day	5th Day	8th Day	14th Day
1.	1·0305	1·0304	1·0301	1·0301	1·0261
2.	..	1·0295	1·0294	1·0291	1·0260
3.	..	1·0284	1·0283	1·0274	..
4.	..	1·0269	1·0265	1.0256	..
5.	..	1·0222	1·0219	1·0218	1·0181
6.	1·0230	1·0228	1·0226	1·0228	..

To point out the most important facts only, shown by these figures, we find that the alcoholic fermentation proceeds rather slowly during the first week, but influences the specific gravity of whey considerably after a second week has elapsed. The presence even of the very small quantity of acetic acid seems to have the effect of retarding alcoholic fermentation. The addition of water to the milk is shown distinctly by the specific gravity of the whey. It is true, that an addition of 5, and even of 10 per cent. of water does not in every case bring the specific gravity of whey down under the

supposed limit of 1·027. But this fact cannot surprise, for we all know very well, that employing even the most elaborate and exact process of analysis we may be unable to condemn a milk which has been watered to the same extent.

I believe, that taking the specific gravity of whey obtained from sour milk may be useful in some case or other, and permit us to form an opinion on the milk concerned, especially so, when particulars are known as to how and how long the milk had been kept.

III. Cream.

Milk, if left standing quietly for some time, throws up a layer, which differs from the original milk chiefly by its richness in fat, and which is called cream. Everybody knows that, and we know very little more. I should be quite at a loss what to say if the simple question were put to me: "How much fat must be present in milk so as to say that a sample of milk is cream?" I have seen so-called cream containing scarcely more fat than a good rich milk, and on the other hand, products containing almost as much fat as butter.

The value of cream, as far as composition is concerned, depends chiefly, not to say entirely, upon the quantity of fat present. As with the increase of fat the specific gravity must decrease, it should be possible to make a rough estimation of the fat in cream by ascertaining the specific gravity. But cream gets with the increasing degree of concentration thicker and thicker, and taking the specific gravity becomes troublesome, and the use of an hydrometer impossible. If the cream is not sour, one may restore a higher degree of fluidity by heating it up, and I have made some experiments with a view to ascertain the influence of variations in the temperature and in the quantity of fat upon the specific gravity.

I found that pure sweet cream, containing 40 per cent. of fat shows at a temperature of 175° F., a specific gravity of 0·960, and that a difference in the temperature of 10° F causes a difference of 0·004 in the specific gravity, and further, that a difference of 10 per cent. in the amount of fat is equal to a difference of 0·015 in the specific gravity; thus, the specific gravity of cream is as follows:—

Cream with	30		40		50 per cent. of fat.
at 185°F.	0·971	..	0·956	..	0·941
,, 175 ,,	0·975	..	0·960	..	0·945
,, 165 ,,	0·979	..	0·964	..	0·949

I should like to be clearly understood that I bring these figures before you simply as a contribution to our knowledge of cream, and not as a general method for testing the same. It may be useful under certain circumstances to take the specific gravity in this manner, but certainly not in the chemical laboratory.

Of course, the most exact way to ascertain the fat is extracting it in Soxhlet's apparatus. It may, however, happen that an indirect estimation is preferred to the direct one. There is, for instance, no doubt that in a certain time one can make more determinations of total solids than of fat; the former are less troublesome, and besides, less costly.

We have said before, that cream differs from milk chiefly by the increased amount of fat present. That is true, but is not the whole truth. The fat globules of milk are floating in the serum, and the latter, where it envelopes the globules, is more concentrated; it contains the albuminoids in a higher proportion. Supposing a milk contains 3 per cent. of fat and 97 per cent. of serum, the latter consisting of 9 per cent. of non-fatty solids, and 88 per cent. of water; 100 parts of serum would contain then 9·28 parts of non-fatty solids. If cream, containing 50 per cent. of fat, would be separated from this milk, the 50 parts of serum would not contain one-half of 9·28, that is, 4·64 parts of non-fatty solids, but about 1 part more. Basing upon this speculation, I have drawn up a table for the calculation of fat in cream from the total solids, of which I give you here a limited number of figures :—

TABLE IV.

Calculation of Fat in Cream from Total Solids.

Found Total solids.	Calculated Fat.	Solids not fat.
60·0	55·0	5·0
55·0	49·5	5·5
50·0	44·0	6·0
45·0	38·5	6·5
40·0	33·0	7·0
35·0	27·5	7·5
30·0	22·0	8·0
25·0	16·5	8·5
20·0	11·0	9·0

In order to ascertain how far this table agrees with actual facts, a series of cream samples—22 altogether—were analysed, and the results obtained compared with the figures of the table. The total solids were determined by keeping about 3 grams of cream in a platinum capsule for six hours on a steam bath, and for other six hours in a hot air bath, at a temperature of from 205 to 215° F. To determine the fat, about 5 grams of cream were mixed with plaster of Paris, brought to dryness, the dry powder put in a paper capsule and exhausted in Soxhlet's apparatus. The results are given in the following table :—

TABLE V.

Analyses of Cream.

No.	Found. Total solids.	Fat.	Calculated. Fat.	Difference.
1	40·9	34·1	34·0	— 0·1
2	48·0	41·0	41·8	+ 0·8
3	59·9	55·2	54·9	— 0·3
4	33·8	25·5	26·2	+ 0·7
5	31·4	24·0	23·5	— 0·5
6	60·6	56·8	55·7	— 1·1
7	47·1	40·4	40·8	+ 0·4
8	63·4	58·8	58·7	— 0·1
9	26·1	18·1	17·7	— 0·4
10	42·9	35·9	36·2	+ 0·3
11	65·5	60·9	61·1	+ 0·2
12	47·1	40·4	40·8	+ 0·4
13	63·4	58·8	58·7	— 0·1
14	30·7	22·8	22·8	0·0
15	36·6	29·5	29·3	— 0·2
16	45·7	37·5	39·3	+ 1·8
17	38·6	31·2	31·5	+ 0·3
18	57·8	52·3	52·6	+ 0·3
19	39·0	32·2	31·9	— 0·3
20	46·7	40·1	40·4	+ 0·3
21	37·2	29·9	29·9	0·0
22	46·8	40·0	40·5	+ 0·5
Average	45·87	39·34	39·47	+ 0·13

With the two exceptions—No. 6 and 16—in which the difference amounts to — 1·1 and + 1·8, the figures for fat found and calculated agree fairly well, certainly well enough to permit the application of this method, whenever not the exact analysis, but the control of cream, is the object. As there was no time to make the analyses in duplicate, I am unable to say what errors were made in the cases of No. 6 and 16. That the large differences in these cases are due to errors, I am fully convinced, but in spite of this I did not like to omit the figures from the table. The average will scarcely be altered.

IV. Skim Milk.

The cream having been removed from milk, the remaining skim milk still contains some fat besides the greater part of all the other constituents of milk. As the nutritious value of the albuminoids and carbohydrates in milk in connection with the mineral salts present is very great, pure skim milk is to be considered a very good and wholesome food or addition to food for man and beast.

The quantity of fat left in the skim milk chiefly depends upon the method employed for separating the cream. This used to be done until eight years ago exclusively by leaving the milk standing quietly in vessels of different shape, size and material, and under different conditions according to the special requirements of the different setting systems for raising cream. One can bring these systems under two heads, viz., the shallow setting system with the application of a mean temperature of 55° F., and the deep setting system with the application of a temperature as near as possible to freezing point.

Eight years ago a new method of separating cream from milk was brought out, and has developed itself rapidly, and during the short time of a few years superseded and replaced already the old setting system in very many instances. I refer to the method of extracting cream by centrifugal power in machines commonly called cream separators.

Of course the quantity of fat left in skim milk depends, not entirely upon the system in use, but upon numerous other conditions as well. One may, however, safely say that skim milk, if one of the setting systems is employed, contains on an average from 0·8 to 1·0 per cent. of fat, in very many instances more and in very exceptional cases less than 0·5 per cent., and that if a cream separator is used, the skim milk should never contain more than 0·5 per cent. of fat. According to reliable analyses the fat has been extracted from milk by centrifugal power to such an extent, that less than 0·1 per cent. was left in the skim milk, but to extract even the last trace of fat by these means has been impossible up to the present and will always be an impossibility. The separation of cream is based in every instance on the difference in the specific gravity between fat globules and milk serum in which they are floating. This difference becomes less and less with the decrease in the size of the globules, and at last is counterbalanced by the adhering envelope of condensed serum, of which we have spoken in another place.

As the alteration caused by separating the cream chiefly concerns the fat, *i.e.*, the lightest constituent, we must expect the specific gravity of skim milk to be higher than that of whole milk. This is confirmed by the fact that the specific gravity of skim milk varies from 1·033 to 1·037, or in other words, the specific gravity of skim milk is 0·003 higher in average than that of whole milk.

As to the determination of fat in skim milk Soxhlet's areometric method should be employed, or the fat extracted in the well-known apparatus brought out by the same chemist. For the use of the said apparatus Soxhlet gives the following directions:— 10 grams of milk mixed in a porcelain dish with 20 grams of plaster of Paris are to be dried on the steam bath. The dry powder is filled into a paper capsule and extracted. After the apparatus has been filled and emptied itself ten times the extraction of the fat is completed. If whole milk or relatively rich skim milk is analysed, sea sand or glass powder may be used instead of plaster of Paris. But whenever the fat present amounts to less than 1·5 per cent., one should stick to the original directions and use plaster of Paris, if possible, not double but three or four times the quantity of milk taken, as in this way only a speedy and complete exhaustion can be secured.

The following table contains some analyses of skim milk:—

TABLE VI.

Analyses of Skim Milk.

No.	Spec. Grav.	Tot. Solids.	Fat.	Sol. n. fat.	Remarks.
1	1·0350	9·75	0·55	9·20	Shallow setting system.
2	1·0355	9·90	0·54	9·36	
3	1·0340	10·10	1·00	9·10	
4	1·0355	10·43	0·98	9.45	
5	1·0335	9·68	1·05	8·63	Deep setting system.
6	1·0345	9.70	0·60	9·10	
7	1.0355	9·81	0·43	9·38	
8	1·0350	10·26	0·88	9 38	
9	1·0365	9·96	0·46	9.50	Centrifugal system.
10	1·0350	9·28	0·34	8·94	
11	1·0370	9·94	0·34	9·60	
12	1·0370	9·80	0·35	9·45	

V. BUTTERMILK.

Buttermilk is extensively used as food for domestic animals, and in some rural districts also as diet for the population. As it is not an article of trade it will in very exceptional cases only form the object of chemical analysis in the laboratory of the public analyst. The money value of buttermilk is, in spite of its highly nutritious qualities, too low to tempt adulteration. Being a sort of bye-product in making butter, one must not expect much fat in buttermilk. The quantity of fat is generally above 0·5 per cent., but does not rise above 1·0 per cent., unless the operation of churning is not properly executed. Whenever it has been tried to churn sweet milk very unsatisfactory results were obtained, about half of the fat being left in the buttermilk; sour milk, as well as sweet or sour cream, form the right material for making butter. Of course the differences in the material influence the composition of the buttermilk to some extent, but other conditions have a far greater influence. During the warm season very often some salt is added to the cream in order to preserve it, and this appears again in the buttermilk. Again, when the butter has been collected it is washed with cold water. This water is generally mixed with the buttermilk, diluting the latter more or less. Some analyses of buttermilk will illustrate these few remarks.

TABLE VII.

Analyses of Buttermilk.

No.	Total Solids.	Fat.	Solids not fat.	Ash.
1	9·77	1·09	8·68	0·69
2	9·03	0·63	8.40	0·70
3	10·39	0·78	9·61	· —
4	8·02	0·65	7·37	1·29
5	9·64	2·51	7·13	0·64
6	8·13	0·82	7·31	0·64
7	10·14	0·92	9·22	0·73
8	8·91	0·50	8·41	0·71
9	8·98	0·49	8·49	1·32
10	10·70	0·54	10·16	0·82
11	9·80	0·76	9·04	0·73
12	9·72	0·80	8·92	0·73

ON THE ANALYSIS OF HONEY.

BY OTTO HEHNER.

Read before the Society of Public Analysts.

THROUGH the kindness of a number of prominent members of the British Beekeepers' Association, I have recently been put into possession of a large number of samples of honey of undoubted genuiness. In many instances the origin of the honey was known, that is to say, the kind of blossom from which it was derived, as far as this is possible. Some of the samples were extracted from the comb by the beekeepers, many of them by myself. I was urged by the Association referred to, to undertake an investigation into the nature of honey, and, if possible, to devise some means for the discovery of its adulteration, on account of the injury done to vendors and producers of the genuine article by the competition of wholesale manufacturers and importers of spurious products.

The information available consists mainly of a paper by Dr. J. Campbell Brown, ANALYST, vol. 3, p. 267; and of a chapter on Honey in Dr. J. Bell's work on Food, vol. 1, p. 115. Most other works on Food also deal with the subject of honey, but do not to give precise instructions for the detection of adulteration.

Dr. Campbell Brown comes to the conclusion that genuine honey contains from 15·5 to 19·5 per cent. of water expelled at 100°; from 5 to 11 per cent. of "water expelled at a much higher temperature and loss," very small amounts of insoluble and mineral matters, the rest being almost equal quantities of levulose and dextrose, cane sugar being in all probability absent. He finds that all the samples he examined are more or less levorotatory, a solution of 16·26 grms. in 100 c.c. of water polarising from — 3·2 to — 5° at 60° Fahr.

Dr. Brown's paper might be held to give sufficiently precise information available for the examination of honey, were it not more or less contradicted by Dr. J. Bell.

In five analyses of honey Dr. Bell finds the proportion of water to vary from 17·10 to 23·32 p.c., glucoses from 66·5 to 74·0, and he gives as third principal constituent a sugar not identified, only partly fermentable, without direct action upon cupric tartrate, but gradually converted into glucose, when boiled for several hours with dilute

sulphuric acid. The amount of this "sugar not identified" varies from 4·48 to 10·12 per cent. There are also small quantities of gum, wax, and inorganic matter, their total varying from ·8 to 3·6 p.c.

Singularly enough, Dr. Bell is silent about the polarising energy of the samples he examined. He states that "Glucose cannot be detected by chemical means, and only *by the polariscope*, when in sufficient quantity to change the angle of rotation beyond the limits found in genuine honey;" but as he does not give these limits, nor, indeed, a single polariscopic observation, one cannot but consider this statement as a bit of that gratuitous information which confronts the chemist in so many works on Food, and which give an air of profoundity to the author, without imparting knowledge to the reader. This is all the more extraordinary in the present instance, as Dr. Bell claims to have discovered a "sugar not identified," and surely the polariscope would have been an invaluable help in identifying the sugar in question.

It is at once seen on analysing honey, that, on adding the percentage of water (loss by drying at 100°) to that of glucose either before or after treatment with acid, it is impossible to sum up to 100. The difference is variable, from 8 to 19 p.c. Dr. C. Brown considers this to be "water expelled at higher temperatures," Dr. Bell an unfermentable sugar, not reducing copper solution. Since saccharine materials even when anhydrous lose water on being heated little beyond 100° (and even below) and since it is quite impossible to fix upon any particular point at which all water is removed and yet decomposition has not commenced, Dr. Brown's statement is fairly open to doubt.

The following analyses are not complete. I have not estimated the amounts of mineral and insoluble matters, as unlikely to afford any important aid in judging of the genuiness of samples, and only in about one half of the analyses have all estimation which I now believe to be essential, been carried out, namely, the loss on drying at 100°, glucose by Fehling before and after inversion by heating with 10 p.c. hydrochloric acid to about 70°; rotatory power of a 10 p.c. solution both before and after fermentation, and solid matter after fermentation.

Two to three grammes of the honey take several days to become constant in weight by drying at 100°.

The fermentation was produced in a 10 per cent. solution, by the addition of a pinch of yeast, the fluid being kept for five or six days at about 30° C. Stronger solutions do not ferment well, and become mouldy before all glucose has disappeared. After the evolution of carbonic acid had practically ceased, the solutions were made up to the original bulk, the glucose titrated, and subtracted from the total solids obtained by evaporating 10 c.c, the difference representing mineral, insoluble, and unfermentable matters. In the following analyses, all figures (except polariscopic indications) are percentages calculated upon the original honey. The rotatory power represents divisions on the Soleil-Ventzke instrument.

1. From bar frame hive, taken in 1880, during flowering of beans; clear, Lincolnshire.
2. Straw hive, September, 1881; thyme and glover, crystalline. ,,
3. Ditto, August, 1882; glover and lime, crystalline. ,,
4. Bar frame, August 1881; glover, clear. ,,
5. Ditto, August, 1880; glover, partially crystallised. ,,
6. Straw hive, August, 1880; beans, quite clear. ,,

7. 1882, from heather, crystalline, Dundee.
8. 1882, mustard and turnips, very solid.
9. 1883, bees partially fed on cane-sugar syrup; crystalline, Lincolnshire.
10. 1883, Ditto Ditto ,, ,,
11. 1882, no syrup feeding, clear; Lincolnshire.
12. Four years old, no feeding; crystalline, Lincolnshire.
13. 1881, Syrian hybrid bees, crystalline, Grantham.
14. 1881, black bees ,, ,,
15. 1881, from heather, near Perth.
16. 1882, Hertford, crystalline.
17. 1882, heather, Dorset; comb was crystalline before the honey was pressed.
18. June, 1883, fruit blossom and white glover, Kent, clear.
19. May, 1883, black currant. Kent, clear.
20. 1883, Cinquefoil, Hertford.
21. 1883, Kent.

	1	2	3	4	5	6	7	8	9	10	11
Moisture ..	21·04	17·48	20·04	21·69	20·22	23·04	23·26	19·20	20·08	16·31	18·40
Glucose	64·50	69·27	65·74	68·19	68·17	61·42	68·26	71·57	67·36	67·18	68·90
Difference ..	14·46	13·25	14·22	10·12	11·61	15·54	8·48	9·23	12·51	16·51	12·70
Glucose after inversion	64·54	70·47	68·23	67·80	67·93	62·90	67·03	71·50	66·72	69·04	69·18
10 p.c. solution polarises	0	— 1	0	— 1	— 2	0	— 2	— 2	— 2	0	0

	12	13	14	15	16	17	18	19	20	21
Moisture	16·96	18·15	16·98	16·49	12·43	20·88	17·79	22·69	17·06	18·37
Glucose	68·49	68·17	67·69	64·37	75·34	64·02	66·74	65·42	70·02	68·15
Difference	14·55	13·68	15·33	19·17	12·23	15·10	15·47	11·89	12·92	13·48
Glucose after inversion	68·46	62·94	68·50	61·16	72·30	64·14	67·02	65·63	70·35	68·30
10 p. c. solution polarises	+ 1	0	+ 1	0	— 1	— 11	0	0	0	+ 1
Glucose after fermentation	..	..	..	..	..	1·37	1·69	nil	nil	2·36
Total solids ditto	..	..	..	..	..	5·85	6·21	7·67	4·30	6·29
Difference	..	..	..	..	..	4·18	4·52	7·67	4·30	3·93
10 p. c. solution polarises after fermentation	..	..	..	..	..	0	0	0	0	+ 2

In the above 21 analyses the amount of water varies from 12·4 to 23·04 per cent. It is worthy of remark, that the consistency of the honey, whether fluid or crystalline, does not appear to be influenced by the percentage of moisture. Thus, while sample 18, with 17·79 per cent. of water, is free from crystals, sample 7, with 23·26 per cent., is almost solid. Some honeys crystallise when a few weeks old, even in the comb (No. 17), others, of apparently the same composition, remain fluid for years (No. 1). Bee-keepers, however, generally consider that all honey, if genuine, will, in time, become solid. No vendor of *genuine* honey can guarantee his article to remain permanently fluid.

In seven samples out of the 21 the percentage of glucose, before treatment with acid, is practically identical with that after inversion. In seven cases the amount has more or less increased, in one case as much as 2·49 per cent.; in the seven remaining samples the inversion has resulted in an apparent diminution of glucose, the loss in most cases being small, but in one not less than 5·23 per cent. I do not venture to express any definite opinion as to the cause of this loss, but I believe that the figures indicate the absence of cane-sugar. Even Nos. 9 and 10, produced by bees fed partially upon cane-sugar syrup, show no greater differences before and after inversion than does the rest of the samples. Evidently the cane-sugar is completely inverted by the bee.

The polarising energy of all samples but one was very small, practically *nil*, the one sample referred to being pressed by myself from a comb, which was partially filled with crystals; the resulting honey contained, therefore, an abnormally large proportion of levulose. After fermentation, the polarising power of the five samples tested in this direction was also *nil*, or very slight.

The whole of the samples gave but a very faint turbidity with alcohol, and with barium chloride.

After fermentation, the five samples, 17 to 21, left but from 3·93 to 7·97 per cent. of substances other than glucose, whilst their amount before fermentation was from 11·89 to 15·47. Considering that these quantities include the mineral and insoluble constituents, which, according to Dr. Bell, may amount to as much as 3·6 per cent., and considering further, that even pure sugar leaves, after fermentation, about 5 per cent. of glycerine, benzoic acid, and other unfermentable substances, it appears evident that genuine honey does not contain any unfermentable saccharine matter, as alleged by Dr. Bell. The following analyses amply corroborate this conclusion. They relate to samples purchased both from dealers of the highest repute in the market, and to others suspected to be adulterated even before analysed :—

22. Orange blossom honey, San Francisco, 2 lbs. 1s. 3d., very crystalline.
23. Neighbour and Co., guaranteed pure, crystalline.
24. Do. Narbonne honey.
25. "Fine new honey," 11d. per lb., crystallised.
26. Finest Swiss honey, guaranteed always to keep clear, no name.
27. Finest Swiss table honey, A. Alt.
28. Hoge's pure honey, partially crystallised.
29. Do. English honey, clear.
30. Do. Californian honey Dew, clear.

	22	23	24	25	26	27	28	29	30
Moisture	17·33	17·73	15·09	18·86	17·54	18·68	21·23	18·90	21·25
Glucose	70·94	93·53	73·46	69·52	48·45	49·66	58·32		
Difference	11·73	8·74	11·45	11·62	34·01	31·66	20·45		
Glucose after inversion	70·87	71·28	73·60	65·86	43·33	48·77			
10 p. c. solution polarises ..	— 2	0	+ 1	+ 1	+ 56	+ 35	+ 15	+ 35	+ 33
Glucose after fermentation			1·89	1·43	9·02	7·59	3·69	5·98	5·15
Total solids do.			5·75	6·20	31·45	25·33	53·29	23·36	18·38
Difference			3·86	4·77	22·43	17·74	49·60	17·38	13·23
10 p. c. solution polarises after fermentation	..	..	+ 2	+ 2	+ 30	+ 28	+ 7	+ 16	+ 10

Samples 22 to 25 possess all characteristics of the pure samples previously commented upon. They are doubtless genuine. I affirm, with an equal degree of certainty, that samples 26 to 30 are adulterated. They all polarise powerfully to the right, both before and after fermentation, they are but very partially fermentable, most of them give heavy dextrinous precipitates with alcohol and with barium chloride much barium sulphate. They are products of the action of sulphuric acid upon starch, consist, in fact, of "corn syrup," or of a mixture of the same, with more or less honey. It is well known that starch sugar, however complete the inversion may be, invariably contains from 15 to 25 per cent. of unfermentable, dextrorotatory substances. Neubauer's process for the examination of sugared wines is founded upon this observation, and has long been used with much success.

All saccharine matters, with the exception of inverted cane-sugar, and which are available for the adulteration of honey, are highly dextrorotatory. If invert-sugar, perfectly free from the acid employed for its preparation, were used as an adulterant of honey, its detection would appear to be a matter of difficulty, if not impossibility. At the present time, however, the acid, viz., sulphuric, readily betrays the artificial origin of the product.

Inasmuch as the polarising power of genuine honeys agrees with that of invert-sugar in which the dextrose very slightly predominates, and as there is at present no saccharine matter known which is fermentable, and without action upon the polarised ray, I incline to the belief, that the "difference" in the analyses is not due to the presence of saccharine substance. I have made some estimations of the specific gravity of solutions of honey, in the hope that this might afford a means to settle the point; but in every case a figure was obtained by reference to tables giving the gravity of sugar solutions which was less than the glucose plus "difference," though somewhat greater than corresponded to the glucose alone.

While leaving this, the scientific aspect of the compostion of honey to be yet examined, I would lay down the following rules for the testing of samples:—

Take moisture and glucose before and after inversion as described, the former should not be above 23 per cent., the sugar should not be sensibly greater after inversion than before.

Ferment a 10 per cent. solution, take the solid matter after fermentation and subtract from it the per-centage of glucose left unfermented. The proportion of unfermentable matter should be no larger than would be yielded by a pure glucose solution after fermentation, namely about 5 p. c.

Observe polarising power of a 10 per cent. solution both before and after fermentation. It should be practically *nil*. Levo-rotation indicates that the honey has become crystalline in the comb; dextro-rotation which is diminished, but not removed, that there is starch sugar.

Test with alcohol and barium chloride: neither should give any notable amount of precipitate.

Conclusion of the Society's Proceedings.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

To the Editor of "The Analyst."

Gentlemen,—I have just been reading in this month's number of The Analyst your remarks on Mr. Newland's book, in which he asserts his priority of authorship of the discovery of periodic law in chemical atoms, and as I am similarly circumstanced with him, I have often thought of the extraordinary treatment that men of this country receive from their scientific countrymen, and from the Press, which one would fancy ought to be rather anxious to claim original research than to ignore it. It ought to be well known, for instance, that it was I who laid the foundation of all the Thermo-chemistry now so largely practised. I published the papers in the *Phil. Mag.*, Oct., 1851, and Nov., 1852. No idea of its principles having been entertained until I first showed the calorific result of decomposition, and the consequent method of calculating the amount of heat of combination in the series of experiments described in the *Phil. Mag.*, 1852. After about twelve months, Faure and Silberman published in Vol. 37 of *Annales de Chimie et Physique*, page 507, exactly the same experiments, showing the same results

and reasonings without mentioning me, and as they were foreigners and had high-sounding names they are always quoted in the English press, although it must be known to be untrue—as the discoverers—see *Nature* for March, 1880, page 493.

It has occurred to me that many similar instances might be quoted, and that a journalist might do worse both for himself and the public than to invite a declaration and proof of any neglect to have claims of priority of discovery acknowledged. The publication would be a simple act of justice, and in establishing the claim of the individual, the whole country is honoured, and many who have given up work in disgust on account of not having their proper share of credit, especially those who, like myself, derive no other benefit from it, might resume their efforts with advantage.

I am, Gentlemen,
Your obedient Servant,
THOMAS WOODS, M.D.

Parsonstown, Ireland,
March 3rd, 1884.

TO THE EDITOR OF "THE ANALYST."

DEAR SIR.—The copies of THE ANALYST for November and December, 1883, have moved me to write to you on a few points in connection with milk which have come within my experience. By the time this reaches you, however, the question may not be so prominent in the minds of the members of the Society of Public Analysts, so if you print only parts of this letter, or suppress it altogether, I shall not quarrel with you. In connection with the question of the relation of gravity to the constituents of a milk. I send a table of results which I obtained upon the milk of Alderney cows from the fancy stock farm of Mr. S. C. Colt, of Hartford, Conn. The samples were taken in presence of one of the N. Y. city Health Department inspectors, and handed to me for analysis. Mr. Colt keeps a herd book, from which the inspector took the points tabulated on the lower half of the sheet. The results have only been printed in the City Record—the official organ of the N. Y. city government—and therefore have been seen by but few comparatively.

As to methods of milk analysis. I have not found Wanklyn's three hours' method satisfactory. Results by it were not always concordant for the same sample. So far as my experience goes, the rapidity with which a sample of milk can be dried over the water bath depends upon the temperature and hygrometric state of the atmosphere, the state of the barometer, the vigour with which the water beneath it is boiled, the distance between the level of the boiling water, and the bottom of the milk dish, and the play of currents of air about the dish. Like others I have found that evaporation is more rapid outside than inside of a drying oven, that is up to a certain point.

The last few tenths of a per cent. of water are best removed by the drying oven at 100° C. I therefore evaporate 5 gms. of milk over the water bath until it *looks* dry, and then dry for about an hour in an air bath at 100°; dry half an hour, and weigh again, repeating this if necessary, until the difference in weight is 0·0025 gm. or less. I find it quite as expeditious as Wanklyn's three-hour method, and get constant results. Then, the milk solids are covered with about 10 c.c. of ether, the ether brought to a boil over hot water, cooled and decanted (without filtration) into a small weighed beaker. This is repeated six times. Three successive treatments with the ether remove all or nearly all of the butter fat, so that six is absolutely safe. Then the dish with solids not fat is dried in the air bath for about 20 minutes, and weighed, and the ether is also evaporated off from the beaker, and the butter also determined directly.

For sugar and casein separation, the milk solids are covered with water, and the dish placed on the water bath. A second dish is weighed and placed beside the first. After warming for about half-an-hour, the water solution of the sugar is decanted into the second dish, and more water is added to the first, and after soaking for some time this is again decanted, and so on. This treatment is repeated usually about four times, until a few drops of the water in the first dish show no appreciable amount of residue when evaporated on a watch class. Both dishes are then dried and weighed, thus determining the sugar by loss and directly after deducting ash. Both residues are burned to ash at as low a temperature as possible. The ash is thus obtained in two sections:—

Evening Milking February 5th, 1878 (*all Alderney Cattle*).

No.	Sp. gr. Milk (60° Fahr).	Sp. gr. Whey (60° Fahr).	Cream Vol. per cent.	Water	Per cent. by weight. Butter	Sugar	Casein	Salts.
1	1·03364	1·02958	10	84·642	5·550	5·020	3·807	0·981
2	1·03480	1·02842	8	86·919	2·922	4·975	4·370	0·814
3	1·03480	1·02871	18	85·476	4·379	4·963	4·407	0·775
4	1·03697	1·02958	18	85·143	4·470	4·825	4·657	0·905
5	1·03306	1·02958	20	83·641	6·158	4·361	4·809	1·034
6	1·03538	1·02958	24	83·150	6·500	4·973	4·544	0·833
7	1·03944	1·03016	25	81·914	5·909	4·667	6·428	1·082
8	1·03480	1·02871	9	85·939	4·256	4·914	4·105	0·786
9	1·03697	1·02900	12	83·421	5·375	4·700	5·617	0·887
10	1·03509	..	..	86·089	3·569	5·082	4·405	0·855
11	1·03509	..	..	85·489	4·218	4·966	4·390	0·937
12	1·03306	1·02929	..	87·064	3·515	4·964	3·620	0·837

No.		Age	Time since last calf	Time to next calf	Daily average Yield	Yield at Evening Milking, Feb. 5th.
1	Imported	10 years	2 months	..	14 qts.	6 qts.
2	,,	10 ,,	6 ,,	..	5 ,,	2 ,,
3	Am. bred.	4 ,,	12 ,,	1 mo.	7 ,,	3 ,,
4	Imported	12 ,,	3 ,,	..	14 ,,	5¼ ,,
5	,,	10 ,,	9 ,,	3 mos.	4 ,,	2 ,,
6	,,	12 ,,	4 yrs. & 4 mos.	..	6 ,,	2 ,,
7	,,	10 ,,	10 months	2 mos.	4 ,,	2 ,,
8	Am. bred.	6 ,,	5 ,,	..	7 ,,	3½ ,,
9	,,	4 ,,	8 ,,	6 mos.	7 ,,	3½ ,,
10	Imported	10 ,,	3 ,,	..	9 ,,	4 ,,
11	Am. bred.	7 ,,	3 ,,	..	7 ,,	3 ,,
12	,,	4 ,,	4 ,,	10 mos.	14 ,,	6½ ,,

Where chlorine has to be determined, I use Volhards method. Dissolve the ash in very dilute nitric acid, add a known amount of standard $AgNO_3$ solution, then a few drops of ferric sulphate, and titrate back with standard solution of potassium sulphocyanide.

I might mention that so far as my experience goes, using the method of drying, &c., which I have described, my conclusions regarding standards for milk, coincide with those adopted by the members of the Society of Public Analysts. I also find that for whole milk let down with water, the lactometer test (100° = Sp.gr 1·029) and the standard of 9 per cent. solids not fat, correspond very closely in most cases for commercial milks, *i.e.*, the mixed milk from several cows as delivered in cities.

E.g.:— Samples of watered milk.

No.	Water	Solids not fat	Parts of Pure milk per 100. Calc. on 9 per cent. solids.	By lactometer.	100 = 1·029. Sp. Gr.
IV	90·135	7·114	79	80	1·0232
V	92·140	4·878	54	54	1·01566
XX	92·465	5·51	61	61	1·01182
XXVIII	94·205	3·563	40	41	1·01189

Both standards are undoubtedly low, but they have to be to make convictions in the courts possible.

I trust that on p. 258 of THE ANALYST for December, 1883, Mr. Allen does not mean to assert that the addition of a given proportion of cream to a milk will lower the gravity more than the addition of the same proportion of water. That is impossible unless the cream is lighter than water, which is not the case.

As to volume per cent. of cream, I have reason to believe that the jarring which milk often undergoes in transportation has a marked effect in diminishing the volume per cent. of cream obtainable. Samples tested at the dairy may give, say 10 per cent., but after being put in a can and sent to the city by rail, they may show only 5 to 8 per cent., while the analysis will give practically identical results for butter fat.

New York, 1884.

Yours truly,

E. WALLER.

LAW REPORTS.

SINGULAR FOOD AND DRUGS ACT PROSECUTION.—Duncan Brown, grocer, 300, Nuneaton Street, was charged before Sheriff Balfour, at the Glasgow Sheriff Summary Court yesterday, with a contravention of section 6 of the Sale of Food and Drugs Act, 1875, in so far as he sold to the Sanitary Department inspectors, on 9th January, a ¼lb. of black pepper which was not of the nature, substance, and quality demanded, in respect that it contained 20 per cent. or thereby of added starch. The defender admitted the charge, and said he merely sold the pepper as he had received it from a wholesale merchant. The sanitary inspectors were examined, and Dr. Tatlock, the city analyst, confirmed their testimony by stating that on analysis he found the pepper in question had 20 per cent. more starch than was to be expected. Professor Dittmar, who was examined for the defence, stated that from the sample of pepper he had examined he considered there was a possibility of there being 10, 15, or 20 per cent. of added starch. The Sheriff held that opinion to be practically in accordance with Dr. Tatlock's. The Sheriff, in giving his decision, said this was the first prosecution of the kind he had heard of in Glasgow. The evidence of the analysts was that the effect of the added starch was not injurious to the pepper in any way, but only reduced its strength. It might be said for the respondent that he bought the pepper in the ordinary

way from a wholesale merchant, and he was not aware of the inferiority of it. At the same time, under the Act he was liable for the sale. The evidence of the chemists practically was the same, and established the addition of the 20 per cent. of foreign starch. In the whole circumstances, seeing that that it was the first prosecution of the kind, he inflicted the mitigated penalty of 10s.

SINGULAR POINT.—*Important to Sellers of Milk and Water.*—At the Buckrose Sessions, Norton, on Saturday, before Mr. W. Preston and Captain Unett, Alfred Mackling, of Norton, milk-seller, was charged by Superintendent Farrah with refusing to sell him, for purposes of analysis, a pint of milk. The officer met defendant in the street, and when he asked for a pint of milk, Macklin replied, "I am not selling milk; I am selling milk and water." (Laughter.) Superintendent Farrah demanded "a pint of whatever it was," and pulled out his purse to pay for it, but defendant refused to comply. Mr. F. Langborne, who appeared for the defendant, argued that the offence had not been committed, seeing that the officer had made no "legal" tender of the money. He admitted that he only "showed" defendant his purse, and the Act said the price was to be "tendered." The Bench ruled the objection to be fatal, and dismissed the case.

PERSISTENT MILK ADULTERATION.—James Dearnley, milk hawker, of Silver-street, Huddersfield, was summoned for selling impure milk. Mr. Kirk, the chief sanitary inspector, prosecuted, and said he felt he was quite justified in describing the case as the worst that had ever come before that Court. The sample of milk in question had been deprived of the whole of its butter fat, and besides that there had been a great addition of water. The whole of the milk was sent to the Borough Analyst, and his certificate was then put in and read by the Deputy Clerk. It was to the effect that the milk consisted of the following parts:—Butter fat, ·63 per cent.; solids, not fat, 7·94 per cent.; water, 91·43 per cent. The Borough Analyst was of opinion that the sample consisted of 12 per cent. of added water, and that 75 per cent. of its butter fat had been abstracted. It was stated that the defendant had been fined four times previously in that Court for selling impure milk in the sums of £5, £10, £15, and £20; total, £50. The Magistrates again fined the defendant, who did not appear, £20 and costs.

THE SALE OF FOOD ACT.—At the Liverpool County Magistrate's Court, on Saturday, before Messrs. G. H. Horsfall, G. W. Moss, and A. Earle, Mr. James Sedson, grocer and provision dealer, of Rice Lane, Walton, was charged with selling adulterated butter. Police-constable 818 said he visited the defendant's shop on February 19th, and purchased a pound of butter for 1s. 2d. He then informed him that he had made the purchase for the purpose of having it analysed, and offered to leave a portion at the shop. The defendant replied that it was butterine. Mr. Superintendent Walsh produced an analysis of the butter, showing that it contained 70 per cent. of beef fat. In reply to the Bench the police officer said butterine was sold from 8d. per lb. upwards. The magistrates told the defendant that he was selling as butter an article which he knew to be butterine, and imposed a penalty of 40s. and costs.—Mr. C. Bocock, grocer and provision dealer, Walton Village, was summoned for a similar offence, and fined 40s. and costs. The butter had been adulterated to the extent of 75 per cent. of beef fat.—Mr. P. Synagh, grocer and provision dealer, Rice Lane, Walton, was also summoned for selling butter which contained 75 per cent. of beef fat. Defendant denied that he sold the article as butter, and said the most ignorant housekeeper knew that what was sold for 1s. a pound was not pure butter. It was a "French composition." Superintendent Walsh said he had bought butter at 1s. a pound. The Bench imposed a penalty of 40s. and costs.

At the Wandsworth Police Court, on Tuesday, Mr. Ernest Lloyd, grocer, Battersea Park Road, was summoned before Mr. Sheil, by Mr. Corsellis, clerk of the Wandsworth Board of Works, for selling coffee adulterated with chicory. Mr. Corsellis produced a certificate of the analyst showing that the sample of coffee contained 45 per cent. of chicory. The defendant said it was sold as a mixture of coffee and chicory, and produced a label to show the way in which the stamp was used. Mr. J. A. Smith, the inspector, said that after he had purchased the coffee, the defendant told him the cover was stamped. He examined the packet of coffee, but he was unable to see the stamp. Mr. Sheil looked at the cover produced by the inspector, and said that the stamp was very faintly printed. As it was folded with the stamp inside the case had the appearance of fraud. He fined the defendant £10 with 12s. 6d. costs. Mr. Emmerson subsequently appealed to the magistrate to reduce the penalty, as the defendant was unable to pay it. He said chicory was not injurious. The inspector said it was injurious in some cases. Mr. Sheil refused to alter his decision, but allowed the defendant time to pay the money.

AN UNFORTUNATE SANITARY INSPECTOR.—At the meeting of the Commissioners for the Burgh of Govanhill (a suburb of Glasgow), held on Tuesday—Bailie Hugh McDougall, jun., grocer, Mount Florida, presiding. Mr. Thomas, the sanitary inspector, stated that he was appointed three years ago by the Commissioners of Supply for the county as inspector under the Food and Drugs Act at a salary of £5 per annum, but he had some difficulty in getting the expenses paid. Meanwhile there were a number of cases of adulteration of food going on in the burgh, which he felt he was powerless to deal

with without authoritative instructions which would guarantee expenses. He could point to four shops where butterine was sold deliberately as butter. Last Friday he went to one of these shops for butter, and asked the salesman if it really was butter. The reply was whispered, "He's no in himsel'; but its butterine." (Laughter.) He was anxious to take the matter up, but must wait instructions. Mr. Robertson, the clerk, said that unfortunately the local authority of the burgh was not the local authority under the Food and Drugs Act, and he was afraid the Commissioners could not give instructions without incurring liability for the expense. He suggested that the Provost, as an *ex officio* member of the County Commission, should be asked to bring the matter up before that Board. This was agreed to.

ALLEGED ADULTERATION BY A PUBLICAN.—At the Sessions House, Boston, on Wednesday, the adjourned hearing of the charge against Mr. John Willey, of Kirton, for selling beer adulterated with 60 grains of salt per gallon, was heard, and excited considerable interest, the court being filled with listeners.—Mr. B. B. Dyer, instructed by the Boston Licensed Victuallers Association for the defence, in the course of his remarks said the water used by Mr. Willey naturally contained a large proportion of salt, which, in the process of brewing, would be increased to the amount found in the beer, he had had the water and beer both analysed, the analyst being in court to give evidence.—Mr. Charles H. Southwell was called, and in answer to Mr. Dyer, said he was a pharmaceutical chemist by examination, and had been engaged in chemical pursuits all his life. Amongst other appointments he had held one as manager and analyst in a large manufacturing pharmaceutical establishment. He read the following certificates:—

"No. 1, ANALYTICAL REPORT:—I have quantitatively examined for salt a sample of water received by me from Mr. Willey on the 11th Feb., 1884. It contains 30·28 grains of Alkaline Chlorides, *i.e*, salt, per imperial gallon. Beer brewed with such water would contain 48 to 60 grains of salt per gallon, perhaps more; the ingredients used in brewing and the concentration of the chlorides through loss of water by boiling would increase the amount of salt 18 to 30 grains per gallon. An analysis of the water used by Messrs. Allsopp and Co., by Dr. Henry Bottinger, vide "Food and its Adulteration," by Hassall, page 681, gives 10·12 grains of salt (Chloride of Sodium) per gallon. The beer brewed from such water, according to the same authority, contains 28 grains of (Alkaline Chlorides salt) per imperial gallon; thus the process of brewing did in that case increase the amount of salt nearly 18 grains per gallon. The water received from Mr. Willey by me was contained in a chemically clean bottle provided by me for the purpose. It was sealed with the monogram J. C., the following certificate being attached—[A certificate from Dr. Story witnessing the collection of the water.]—CHAS. H. SOUTHWELL, Pharmaceutical Chemist, Boston."

"No. 2, ANALYTICAL REPORT.—I have quantitatively tested for salt, a sample of beer received by me from Mr. Willey on the 12th February, 1884. It contains 12·76 grains of chlorine per imperial gallon, equivalent to 54 grains of Chloride of Sodium (salt). The beer was contained in a wine bottle insecurely corked with a piece of old cork, which might have been easily extracted without injuring the seal. This manner of collection might materially alter the result of the analysis. Samples of beer for analysis should be collected in chemically clean bottles closed with glass stoppers.—CHAS. H. SOUTHWELL, Pharmaceutical Chemist, Boston."

Supt. Crawford took exception to the accusation against him of unfairness in collecting the beer. Mr. Southwell explained that no accusation was intended, nor even an imputation. He merely drew attention to the slovenly way of collecting samples for analysis (producing the bottle.) He further explained that the time employed by brewers for boiling varied from two to five hours; he believed Allsopps boiled two hours. Of course the more time taken in boiling the more salt would be found, the water evaporating and the salt remaining.—The bench after this evidence, immediately dismissed the case.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Pharmaceutical Journal; The Sanitary Record; The Miller; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; Cowkeeper and Dairyman's Journal; Sugar Cane; Country Brewers' Gazette; The Medical Record; The Grocers' Gazette; London Water Supply, by Crookes, Odling and Tidy; Chemical Review; Independent Oil and Drug Journal and Paint Review; Science Monthly; Journal of the Society of Chemical Industry.

THE ANALYST.

MAY, 1884.

PROCEEDINGS OF THE SOCIETY OF PUBLIC ANALYSTS.

An ordinary general meeting of this Society was held at Burlington House, on Wednesday, the 16th April. In the absence of the President the chair was taken by Dr. Wynter Blyth.

Dr. Veith was appointed scrutineer, to open the ballot papers, and reported that Mr. F. Woodland Toms, F.C.S., F.I.C., Official Analyst to the States of Jersey, of St. Heliers, Jersey, was duly elected as a member. Dr. C. M. Cresson, Chemist to the Board of Health, Philadelphia, was proposed as a Member, and Mr. W. Beam, assistant to Dr. Leffmann, of Philadelphia, as an Associate.

The following papers were read and discussed:—

"On the Detection of Apple Pulp in Jams," by M. A. Adams, F.R.C.S.

"A New Method for the Examination of Water Biologically," by H. S. Carpenter, F.I.C., and W. O. Nicholson, F.C.S.

"On Logwood Paper as a Re-agent, and on the Identification of Mineral Acids in Presence of Organic Acids," by A. Ashby, M.B.

An extraordinary general meeting was afterwards held for the purpose of confirming the resolution with regard to Associates passed at the extraordinary general meeting held on March 19th.

The next meeting of the Society of Public Analysts will be held at Burlington House, on Wednesday, the 14th May.

THE ANALYSIS OF BUTTER.

By William Fox and J. Alfred Wanklyn.

(*Abstract of a Paper read on March 19th.*)

In making examinations of butter, the smell of butyric ether has been observed when the butter is saponified in the usual manner, *i.e.*, by the action of alcoholic solution of potash on the butter, but until we called attention to the subject, in the course of last year, the butyric ether arising during this action was regarded as an insignificant by-product. We have shown* that the butyric ether is a main product, and that by

* Chemical News, vol. 48, page 49, and in a paper read before the chemical section of the British Association, Southport meeting, 1883.

restricting the action of the potash it is possible to cause all of the butyric acid—which is derivable from butter—to assume the form of butyric ether. At any rate we have proved that much more than half of the butyric acid may be made to assume the form of butyric ether. Very important theoretical and practical consequences follow from a knowledge of this fact.

The theory has a bearing on the analysis of butter, and we propose to deal with that on the present occasion, and have to offer a rapid and accurate method of analyzing butter by means of a measurement of the quantity of butyric ether, which is evolved under certain specified conditions.

The working details of our method are the following:—

The butter is clarified in the usual way, and then 5 grammes are weighed and taken for the analysis. The butter is placed in a small retort of about 200 c.c. capacity, and fitted to a condenser. About 100 c.c. of alcohol (sp. gr. 0·838) is added to the butter in the retort, and then 0·5 grms. of solid potash is added. The retort is then gently heated, and the contents are distilled, the distillation being continued to dryness. The distillate is received in a bottle fitted with a stopper, and containing 40 c.c. of accurately measured normal caustic potash or soda. When the distillation is complete the stopper is placed in the bottle and the contents are shaken for a short time, and presently it will be found that the smell of butyric ether has vanished. Phenol phthalein is now added to serve as an indicator, and the solution is titrated with normal sulphuric acid. The following results have been obtained:—

	I.	II.	III.			
Butter sample I.	.... 3·20	.... 3·46	.... —	per cent.	$C_4H_8O_2$	Mean of insoluble fatty acids, 87·80 per cent.
,, ,, II.	.... 2·96	.... 2·96	.... 3·17	,,	,,	
,, ,, III.	.... 3·17	.... —	.... —	,,	,,	
,, ,, IV.	.... 3·00	.... 2·85	.... —	,,	,,	
,, ,, V.	.... 3·40	.... —	.... —	,,	,,	
,, ,, VI.	.... 3·26	.... 3·13	.... 3·40	,,	,,	

Three samples of butter received by Mr. Wanklyn from Buckingham, gave—

No. I.	.. 2·86	.. 3·15	.. 2·97	per. cent. $C_4H_8O_2$,	insoluble fatty acid 87·86
,, II.	.. none	.. —	.. —		,, ,, ,, 95·16
,, III.	.. 3·20	.. —	.. —		,, ,, ,, 88·60

No. II. therefore contained no butter fat whatever, and was reported on to that effect.

Several samples of "one shilling butter" bought at various shops gave no trace of butyric ether, and consumed no alkali when treated as above described. The insoluble fatty acids in these samples was found to be a little more than 91 per cent.

In like manner cocoanut-fat and various other fats and oils, some of which yield less than 95 per cent. of insoluble fatty acids, have been found to yield no butyric ether when treated by our process.

We are of opinion that slight admixtures of butter with foreign fat are of very rare occurrence in commerce; either the fat which is sold under the name of butter, is butter altogether, or else it is devoid of butter.

And certificates that a given specimen of commercial butter contained, say 20 per cent. of foreign fat mixed with the butter or say 80 per cent. of foreign fat mixed with the butter, are open to grave suspicion.

In the course of the discussion which ensued after the reading of the original paper.

Mr. ALLEN said:—The formation of butyric ether during the saponification of butter is certainly an exceedingly curious reaction, of which I do not venture to offer any explanation further than that put forward by Mr. Wanklyn. I wish, however, that gentleman had brought forward some further facts in confirmation of his isoglycerine theory; still, we can take it as a fact, that butyric ether *is* produced in saponification, and that when the operation is carried out in the manner described by the authors, slightly over 3 per cent. of butyric ether is obtained. I do not gather that the quantity which distils over is necessarily all the ether that is formed. It would be interesting to know whether the volatile product is butyric ether only, or contains ethers of other volatile acids besides. When the paper is printed I hope we shall see actual analytical figures, and we shall then be able to judge how far the process is capable of giving constant results. Since the introduction of Hehner and Angell's process many modifications have been proposed, but these, unfortunately, have not always stood the test of experience, and in the present case it will be most desirable to know how much this process can do. I have myself attempted other plans, but have not succeeded in working out a process which would give absolutely constant figures on repetition.

The figures given by the authors of the paper seem to me to be very low, and a grave source of error exists in the possible variation in the proportion of alkali used. It is all very well to assume that we have to deal with butter or with butterine, but, unfortunately, we have to do sometimes with mixtures, and how do we then know whether we have not more caustic potash than is sufficient for this reaction? Supposing for instance, that we have 20 per cent. only of butter in a mixture, would not then the excess of potash be very considerable? This, it seems to me, wants further explanation and experiment before we know how far the process is likely to give reliable results.

It is not so many years ago that Mr. Wanklyn used to pooh-pooh Hehner and Angell's method on the ground that the true proportion of butyrin in butter was a mere fraction of 1 per cent. I do not know whether Mr. Wanklyn is not even now prepared to hold the same view, on the ground that butyric acid is not contained as a glyceride in the butter, but that the acid is formed in the process itself. It would be interesting to know what should happen if butter-fat were decomposed with sulphuric acid instead of alkali; would we then still get butyric acid? In this manner more light might be thrown on this interesting reaction.

MR. HEHNER said: No analyst can be more desirous than I am myself to see butter analysis further improved, and I am sure no one appreciates the difficulties of the methods at present in use more keenly than I do. I hail every improvement in butter analysis with delight, for every one affords further evidence that the seed sown by Mr. Angell and myself, now a good many years ago, is growing and flourishing. I am, however, sorry to think that the method suggested by Messrs. Wanklyn and Fox, instead of being anything like an improvement, is decidedly a retrograde step; it brings us back almost to the position in which butter analysis found itself when first taken up by me. Ten years ago it was said that butter fat contained about two per cent. of glyceride

of soluble fatty acids, and it was not without strong opposition—mainly, also, on the part of Mr. Wanklyn—that we demonstrated that the actual quantity was very much larger. Six to seven per cent. or more of soluble fatty acids being readily obtainable from butter fat. Now, after the lapse of ten years, Mr. Wanklyn comes to us with a method by which he actually gets from 2½ to 3 per cent. of butyric acid. This is, for Mr. Wanklyn, a decided advance; if he continues his labours he may, *in time*, reach the quantities readily obtained by other analysts.

Now, if we look at the paper just read, we see that it consists of a great deal of theory, and of a very little bit of fact. I have heard a very eminent lawyer say in Court, that he preferred one grain of common-sense to a cartloadful of chemistry. I might paraphrase, and say "one grain of fact is better than a ton of theory." Analytical methods should, before all things, stand upon solid facts, not be merely pegged on to theories. The original foundation of Mr. Wanklyn's isoglycerine theory was the supposed fact, that from some fats after saponification, he was unable to obtain any glycerine whatever. He "rushed into print," and announced his great discovery in the *Chemical News*, in a paragraph of a few lines, never afterwards, as it ought to have been, amplified by the publication of actual experiment. True, he read a paper on the same subject before the British Association, but as far as I am aware, that paper has not been printed. Somewhat later the inventers of isoglycerine find that the fats, from which they were unable to extract any glycerine after all could be made to yield up their alcohol in a tangible form. With that observation one should imagine the isoglycerine would have collapsed, but it was too excellent a theory to be allowed to die in this manner. In order to keep it alive, Mr. Wanklyn now comes to us and transfers the production of his mind to butter fat. Because it is a remarkable fact that butterfat on saponification with alcoholic potash yields some butyric ether, the butyric acid combining, to a small extent, with ethyl instead of potassium, and because, according to Mr. Wanklyn's distinct statement, butyrate of glycerine, on being saponified, does not yield any butyric ether whatever, therefore butterfat is devoid of any compound of butyric acid, but must contain *isoglycerine*. The foundation, in fact, then, of his theory as it now stands is his allegation that butyrine on saponification cannot yield butyric ether. I have, myself, prepared some tributyrine, by heating together glycerine and butyric acid to 260° C., and thoroughly washing the product. This most easily yields a powerful odour of pineapple when saponified in the presence of alcohol, Mr. Wanklyn's statement notwithstanding (the experiment was here shown).

With this one little fact Mr. Wanklyn's theory vanishes and collapses.

If it must then be admitted that a glyceride containing the butyric radical can yield butyric ether in the presence of potash, why does the butyric acid combine with ethyl instead of potassium? You will notice that the authors of the paper are careful to use a quantity of alkali only just sufficient to saponify the fat employed. They avoid an excess. As the butter fat gradually dissolves it must indeed be locally in excess. The molecule is broken up by the alkali, part of the acid combines with it, but the rest of the acid is free to do what it likes, and accordingly takes hold of the alcohol. If we have butyrine $(C_4H_7O_2)_3\ C_3H_5 + 2KHO + C_2H_5\ HO$ we could get $2C_4H_7KO_2 + C_4H_7\ C_2H_5\ O_7 + C_3H_5\ (HO)_3$

Be this the explanation of the fact or not, it is quite evident that Mr. Wanklyn's explanation is not an explanation at all; he attempts to explain things which are unknown, by others still more unknown. He has to *invent* a substance, isoglycerine, to explain an observation apparently in opposition to our knowlege of the behaviour of organic ethers. But admitting for the sake of argument that isoglycerine exists, is it intelligible why the butyric acid, formed by its decomposition, should be able to combine with ethyl in the presence of potash, whilst that power is expressly denied to butyric acid present in a glyceride? The acid, whatever its origin, cannot have different properties in the one case from the other.

So much for Mr. Wanklyn's theory. Now as to his facts, which, as I have said, are very small indeed.

We all know that, however much alkali be taken to saponify butter fat, some butyric ether always forms. With a great excess of alkali the quantity yielded is small. I have found as little as ·3 per cent. With a barely sufficient amount of alkali, as the authors of the paper show, as much as 33 per cent. may be obtained. It is quite evident that the resulting percentage is necessarily only a function of the quantity of alkali, and as in this new process no particular provision is made to use an absolutely exact proportion of the two agents, fat and potash, it follows that the quantity of ether which is obtained is quite accidental. The whole of the facts come to this, that the formation of butyric ether affords a good *qualitative* test for the presence of butter in a mixture of fats. We knew this years ago, when a once notorious member of this Society first alluded in a police court to a "saponification test" he was possessed of for the examination of butter. Messrs. Wanklyn and Fox bring us no further than this. Unless they study the subject much more intimately than they have done, I would advise them rather to bear the ills they have than fly to others that they know not of.

Mr. Wanklyn replied: I have listened with very great attention to the remarks made by Mr. Hehner, and I am delighted that I have induced him to experiment on this matter. The subject of ethers is one upon which I have been engaged for the last seventeen years, and is, as everyone knows who has worked on it, one of the most difficult subjects in organic chemistry and full of pitfalls. Mr. Hehner has shown us a very beautiful experiment; but I think I may mention that it is possible to produce a trace of butyric ether from butyric acid, alcohol, and potash alone—a possibility owing to causes which are pretty well known to chemists; this fact we can verify in a variety of ways. When we bring butyric acid and alcohol together no combination takes place, but if a trace of potash is added, immediate combination is obtained, and in this way we might get a little butyric ether.

Mr. Hehner, to judge from his remarks, has evidently not made himself acquainted with the grounds which inspired the isoglycerine theory, and as to his remarks on theories generally I was sorry to hear them. I have been accustomed to work in a laboratory nearly all my life, and in my opinion a good chemical theory is worth a lifetime of experiment. The most valuable possession a scientific man has is a theory,

which may be true or false, but which leads to investigation. I have reason to believe that my theory will stand complete investigation. As to my paper before the British Association, it will be published in the report of the Association when this appears.

The theory of isoglycerine depends upon this: No natural fat yields the proper theoretical quantity of glycerine. I have taken the trouble to get information from manufacturers who only get five per cent. of glycerine from the total fat taken, the fatty acids being 95 per cent. and 5 per cent. of glycerine being obtained by the manufacturer, he is satisfied with his yield, the figures summing up to 100; nevertheless, half of the theoretical amount of glycerine is missing. My explanation of this circumstance is that only one half of the glycerine there is here, and the other half exists as isoglycerine.

Reverting to butter, a good many chemists have worked on this subject but not one has succeeded in getting the theoretical quantity of glycerine from it. Last summer I worked at the subject and saponified with hydrate of lime; first of all there is a curious combination of lime with the butter. I expected a loss of water, but remarkably enough there was no loss. Afterwards, when the action is completed the lime combines bodily with the glycerine and the fatty acids, and from this no glycerine can be extracted. It is only after prolonged extraction with boiling alcohol that the compound is broken up and yields its glycerine. I do not mean to recommend the use of lime for this saponification; I merely warn analysts against its use.

It is not only the smell of butyric ether that we obtain, but from 3 to 4 per cent., and I believe it is even possible to get a higher percentage. The process described in the paper is a practical method for examining butter, and I do not agree with Mr. Hehner that it is a step backwards. By our process one is enabled to turn out in about an hour a very fair examination of butter or fats containing butter, and I expect that the degree of accuracy to which we shall rise will be that we shall be able to measure 20 per cent. of butter in a fat, and that within an hour.

ON CONDENSED MARES' MILK.

By Dr. P. Vieth, F.C.S.

In last year's volume of The Analyst (page 81), I have published the analyses of two samples of condensed mares' milk. Having had the opportunity of procuring some more samples of this new food for infants, and thinking the matter of some interest I do not hesitate to bring before you two further analyses accompanied by a few remarks.

The condensed mares' milk is prepared by "Carrick's Russian Condensed Mares' Milk Company." This company possesses a stud and factory near Orenbourg, south-eastern Russia, where mares are kept exclusively for milking purposes and the milk is condensed. The first experiments at large were made during the summer of 1882, but 1883 may be considered the first year of regular work.

The preparation is recommended as a substitute for mother's milk, or as an adjunct to it, and medical men of Moscow, St. Petersburgh and London, who have used it in a number of cases in hospitals as well as in private practice, report very satisfactorily on it, praising its great digestibility, its highly nutritious properties, its curative powers in cases of diarrhœa and its action as an excellent hypnotic.

A consignment of last year's production arrived in London at the end of the year, and of this I have examined two samples.

The condensed mares' milk is contained in cylindrical tins, $2\frac{1}{2}$ inches in diameter and $2\frac{3}{4}$ inches high. The total weight is about $12\frac{1}{2}$ ounces, the weight of the contents 10 ounces. According to statements on the label, the milk is condensed in vacuo to $\frac{1}{8}$th its original bulk with the addition of 3 per cent. of sugar. I opened two tins and found the contents to be of very thick, scarcely fluid consistency, of almost pure white colour, of agreeable smell, and of pure taste, resembling somewhat that of honey. The preparation is, especially with respect to taste, far superior to that examined and reported upon last year. The condensed milk readily dissolves in warm water, leaving some small flakes only undissolved, apparently consisting of coagulated albumen. Solutions made in the proportion of one part of condensed milk to 7 parts of water had a specific gravity of 1·033 and 1·036 respectively. The composition of the two samples was found to be as follows :—

	I.		II.
Water	26·73 per cent.	..	24·04 per cent.
Total Solids ..	73·27 ,,	..	75·96 ,,
Fat	4·77 ,,	..	6·20 ,,
Protein	13·69 ,,	..	12·17 ,,
Sugar	53·07 ,,	..	55·81 ,,
Ash	1·74 ,,	..	1·78 ,,

The ash had a pink hue and gave a strong re-action of iron.

The comparison of these figures with reliable analyses of mares' milk, published previously, leads to the conclusion, that the milk employed has been condensed not to $\frac{1}{8}$th, but to $\frac{1}{6}$th its bulk. Basing upon this assumption, and taking into account the addition of three per cent. of sugar, the composition of the original milk was calculated to have been as follows :—

	I.		II.
Water	90·50 per cent.	..	90·04 per cent.
Total Solids ..	9·50 ,,	..	9·96 ,,
Fat	0·83 ,,	..	1·06 ,,
Protein	2·35 ,,	..	2·09 ,,
Sugar	6·02 ,,	..	6·50 ,,
Ash	0·30 ,,	..	0·31 ,,

There have not been very many reliable analyses of mares' milk published previously, and in very few instances a remark is made, saying that the analyses refer to milk yielded by mares belonging to the steppe race. And even in these cases the mares were not kept under their natural conditions in the steppes, when they yielded the milk concerned. It might seem inadmissible to compare the products obtained under quite different conditions, as long as there is no proof that this difference does not influence the composition. To put the degree of condensation beyond doubt, it would be necessary to know the actual composition of the milk used. Such analyses do not exist, but I have it on the best authority, that the specific gravity of all the milk condensed was between 1·030 and 1·036.

A 3 per cent. sugar solution has a specific gravity of 1·012, or in other words, 3 per cent. of sugar, raises the specific gravity as much as 0·012. Mares' milk, to which 3 per cent. of sugar has been added, would show consequently an average specific gravity of 1·045. We have seen, however, that the solution of the condensed mares' milk made in the proportion of 1 to 7 had a specific gravity of 1·033 and 1·036 respectively, and by a simple calculation it will be found that the specific gravity would be 1·044 and 1·047, if the solutions were made in the proportion of 1 to 5. This proves again, that the milk had been condensed to 1-6th its bulk, or, that of six parts by weight, five parts of water have been evaporated. The statement on the label, therefore, does not agree with our calculation, but is in full accordance with the actual facts, if meant in this sense, that eight parts by measure have been reduced to one part by evaporation.

Conclusion of the Proceedings of the Society of Public Analysts.

PARIS MUNICIPAL LABORATORY.

On another page we print the report of the Paris Municipal Laboratory for the month of February. We should be glad to print these returns every month if our space allowed of it, as they shew strikingly the activity with which this useful legislation is enforced in Paris, as compared with the apathy shewn in England, and especially in the metropolis. There are several points in the return which will be of interest to our readers, in view of the amendment of the Act, which must naturally take place in this country in a short time.

Milk adulteration appears to be almost as prevalent in Paris as in London, for we find that more than 30 per cent. of the samples bought by the Inspectors were watered and skimmed.

The most remarkable feature in the return is the extent to which the falsification of wine is practised in Paris, and the stringent standard set up by the Municipal Laboratory for judging by. Thus we find that a disagreeable flavour, fortification with alcohol or sugar, or the addition of salicylic acid, are all sufficient to place samples in the "C" or "Bad" class. We notice also that more than 25 per cent. of the samples of wine were condemned on the ground that they were plastered with two grammes per litre, and that 24 samples are condemned as adulterated with foreign colouring matters.

It will be observed that in chocolates, 8 samples were condemned on the ground of the addition of the debris from the shell and starch, and 9 samples are condemned for the addition of foreign fats, which we presume have been added to replace the cocoa butter. This adulteration is said to be very common in this country, but we have not yet met with a case of prosecution for it.

Thirty-two samples of tin ware and glazed pewter were examined, and 27 of them were condemned on account of the presence of lead.

Colouring matters, toys, and coloured papers and wrappers are dealt with very stringently, though, in our opinion, not too much so. Only two samples out of 37 examined passed satisfactorily.

ANALYSES MADE DURING THE MONTH OF FEBRUARY IN THE MUNICIPAL LABORATORY OF PARIS.

Nature of the samples analysed :—	Total A.	Good B.	The other samples are classed as follows :— C.	
Wines	782	136	72	Sickness of wine (bitter, acid, fusty, &c.)
			117	Flavour disagreeable.
			206	Plastered above two grams per litre.
			78	Fortified or sugared.
			62	Adulterated with decoction of dried grapes (raisins).
			234	Adulterated with water.
			24	,, with foreign colouring matters.
			15	,, with salicylic acid.
Vinegars	18	1	17	Substitution of alcohol vinegar for wine vinegar.
Beers	21	15	4	Adulterated with water.
			2	,, with salicylic acid.
Ciders	6	3	3	Adulterated with water.
Alcohols and Liqueurs ..	19	5	8	Adulterated with forbidden colouring matters.
			11	,, with glucose and various adulterants.
Syrups	4	0	3	Adulterated by adding glucose.
			2	,, with forbidden colouring matters.
			2	,, various causes.
Waters	7	2	5	Contaminated with organic matter.
			4	,, with mineral matter.
Milks	531	364	167	Watered and skimmed.
Butters	35	28	7	Addition of foreign fats.
Oils	3	1	2	Addition of foreign oils.
Flours	8	6	2	Damaged flours.
Doughs	2	2		
Meats	6	3	3	Tainted.
Sugars	..	..		
Preserves	19	17	1	Green with copper.
			1	Tainted.
Peppers	7	3	4	Addition of flour and dust.
Salt	..	..		
Coffees, chicorys, Teas ..	13	13		
Chocolates	25	8	8	Addition of the debris from the shell & starch.
			9	,, of foreign fats.
Honeys	2	2		
Jams	3	2	1	Addition of glucose.
Colouring materials	22	1	21	Forbidden colouring matters.
Toys	5	..	5	Forbidden colouring matters.
Coloured papers and wrappers	10	1	19	Coloured with forbidden colouring matters.
Tin and glazed pottery ..	32	5	27	Presence of lead.
Spices	1	1		
Pharmaceutical preparations	11	11		
Perfumery	8	4	4	Forbidden substances.
Petroleums	11	7	4	Inflammable below 35° C.
Various	45	17	28	Various causes.
	1656	658		

NOTE.—The totals of the columns B and C will not agree with the number of the analyses made, for the same sample may be counted under several headings in column C.

FORBIDDEN COLOURING MATERIALS IN FRANCE.

Serious accidents have frequently resulted from the employment of wrapping paper used for packing alimentary substances which has been coloured with poisonous materials, and more frequently still from the use of liqueurs, confectionery, &c. in which an artificial colour has been produced by a substance the use of which may entail serious consequences to the consumer.—The "Prefecture de Police" Paris have therefore issued the following regulations. Manufacturers and dealers in all kinds of food are forbidden to use the undermentioned colours, and will be held personally responsible for any accidents which may occur from such use of them.

MINERAL COLOURS.

Containing copper.—"Cendres bleues," mountain blue. Containing lead.—Massicot, minium, pale orange, oxychloride of lead, Cassel yellow, Turner's yellow, Paris yellow, white lead, céruse, silver white, Naples yellow, sulphate of lead, chrome yellow, Cologne yellow, chromate of barium. Containing arsenic.—Arsenite of copper, Scheele's green, Schweinfurt green, vermillion.

ORGANIC COLOURS.

"Aconit Napel," Fuchsine and its immediate derivatives such as Lyons blue, Eosine, colouring materials containing nitrous compounds such as napthol yellow, Victoria yellow. Tropeolines, xylidine red, &c., &c.

Children's toys must not be coloured with poisonous pigments.

From the above and also from the table of analyses made at the Municipal Laboratory (which we print this month) it will be seen how rapidly and thoroughly the French have advanced with their "Adulteration Act," greatly to the credit of the Government.

ADULTERATION OF ALMOND OIL.

ALMOND oil, like other oils, is often adulterated. It is mixed with the oil which is obtained from peach, apricot, and plum kernels; and even with gingerly oil, poppy oil, &c. Very careful researches bearing on these adulterations have been made by Herr Bieber, of Hamburg, who has amongst other details given the following indications for detecting falsifications:—Prepare a re-agent by mixing equal parts by weight of concentrated sulphuric acid, nitric acid and water, and allow the whole to cool. By mixing five parts of the suspected sample with one part of this acid mixture, if the oil be pure, there is formed a liniment of a pale yellow colour; in the peach kernel oil the liniment will first be red and will then turn to a dark orange-shade; with gingerly oil the colour will first be a yellowish red, and will then pass to a dirty orange-red; with poppy or nut oil the liniment will be whiter than with almond oil. By mixing almond oil with nitric acid, at a gravity of 1·40, there is formed a liniment of a pale yellow colour; with peach kernel oil the liniment will be red; with gingerly oil it will be of a dirty yellowish green which in time becomes red. A mixture to the extent of 5 per cent. of peach kernel, or gingerly oil, can thus be perfectly traced in almond oil. By preparing various mixtures of almond oil with peach kernel, and by allowing the acid liquid to act upon these mixtures, a graduated scale is established for recognising approximately the quantity of foreign oil added to the almond oil.—*Independent Record.*

REVIEWS.

A Treatise on the Chemical Constitution of the Brain Based Throughout upon Original Researches. By *J. W. L. Thudichum, M.D.* London: Published by Baillière, Tindall, and Cox.

To the true chemist this is a book of most absorbing interest, although dealing with matters somewhat out of the general run of his studies. Such a work would have been impossible in the hands of an ordinary labourer in our science, because of the time and expense involved, but Dr. Thudichum has been fortunate in obtaining State aid for the last twelve years, and has so been enabled to thoroughly devote his whole energies to his subject. At first, one takes up the book almost with a sigh of despair at the presumed dryness of its contents, but, in the very preface, the author contrives to inoculate the reader with some of his own enthusiasm, and as one new and curious compound after another comes into view, the interest increases, until at last the work is laid down in sincere admiration for its contents, and with a feeling almost of envy of the man who has been placed in so happy a position as to be able to engage in such research. It would be manifestly impossible to even attempt to follow the author through his subject within the space of a short notice like the present, but there are two points which at once appeal to a chemist, in the marvellous chemical structure of the brain. The first consists in the extraordinary isomerism exhibited by comparatively common substances when modified by the action of the vital forces of that organ. Take, for instance, stearic acid, there we find no less than three perfectly new isomers discovered by the author, two being of the nature of fatty acids, while the third is an alcohol. To inosite and the glucose group generally is added a new carbohydrate, namely, cerebrose, which has been found to be the fundamental radicle of the group of bodies termed cerebrosides, the chief of which are phrenosin and kerasin. The second great point of interest to the general chemist is the chapter on the phosphorised bodies in the brain. When the first of these, namely, lecithin, was discovered, it yielded its phosphorus in the form of glycerophosporic acid, and was, therefore, believed to be analagous in structure to an ordinary fat, but the author has proved that this belief was wrong, and that there are many such bodies which do not yield glycerol in any form. He therefore concludes that they are not of the nature of fats, but simply the radicle phosphoryl in combination with other radicals on the type of ordinary tribasic phosphoric acid. This class of bodies he now denominates *phosphatides*. With reference to them, he states that they are the centre, life, and chemical soul of all bioplasm whatsoever, both in plants and animals; their chemical stability being due to the fact that their fundamental radicle is a mineral acid of powerful and multitudinous dynamicities. The extraordinary point of interest about these compounds is their power of colloidation, and their liquefaction under the influence of disease is the first stage of their decomposition, which is then accomplished by patholysis, just as it can be in the laboratory by chemolysis. Again, we have bodies like amidomyelin, which are naturally present in the dissolved liquid state at the ordinary bodily temperature, but become colloid at fever heat, and these may be the real cause of death from fever. The book concludes with a scheme for the quantitative analysis of the brain, and the author finishes by urging that it is to physiological chemistry we are to

be chiefly indebted for our medical practise in the future. The advance of chemistry, and the discovery of the uses of such bodies as mercuramine, phosphomolybdic, and phosphotungstic acids have given the organic analyst powers of quantitative estimation hitherto undreamed of, and when the chemist has completed his researches it is then for the medical man to step in and use them for the benefit of humanity. Then, as the author says, by the aid of chemistry many derangements of the brain and mind which are at present obscure, will become accurately definable and amenable to precise treatment, and what is now an object of anxious empiricism will become one for the proud exercise of exact science.

NUMERICAL EXERCISES IN CHEMISTRY. By *T. Hands, M.A.* London: Published by Sampson Low, Marston, Searle, and Rivington.

THIS is an addition to the already numerous books of stoichiometric problems intended for the use of chemical students. Commencing with exercises on the metric system, it takes in both ordinary chemical calculations and those belonging to the heat department of chemical physics. The exercises given are very numerous, and possess the advantage of yielding answers coming out to exact figures, and not, as a rule, to recurring decimals. The key to the calculation is also included, and thus the student is not taxed with the purchase of another book to get at the answers. The preliminary explanations to each variety of problem are more copious than usual, and the only fault is that they are sometimes a little too diffuse, and couched in language occasionally, to some extent, beyond the grasp of beginners. To teachers seeking for a large mass of varied examples, the book will be found very useful, especially in training students for examinations, and we have no doubt that it will meet with an extensive sale for this purpose.

ALCOHOL TABLES. BY *Otter Hehner*, 11, Billiter Square, E.C. Price 3s. 6d.

THESE well known tables have proved of great service to Public Analysts, and Analytical Chemists. We understand Mr. Hehner has still a few copies left, and we can confidently recommend them to all engaged in the testing of wines and spirits as being perfectly accurate and reliable.

The tables are arranged and printed in such a clear manner that they are invaluable for reference purposes.

SUGAR IN MILK.

M. PAUL BERT, the eminent French biologist, has been investigating the origin of sugar in milk. Two theories exist for explaining this phenomenon, one of which supposes that it is formed in the gland itself from lactogenic or milk-forming matter, the other supposes that it comes from the blood, and is merely stored in the breasts of animals. M. Bert has experimented with cows and she goats, and found beyond a doubt that sugar of milk is introduced by excretion in the breasts from sugar formed in excess by the animal. The sugar is apparently first formed in the liver, but whether it appears in the form of lactose, or glycose, afterwards transformed into lactose in the breasts, is yet a moot point which M. Bert has not investigated.

ANTI-ADULTERATION LEGISLATION IN AMERICA.

From the following circular and leader, which we reprint from our excellent contemporary, *The Sanitary Engineer*, of New York, it will be seen that the war against the Adulteration Act is being fought in the United States with almost as much ill-feeling as during the earlier days of the introduction of our Adulteration Acts in this country. Probably longer experience in the States will prove that matters can be worked as comparatively harmoniously as in this country at the present day:—

TACTICS OF FOOD-ADULTERATORS—A FORGED CIRCULAR.

The following is the text of the circular sent out by certain druggists of Boston, to which we refer editorially in this issue:

State House, Boston, March 6, 1884.

Dear Sir,—We desire to call your attention to a law that now exists upon the statute-book of Massachusetts, to regulate the sale of drugs, medicines, spices, and all articles of food and drink. The Legislature of 1882 passed a law which was recommended by some parties in the interest of the Pharmacopœia, and was gotten up by the graduates of the College of Pharmacy and other self-constituted parties, who have compiled a book, containing about one-eighth of the matter contained in the United States Dispensatory, at a cost of ninety cents per copy, which is sold in the market at $4·00. This book, strange as it may seem, was made in 1882 the legal standard of all articles of food, drink and medicine in this Commonwealth. This book, it will be remembered, is not the United States Dispensatory, the standard in use by all druggists and physicians, but a commentary or appendix upon this book. The standard of medicine is at variance, in many important respects, with the Dispensatory, and all the preparations are supposed to be prepared in accordance with the metric system. Under the law, as it now exists, all medicine must be made according to this book, under a fine of $50; of all articles of food or drink, not laid down in this book, the standard is to be fixed by the State Board of Health, who can exempt, change, or fix the standard at their own will or pleasure. Under this law the State Board of Health appointed B. E. Davenport, Professor of Chemistry in the College of Pharmacy, who commenced prosecuting parties for violations of this law. Some half-a-dozen of the wholesale and retail druggists in Boston and vicinity were brought up before the courts for selling adulterated laudanum, when the same was made in accordance with the United States Dispensatory formula, in use by every druggist. The offence was that the laudanum was not made according to this new hand-book, or Pharmacopœia.

The new legal formula had increased the strength of laudanum nearing 100 per cent. It was found upon experiment that opium, as imported and usually sold, would not produce the strength required by the new law, yet these firms were advertised before the country as selling "adulterated drugs" when they were required to do an impossibility. Under the law, as it now stands, there is hardly a drug, medicine, spice, or article of food sold by any druggist or merchant but what is illegal, and lays the party selling the same liable to a fine of $50. To show to what extremities the State Board of Health have pushed this matter, we will relate a single instance. One of the oldest

and most reliable dealers in canned-goods in Boston was brought up before the court, and fined $50 for selling adulterated vinegar, for the simple reason that it contained one grain of salt in a gallon. This had not been added to the vinegar, but came from the fact that the cider had been stored in a cask that had some time been used for pickles. Under the law, as it now stands, all medicines or articles of food must either be made by the new edition of the Pharmacopœia, or the standard fixed by the Board of Health, under penalty of $50. This, of course, includes all spices, conserves, confectionery, which are classed as food under the law, also, all patent-medicines and proprietary articles of whatever name or nature. The manner in which this law is framed, and the spirit with which it has been enforced thus far, warrants the belief that the State Board of Health, aided by the Professor of the College of Pharmacy, are determined to drive from the market all preparations that are not made according to their formula, which outlaws ninety per cent. of all the medicines now in use, or an arbitrary standard that may be set up, altered, or set aside at the will of a few men.

The State Board of Health has asked for an appropriation of $10,000 to enforce that obnoxious law. A bill has been introduced on lieve to the Legislature, granting the State Board of Health additional powers.

The following is a copy of the bill:—

COMMONWEALTH OF MASSACHUSETTS.

IN THE YEAR ONE THOUSAND EIGHT HUNDRED AND EIGHTY-FOUR.

AN ACT TO REGULATE THE SALE OF PATENT-MEDICINES AND PROPRIETARY ARTICLES.

Be it enacted by the Senate and House of Representatives, in General Court assembled, and by the authority of the same, as follows:

SECTION 1. The State Board of Health, Lunacy and Charity shall take samples of all patent-medicines, prepared food, and any other preparations claimed to have medicinal properties. They shall cause analysis to be made of the same, at the expense of the owners thereof; except such medicines and preparations as are found in the National Pharmacopœia, and having the name of such article marked upon each package.

SEC. 2. If, upon analysis, the State Board of Health, Lunacy and Charity find any preparation which, in their opinion, is not a suitable remedy for the purpose intended, or is poisonous or hurtful to the public health, or upon which an exorbitant price has been fixed, with a view to cheat or defraud the public, they shall forbid the sale of such article, and notify the owner or owners thereof

SEC. 3. Whoever shall sell or offer for sale any article, the sale of which is forbidden by the State Board of Health, Lunacy and Charity, as provided in Section 2 of this Act, shall forfeit and pay the sum of fifty dollars for each and every offence; or may be imprisoned in the common jail of the county wherein the offence has been committed for a term not exceeding six months.

An order has also been introduced, asking that the State Board of Health have power to examine all persons who sell or prescribe medicines, and to license such as they may select. An effort is being made to repeal these obnoxious laws, and do away with the attempt which has been made, during the last ten years, to create a monopoly in the sale of medicine, and place the whole business in the hands of a select few. If you are opposed to granting such extraordinary powers to the State Board of Health, and in favour of the equality of all men before the law, you will see your Senator or

Representative in the Legislature, at the earliest possible moment, or write to them, to oppose any further grant of this extraordinary power to the State Board of Health, and also to urge the repeal of the present arbitrary and oppressive laws.

For further particulars consult with the Counsel for the Remonstrants,

HON. CHARLES T. GALLAGHER.

Sears Building, 209, Washington Street,
Boston, Mass.

THE DRUG-ADULTERATION WAR IN MASSACHUSETTS.

THE Massachusetts State Board of Health should be proud of its achievements in enforcing the Food and Drug Adulteration Law, especially since this enforcement has resulted in showing the rascally nature of the opposition to it, and the dishonesty of the prime movers in this opposition. Their latest attempt has been the sending out a forged circular, elsewhere printed, to country druggists and proprietary-medicine makers, filled with untruthful statements, in which is a copy of a bill that they had prepared and introduced for the sole purpose of forcing the patent-medicine interest to join the adulterators and make common cause against the State Board of Health. This Bill was introduced without the knowledge of the Board of Health, and it is in no way responsible for it.

As to the statement in the circular, "that the Food and Drug Adulteration Law was recommended by some parties in the interest of the Pharmacopœia, and was gotten up by graduates of the College of Pharmacy," &c., it is only necessary to remind our readers that the Massachusetts Adulteration Law is practically the same as that passed in New York and New Jersey, and that these were copied from the draft of an act submitted by the Special Committee of Award in the competition instituted by the National Board of Trade and conducted by the Sanitary Engineer. The committee which drafted the Bill was appointed by the National Board of Trade, and the Bill received the endorsement of that body as well as of the Boards of Trade of various cities, Boston included. Moreover, the commercial interests of the country were represented on that committee by Mr. Alpheus H. Hardy, a Boston merchant.

The circular adds that "the Pharmacopœia is simply a commentary or appendix to the United States Dispensatory." It is hardly necessary to say the Pharmacopœia has nothing to do with food and drink, but is the standard for the strength and purity of medicines, and is adopted as such by the medical and pharmaceutical professions generally throughout the country. Indeed, it is the production of a convention which meets decennially in Washington and appoints a large and representative Committee of Revision, to which committee is entrusted the labour of revising and publishing the Pharmacopœia.

The convention and its Committee of Revision represent both the regular medical and pharmaceutical professions of the country. The Pharmacopœia thus issued is acknowledged to be the only official standard for the strength and quality of all the medicines which it contains, and this claim is universally recognised by the Supreme Courts of all the States in which its authority has been questioned.

The dispensatories, of which there are three, are merely commentaries, two of them being based upon the Pharmacopœia. They are published for the profit of their authors, and are neither legally nor morally the authoritative standards by which pharmacists can be bound. Fortunately, these Dispensatories have been written by able men, and are often useful in explaining minutely the processes and requirements of the Pharmacopœia.

The statement made in this circular, that laudanum prepared by the formula given in the U.S. Dispensatory will not meet pharmacopœial requirements, is absolutely false. On page 1,466 of the last (15th edition) of the U.S. Dispensatory is given the formula of the U. S. Pharmacopœia, 1880, *verbatim*. If honestly followed, with opium of the quality prescribed by the Pharmacopœia, no pharmacist need fail to obtain a strictly standard laudanum. Any falling-short on the part of manufacturers is due either to carelessness, ignorance, or intentional dishonesty. The Boston manufacturers, who have so long sold deficient preparations and who have been convicted under this law, can hardly plead ignorance, will probably not plead carelessness, and the inference is just that a desire for gain has led them to sell preparations known to fall short of accepted standards.

The just and wholesome law now enforced in Massachusetts is not oppressive; it makes no requirements which conscientious manufacturers cannot meet. It does punish adulteration and misrepresentation, and for this reason, and no other, it is antagonised by those manufacturers whose evil practices have been detected. The law aims to protect the health and the purses of those who must buy food and drugs upon faith; thus far much good has been accomplished, and the repeal or crippling of the law could not but prove a public calamity.

The *Springfield Republican*, *Boston Traveller* and *Boston Advertiser*, we notice, have been doing good work in exposing the fraudulent conduct of those who are fighting the State Board, and they deserve well of the people and honest dealers in Massachusetts, because they may lose a little avdertising by their course, and are therefore doing the right thing in apparent opposition to their own immediate pecuniary interests.

ANALYSTS' REPORTS.

At the Glamorganshire Quarter Sessions, Dr. W. Morgan, public analyst, reported that during the past quarter he had received sixty-one samples, among which there were—butter one, butterine one, lard two, white pepper one, black pepper three. The samples of butter and lard were all genuine. The butterine was free from deleterious ingredients, and appeared to be perfectly wholesome, and there cannot be any objection to its sale under its proper name. The sample of white pepper was genuine; also two of the black peppers were genuine but of very inferior quality, the other sample containing 6 per cent. in excess of siliceous and earthy matter.

At the Devon Quarter Sessions, on Tuesday, Dr. Wynter Blyth, county analyst, reported that during the quarter he had examined samples of coffee, chicory, flour, sugar, quinine, and arrowroot: seven in all had been submitted for analysis; none of the seven were adulterated. He wrote saying he thought it better that in the future he should be paid a salary instead of taking his remuneration in fees, as the number of samples for analysis would be thereby much increased. During the past quarter neither a sufficient quantity, number, nor variety of samples had been analysed to make any impression on adulteration, nor from such a small number as seven could any useful deduction be drawn as to the prevalence or absence of offences against the Act. The Cornwall county analyst (Mr. J. J. Beringer) has reported that during the last quarter he received twelve samples for analysis under the Sale of Food

and Drugs Act. The results of all the analyses were satisfactory, and called for no remark. The samples submitted were two of lard, two of bread, one mustard, one whisky, one beer, one gin, one sweets, one cocoa, one tea, and one butter.——At the Somerset Quarter Sessions, held at Wells, on Tuesday, the county analyst (Dr. Alford) reported that during the quarter he had analysed 203 samples, and found thirteen to be adulterated, among the adulterated articles being two of coffee and three of mustard, but the adulterations in these were not prejudicial to health.

The Sale of Food Act.—The County Finance and General Purposes Committee on Tuesday reported to the Court of General Sessions for Kent, that during the past quarter 126 samples of food, &c., had been analysed, 32 being certified as adulterated. The expense had been £87 2s. 6d., and of twenty persons proceeded against, eighteen were convicted, and fines imposed averaging 6d. to £3, and amounting in the aggregate to £18 2s. The Committee again expressed their regret at the great want of assistance which they experienced from time to time from the various petty sessional authorities in the difficult and disagreeable duty of putting the Adulteration Act into force. During last quarter a case was taken before justices on the certificate of the county analyst, in which it was stated that an article sold as butter was composed entirely of foreign fat, and as a penalty of 40s. only was imposed the Committee held it was impossible to suppose that any good result would accrue to the unfortunate customers of such unscrupulous tradesmen.

Adulteration of Mustard.—At Gloucestershire Quarter Sessions, the Chairman (Mr. J. E. Dorington) said the county analyst had reported that thirty-two articles had been sent to him for examination, and that four had been found to be adulterated. Three of these were adulterations of mustard. The Police Committee had discussed the question, and they came to the conclusion that, although it was very proper that adulteration of mustard should be prevented, yet as up to a certain extent so-called adulteration was really a necessity of its use, and as it was actually mixed by the wholesale dealers and supplied with an announcement that it was so adulterated to the petty tradesman who were prosecuted for not informing their customers, the Committee rather proposed to direct the Chief Constable only to prosecute in cases where the report of the analyst showed that the mustard was adulterated with flour in excess of the quantity necessary. Sometimes these prosecutions had the appearance of being rather persecutions than proper prosecutions for the protection of the public. The public ought to be protected against adulterations injurious to them. Mr. C. Sumner said he did not think it ought to go forth that adulteration was to be excused if the adulteration were not injurious. He understood the Chairman to say that the adulteration might be permitted where it was not injurious to the purchaser. It might be injurious to the health or to the pocket of the purchaser. If a person applied for a pint of milk, and got a quarter of a pint of milk and three-quarters of a pint of water, it might not be injurious to his health, but it certainly was to his pocket. It seemed to him that the proposition laid down by the Chairman was too wide. The Chairman remarked that he did not mean simply injurious to health, but injurious in the sense that he was buying that which he did not expect to buy. He imagined people in buying mustard expected to buy it in a condition in which they could use it; he was told it could not be used in its raw state, and that it required a certain admixture of other material with it. They could therefore give the police discretionary power not to prosecute in those cases. The Lord Lieutenant (Earl of Ducie) said he should like to inquire whether "pure mustard" was not a trade fiction—whether we were not unable to eat pure mustard. The motion suggested by the Chairman was adopted.

LAW REPORTS.

Condensed Milk Prosecution at Birkenhead.—Analysts at Variance.—At the Birkenhead County Magistrates' Court, last week, before Messrs. S. Ledward (presiding), T. H. Jackson, T. Russell Lee, and C. J. Bushell, Edward Penson, grocer and provision dealer, New Ferry, appeared on an adjourned summons charging him with having sold a tin of condensed milk which it was alleged was not of the quality represented, the fat having been abstracted. Mr. T. M. Bleakley appeared for the defence. It will be remembered that on the former hearing of the case, about three weeks ago, Chief Superintendent Egerton produced a certificate from Dr. J. Carter Bell, public analyst, to the effect that the milk was not a preserved or a condensed milk, but that 90 per cent. of the fat had been abstracted before boiling down with sugar. Mr. Bleakley at the time challenged the analysis of Dr. Bell, and asked for an adjournment of the case in order that he might obtain further evidence as to the quality of the milk. The Bench, in justice to the defendant, directed that a sample of the milk should be forwarded to Somerset House for analysis. The following certificate was now produced from the

authorities at Somerset House:—"Non-fatty milk, solids, and cane sugar, 69·68 per cent.; fat, 10·84; water, 19·48; total, 100. From a consideration of these results we are of opinion that no portion of of the fat has been abstracted from the milk." This certificate was signed by Drs. J. Bell, R. Bannister, and G. Lewin.—Superintendent Egerton said that no further evidence had been obtained, but it seemed, according to the certificate from Somerset House, that there was no case against the defendant.—Mr. Kent (the clerk): It is a case, your worships, of doctors differing.—Mr. Bleakley said that several other eminent London analysts had supplied certificates confirming that from Somerset House, and Mr. Harland, of Messrs. Wigner and Harland, had come down from London specially to prove that no fat had been abstracted from the milk. The Anglo-Swiss Condensed Milk Company, for which he (Mr. Bleakley) appeared, sold thirty million tins a year of the milk, and had carried on business for sixteen years without a single information being preferred against them. As the expenses of the case would amount to about thirty guineas, all through a gross blunder on the part of Dr. Carter Bell, he hoped the Bench would allow the defendant some portion of the costs.—Superintendent Egerton said that Somerset House only charged 10s. 6d. for each certificate.—Mr. Ledward said that the police had no doubt done their duty in endeavouring to protect the interests of the public by sending the tin of milk to Dr. Carter Bell for analysis. That gentleman's analysis, however, had turned out to be very incorrect—at least the Somerset House authorities had pronounced it such. The Bench had acted according to law in referring the matter to Somerset House, according to the certificate from which there was clearly no ground for convicting the defendant. As to the question of costs, the Bench only thought it fair and reasonable that a man who was acquitted should have his costs; but costs would only be allowed subject to taxation.—The summons was then dismissed, the clerk being directed to tax the costs.

At the South Staffordshire stipendiary Court, held on Monday, at Sedgley, before Mr. W. F. F. Boughey, Mr. David Beckley, grocer and provision dealer, Acker Hill and Toll End, was summoned by Mr. J. G. Horder, the inspector under the Sale of Food and Drugs Act, for selling adulterated dripping. Samuel Toy said on the 22nd ult. he purchased a pound of dripping at the defendant's shop at Acker Hill for which he paid 5d. Mr. Horder.—Was it labelled in any way? Witness.—The tin in the shop was labelled "mixed dripping." Was your attention called to the label in any way previous to the purchase? No, sir. Defendant.—Was not the article sold to you as "mixed dripping?" Witness.—I asked for dripping, and I was supplied with dripping and water. Defendant.—Did not the assistant—who was my son—tell you that it was mixed dripping before you said you wanted it for analysing?—No, sir. Mr. Horder put in a certificate from Mr. Jones, the county analyst, who certified that the dripping contained 16 per cent. of water. Defendant.—He purchased it as mixed dripping, and he sold it at a proportionate price. The genuine article was 8d.; that sold to Toy was 5d., and he did not think he was in any way breaking the law. The tin was labelled "mixed dripping" in front. Mr. Green (magistrate's clerk).—The question is whether any person would contemplate that dripping and water was mixed dripping? Mixed dripping, I should think, would mean beef and mutton dripping. The Defendant.—In that case it would be dripping. Mr. Green.—Well, what does "mixed" mean? The Defendant.—Well, in this case I didn't know what it was: it appears to be water and dripping. Mr. Green.—And it is only by a mechanical process that they can be mixed. The Stipendiary fined the defendant £1 16s.

At the Liverpool City Police Court, on Wednesday, before Mr. Raffles, Mr. John Irving, grocer, of 157, Westminster Road, appeared in answer to a summons charging him with selling adulterated rock cocoa. Mr. Marks prosecuted, and Mr. Broadbridge defended. Mr. Marks stated that the defendant was charged with selling cocoa which contained foreign matter. Inspector Baker called at his shop and asked for a quarter of a pound of rock cocoa, and when he received it, the assistant said, "it is not pure, there is sugar and starch in it." There was no label put on the packet. The cocoa was afterwards taken to Dr. Campbell Brown and analysed. He said that it contained 5½ per cent. of moisture, 18 per cent. of sugar, and 25 per cent. of starch, altogether 45 per cent. of foreign matter. No doubt it would be stated for the defence that notice had been given by the assistant that it was a mixture, but they had overlooked the fact that it should be a written or printed notice. If the goods were adulterated they could not get rid of their liability by giving merely a verbal notice. Mr. Raffles.—Certainly not; that has been already decided. Mr. Broadbridge contended that this was the only known preparation of rock cocoa; it was not injurious to health, nor was it sold to the injury of the purchaser. Mr. Raffles.—Then you contend that this is rock cocoa? Mr. Broadbridge.—Yes; this is the article known in commercial circles as rock cocoa. There is no other rock cocoa manufactured. Mr. Marks.—They might equally call it rock starch. Mr. Raffles.—I shall decide according to the analysis that this is not rock cocoa, and impose a fine of 20s. and costs.

At Liverpool, on Wednesday, before Mr. Raffles, Mr. William Sleightholme, 251, Breck-road, was summoned for selling green peas without a proper label describing them, as required by the Sale of Food Act. The peas had been analysed by Dr. Brown, and it was found that they contained as colouring matter salts of copper equal to two and a quarter grains of sulphate of copper per pound tin. These salts of copper were poisonous in large quantities, but in small doses were, according to the certificate of analysis, "astringent and purgative."——Mr. Thomas Taylor, of 213, London-road, was summoned for a similar offence, and the poisonous matter in this case somewhat exceeded that in the other. His Worship: Somebody will be getting poisoned one of these days through eating these peas, and then some of these people who sell them will be brought up on the charge of manslaughter. The defendant said these peas were the very best that could be purchased in 1881, and only a few tons remained. In that year, according to the evidence of Dr. Brown, he used them himself, and he said they were not injurious unless they were taken in large quantities, and the cases brought on then were decided in favour of the defendants. Since then, he (the defendant) had felt perfectly justified in selling these peas under the protection of the Court. Moreover, he had never sold a single tin without telling persons that they were coloured. Indeed, one of his customers, an old lady, told him she preferred them coloured, as otherwise they would not look nice on the table. His Worship: Is the old lady living yet? The Defendant: Oh yes: she bought some only on Monday last. They do not use them in large quantities. Mr. Marks, who appeared for the prosecution, stated that the cases referred to by the defendant in 1881 were brought under a different section of the Act from the present information. The prosecution then was for adulteration simply, and what Dr. Brown had stated was entirely misunderstood. He did not state that he used the peas himself, but he found that his household had been using them; but directly he had found it he put a stop to their use in his house. A fine of 10s. and costs was inflicted in each case for not having the tins properly labelled, and it was pointed out that even if they were labelled, and were adulterated so as to be injurious to health, this would not protect the seller.——Mr. Jesse Holt, Low-hill, was fined 10s. and 15s. costs for selling as rock cocoa an article containing about 58 per cent. of impurities.——Mr. Edward Hayward, carrying on business at 12, Eastbourne-street, was fined 20s. and 15s. costs for selling as butter an article containing 60 per cent. of animal fat.

At the Hammersmith Police-court on Tuesday, Henry Earl, of Church Road, Acton, appeared to answer an adjourned summons for selling lard adulterated with 19 per cent. of added water. The case was adjourned for the attendance of the county analyst, the magistrate doubting whether there had been any adulteration. Dr. Redwood now said water to that extent was added purposely as an adulterant. Lard and water were beaten up together. In reply to the magistrate, Dr. Redwood said dipping lard into water would not cause it. The defendant said the lard came from America. Dr. Redwood added that he did not suppose the defendant added the water; it was a manufacturing operation. Mr. Sheil allowed the case to be settled on payment of 12s. 6d. costs.

Alleged Adulteration.—Robert Dennis, of 18, Russell-street, dairyman, who was summoned on the 31st ult., by Inspector Luke, for abstracting cream from milk, so as to injure its quality, appeared to-day. The Government analysts, to whom it had been referred to arbitrate between the conflicting local analyst, Dr. Gramshaw, and Mr. Harland, analyst on behalf of the defendant, have sent in their certificate, which was as follows:—"No change had taken place in the milk which would interfere in the accurate estimate of it. From a consideration of these results we are unable to affirm that cream has been abstracted, the analysis being as follows:—Non-fatty solids, 8·84 per cent.; fat, 2·82; water, 88·34."—Mr. Mitchell, who appeared for the defendant, now applied that the summons against his client should be dismissed with costs.—The Bench concurred, awarding £6 6s.

RECENT APPOINTMENTS.

Mr. Charles E. Casselk, F.C.S., F.I.C., has been appointed Public Analyst for the Borough of Chipping Wycombe, Bucks, at 10s. 6d. for each quarterly report, 10s. 6d for each ordinary analysis, 21s. for each analysis of water, and 21s. 3d. per mile for each compulsory attendance as a witness.

Mr. David Hooper, F.C.S., of Birmingham, has been appointed by the Secretary of State for India Analytical Chemist and Quinologist to the Nilgiri Government Cinchona Plantations in the Madras Presidency.

GLUCOSE IN LEATHER.

According to the *Shoe and Leather Review*, the falsification of the weight of leather by adding glucose, or grape sugar, appears to be carried on rather extensively in Germany, and the shoe trade societies are taking steps to protect themselves from the imposition. A simple test is recommended, which consists in placing pieces of the leather in water for the space of twenty-four hours, when the glucose will be dissolved by the water, and the result will be a thick, sirupy liquid. When two pieces of the leather are placed together and left in that position for a time, it will be found difficult to separate them, as the gummy exudations will stick them together. It is stated that some samples of sole leather were found to contain as high as 30 to 40 per cent. of extra weight. Another test recommended is to cut off small pieces of the leather, and, wrapping them up in a damp cloth, lay them away for a few days in a temperate place. If the leather is adulterated, the pieces will be found to be stuck together, and surrounded by a sirupy substance in proportion to the quantity of the adulterant used; and the peculiarity about leather treated with grape sugar is that, after wetting, it is difficult to dry, and resembles gutta percha or untanned leather more than the genuine article.—*Scientific American.*

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

No.	Name of Patentee.	Title of Patent.	Price
1333	A. J. Boult	Burning Hydro-Carbon Oils, together with Steam or Water, &c.	6d.
1366	H. J. Haddan	Apparatus for Manufacture of Illuminating and Heating Gas, from Petroleum and other Oils	2d.
1339	H. E. Newton	Apparatus for Producing Coal Gas	6d.
1349	J. S. McDougall	Production of Sulphurous Acid, &c., and applying the same to the treatment of Wood Pulp, &c.	4d.
1390	A. G. Bouet	Material or Composition to be used as a Substitute for Plaster of Paris, Tripoli, or the like, and Manufacture of same	2d.
1427	W. Ramsay	Manufacture of Sulphur Compounds	2d.
1432	Sir J. S. Blane	Treating White Peat for production of an agent suitable for combining with Paints, Varnishes, Paper Pulp, and other materials to render same fireproof, and impervious to moisture	4d.
1447	W. B. Wicken	Regenerative Gas Burners and Lamps	4d.
1469	M. Zingler	Treatment of Fish or other Animal Offal, for Producing Artificial Guano and other products	2d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Pharmaceutical Journal; The Sanitary Record; The Miller; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; The Inventors' Record; New York Public Health The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; Cowkeeper and Dairyman's Journal; Sugar Cane; Country Brewers' Gazette; The Medical Record; The Grocers' Gazette; London Water Supply, by Crookes, Odling and Tidy; Chemical Review; Independent Oil and Drug Journal and Paint Review; Science Monthly; Journal of the Society of Chemical Industry.

THE ANALYST.

JUNE, 1884.

THE Health Exhibition opened this month at South Kensington affords another opportunity to the public, to learn the nature of the various ingredients used in the preparation of most of the articles of every-day consumption.

Although the Exhibition is most successfully arranged, so as to display, in a prominent manner, all the articles connected with food, yet the public are only shown what is done by the most careful and respectable firms, whose names are a sufficient guarantee that only materials of the highest quality are used in the preparation of the goods which they show.

All who are connected with food produce know how, from time to time, the desire on the part of the consumer for cheap goods, is the cause of the introduction of articles called "substitutes," which are offered to the manufacturer at one-third the price of the genuine material, and which frequently consist of some cheap and simple preparation, the very opposite, in its chemical character, to the article for which it is said to be an efficient substitute: several cases of this kind have recently been brought to our notice. For instance, we have seen an article to be used as a substitute for tartaric acid, the composition of which has been found to be acid sulphate of alumina in solution; a substance which, if introduced into the manufacture of bread or biscuits, is as objectionable as alum, and quite as much an adulterant. Bisulphate of potash is also sold under a name similar to tartaric acid, and is equally as worthless as sulphate of alumina. These are only two instances out of many, and serve as an additional argument to show the keen competition in trade, which causes the manufacturer to produce, and unscrupulous firms to sell, such articles under "Royal Letters Patent," or some other heading of this sort, to attract the notice of the consumer.

The public analyst, although, of course, he should be cognizant of these facts, has quite enough work for the remuneration paid to him, and in addition to this there is the fact that the Sale of Food and Drugs Act is so limited in its aim and scope, as to practically prevent the analyst from testing anything but the common articles of food, such as bread and milk, unless they are sold under some recognised name. Let him once travel outside these lines, and a whole host of objections are raised. What is really wanted, is more stingent legislation, similar in character, to that at present in operation in the United States and Paris.

We have several times printed in this Journal the monthly reports of the Paris Municipal Laboratory, showing the complete and thorough manner in which the food supply of that city is protected: why cannot something of the same sort be done in London? What is wanted is a measure defining what is and what is not adulteration, and prohibiting the use of articles which are frequently employed at the present time, and the sale of which, while benefitting one class, seriously injures another, by substituting an inferior article, for one of better quality.

Considerable good would have been done by the Health Exhibition, had they exhibited a case of these so-called substitutes. The prominent display of this class of article in a National Exhibition, would have done much towards putting a stop to a trade, which, while it enriches the unscrupulous trader, places the honest manufacturer in an awkward position.

PROCEEDINGS OF THE SOCIETY OF PUBLIC ANALYSTS.

THE meeting of the Society of Public Analysts, which should have been held on 14th May, was postponed.

The next meeting will take place at the Chemical Society's Rooms, Burlington House, on Wednesday, the 18th June.

A METHOD FOR THE EXAMINATION OF WATER BIOLOGICALLY.

H. S. CARPENTER, F.I.C., F.C.S., AND W. O. NICHOLSON, F.C.S.

Read before the Society of Public Analysts, on April 16th, 1884.

THE germ theory of disease, though essentially of modern growth, is yet not by any means new. And although held with unfaltering faith by a large proportion of the most eminent scientific men of the day, it has certainly not met with such general acceptance from those to whom it would appear to be of the first importance—the medical profession.

It is perhaps scarcely within our province to enter here into a controversy in favour of this theory; the brilliant researches of Pasteur, Koch and others, must be too well known to members of this Society to make reference to them necessary. Neither is it desirable that we should endeavour to sum up the arguments of those who do not accept it. But we feel bound to add that the very large and constantly accumulating amount of corroborative evidence that it has received of late years would seem to lead irresistibly to the conclusion that the day cannot be far off when it will be accepted as a scientific fact.

Those who, with us, hold this view, will at once admit the importance of the subject; which, indeed, it is almost impossible to over-estimate. To those, on the other hand, who hold the contrary opinion, this paper will be of little interest from a hygienic point, though possibly it may be of some biologically.

No doubt all amongst us will remember Dr. Frankland's reference to an outbreak of typhoid fever at Lausen, in Switzerland, in a paper read before the Chemical Society in November, 1876, the evidence being indisputable that the disease was conveyed by the water supply, and, in fact, we are constantly being reminded of the part which water plays in the propagation of certain diseases, either directly, or perhaps, through the agency of the milk-can.

It therefore appears to be of the greatest value that some method should be devised for detecting the presence or absence of bacterial organisms in water. Such a method we are about to lay before you to-night.

It is, no doubt, a fact that, under certain conditions, these bacterial organisms may be taken in countless myriads, without any bad results arising. Therefore not until it is possible to distinguish between the injurious and non-injurious ones shall we be able to say with certainty as to whether a water will cause disease or not. In the present state of our knowledge we ourselves should be inclined to hold that only a water perfectly free from these organisms is entirely safe.

However, we do claim that we have made a distinct advance, and an advance in a direction which, without, we hope, undue confidence, may be reasonably anticipated to lead to more valuable results than can be obtained from a purely chemical examination.

It is quite conceivable that a sample of water may contain so small a number of organisms or their germs, that very possibly none of them may be brought within the limited field of the droplet under the microscope.

The method we are about to lay before you has been devised for the purpose of fostering the growth and reproduction of any organisms (vegetable) present in the water, so that, by reason of their increased number, they may readily be detected.

The principal difficulty that confronted us was the prevention of the access of any adventitious germs present in the atmosphere. This we hope to have satisfactorily overcome.

The apparatus employed by us consists (i) of a propagating vessel. For this we use a short-necked four-ounce flask which is fitted with a caoutchouc stopper, through which pass two tubes, bent at right angles, slightly drawn out, so as to admit of their being readily fused up.

(ii). A transferring vessel. This is a tube having a bulb capable of containing about 25 c.c. blown upon the side.

(iii). A tube for sterilising the air necessary to be supplied. This is simply a piece of combustion tubing about 18 inches long, 9 or 10 inches of it being loosely packed with asbestos and which can be connected with a refrigerator.

We then proceed as follows:—Into the propagating flask 50 c.c. or thereabouts of Pasteur's solution, previously filtered and recently boiled, are introduced. This is then boiled for some time and whilst steam is still issuing the tubes are plugged with cotton wool (sterilised).

The sterilising tube is then attached and kept at a red heat and the flask is again boiled, whilst a current of sterilised air slowly passes. After a short time the tubes are sealed up hot.

We thus have a flask containing a fluid, devoid of life, but admirably adapted for supporting lower organisms.

Now for the sample. The two ends of the transferring bulb are drawn out to fine points, and one is sealed up. A little distilled water is then introduced and the bulb heated in a calcium chloride bath till the water is dissipated, after which the point is sealed. The bulb thus contains practically nothing but aqueous vapour. One end is now broken off 3 or 4 inches under the surface of the sample water, to be examined; the water rushes up and nearly fills the bulb; the point is then immediately sealed. The next step is to introduce the sample of water in the bulb into the propagating flask.

Having heated the sterilising tube, and attached the refrigerator, a rapid current of air is passed for some time in order to clear the apparatus. One of the points of the transferring bulb is then passed through a flame in order to destroy possibly adherent germs and connected with the refrigerator; the other point of the bulb tube, and

the point of the propagating flask, are heated in a similar manner, and connected by a piece of india-rubber tubing, which has just been taken out of boiling distilled water.

The refrigerator is now surrounded with cold water and the several points are broken off by pressure on the rubber connections.

Owing to the lesser pressure (partial vacuum) in the flask, the water speedily passes over, followed by sterilised air, after which all that has to be done is to seal up and disconnect.

The propagating flask is afterwards removed to any convenient place where it is exposed to the light and can be kept at a suitable temperature and is examined daily, so that the first appearance of any turbidity may be observed.

In the case of waters contaminated with sewage we find this usually occurs in 2 to 4 days, whilst with waters that are tolerably pure 7 to 10 days are required.

The extent and general appearance of the cloudiness enables us to form some opinion as to the desirability of the sample; and a careful microscopical examination with high powers, made immediately after the opening of the flask, reveals the nature of the organisms. We use a $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$, and $\frac{1}{25}$, in succession and have found that whilst some waters contain various kinds of bacteria, yeast, and other organisms, in others only an unicellular fungus or confervoid growth can be distinguished.

We may add that the Thames water supplied by some of the London companies provides a fine variety of organisms.

It is our intention to examine a much larger number of waters, from all parts of the kingdom, in this manner, and shall be very much obliged if at any time any member of this Society can favour us either with a pure sample of water or of one which may reasonably be suspected of propagating diseases.

ON LOGWOOD AS A RE-AGENT.

[By A. Ashby, M.B., F.R.C.S.]

Logwood, as is well known, has long been used as an indicator in alkalimetry, but I am not aware that the peculiar action upon it of many acids to be described in this paper has been previously observed. Alterations in the colour of logwood extract and of hæmatoxylin, under the influence of various agents, are, of course, well-known. In Watt's Dictionary of Chemistry, Vol. iii, p. 732, it is stated that acids turn the colour of logwood dye to yellow; alkalies deepen its colour, and give it a purple or violet hue. Again, on page 662. of the first supplement of the same work, we read: "a solution of hæmatoxylin, or paper saturated with it, is recommended by Wildenstein (Zeitschr Anal. Chem., ii. 9) as a test paper, especially for the detection of ammonia, the fixed alkalies, alkaline earths, and certain metals. Swedish filtering paper thus prepared has a yellowish colour when dry, and is coloured red, violet, or violet blue, by the smallest trace of an alkali. And on page 920, Pt. 2, Vol. viii. of the Dictionary, hæmatoxylin is recommended as an indicator in acidemetry, especially for the estimation of non-volatile

acids, which, by its aid, may be directly titrated with alkaline bicarbonates, and, according to Frébault, it may be used for the estimation of iodine.

I find that logwood, or hæmatoxylin, is capable of being put to many more uses than the foregoing.

The re-agent may be used as a test paper, but it allows of greater delicacy when the method, to be presently described, is put in practice.

The paper may be made from an alcoholic or aqueous extract of logwood. To prepare the latter, pour 100 c.c. of boiling water on to about 2 grammes of logwood chips, and allow it to extract for an hour or so. Then draw pieces of filter paper through the solution one or more times, according to the depth of tint desired. When dried they should have a uniform pale buff colour. The paper should not be fingered or touched with metallic substances whilst wet, as a blue colour is thus readily imparted to it.

Hæmatoxylin paper may be made in the same way, using about a 0·1 per cent. aqueous solution.

In use, the paper is moistened with the solution to be tested and dried in a current of heated air. I find about 180° C. a convenient temperature, and it is desirable that it should have been subjected to this heat before being used. A piece of copper pipe, an inch or so in diameter and about a foot long, placed in a slanting direction over a burner, answers the purpose, and it may be so arranged as to fix on to an ordinary Bunsen's burner. The test paper must not be dried over a naked gas flame, on account of the acid products of combustion. It gives a purple colour with alkalies, and a rose red colour with mineral and some fixed organic acids, this particular re-action only taking place on evaporation, but with a comparatively strong solution of the acids it takes place at once. When moistened with weak solutions and dried as described, a beautiful evanescent rose-coloured blush, commencing at the edges, traverses the surface of the paper. On the other hand, volatile and some fixed organic acids either give no re-action with logwood, or else impart to it a more intensified yellow tint.

With extremely weak solutions it is necessary to repeat the moistening and drying several times, adding drops of the solution to the paper rather than re-dipping the latter into the solution, so as to concentrate the acid on the paper; the sensitiveness of the re-action being thus considerably enhanced. The surface of the paper must be closely watched during the drying, as the colour is exceedingly fugitive with very weak solutions.

Perhaps a better way to use logwood as an indicator, is to evaporate its extract on white porcelain over a water bath or argand burner. Several very small drops of it should be evaporated at the same time, to one of them should be added a drop of the solution to be tested, the others serving for subsequent use and for comparison of colours. When dry, if there is no distinct reaction, the former may be re-moistened with a drop of the solution under examination and again evaporated. This process may be repeated if necessary, and thus the re-action becomes extremely delicate.

In the following table are embodied the re-actions of various acids and acid salts with logwood so far as I have observed them :—

Name of Acid.	Colour reaction on evaporating	Subsequent reaction with Alkalies	Name of Acid.	Colour reaction on evaporating	Subsequent reaction with Alkalies
a. Mineral acids:			*b. Organic acids:*		
Arsenic ..	Rose red, charring ..	..	Acetic	Bright. Yellow ..	Purple
Arsenious ..	Grey	Purple	Benzoic ..	*Nil*	Ditto
Boracic ..	Rose red	*Nil*	Butyric ..	Slight yellow ..	Ditto
Carbonic ..	*Nil*	Purple	Cinnamic ..	Yellow	Ditto
Hydrobromic ..	Rose red	Slight bluish	Citric	Red	Ditto
Hydrochloric ..	Rose red, slight charring	Purple	Formic ..	Bright yellow ..	Ditto
			Gallic	*Nil*	Ditto
Hydriodic ..	Rose red, slight charring	Slight bluish	Hippuric ..	Orange red	Ditto
			Lactic	Yellow	Ditto
Hydrocyanic ..	Rose red	Purple	Malic	Orange red	Ditto
Hydrofluoric ..	Rose, changing to orange	Ditto	Meconic ..	Rose red	Ditto
			Oxalic	Rose red	Ditto
Hydrosulphuric	*Nil*	Ditto	Picric	Reddish	Green
Iodic	Colour destroyed, no red	*Nil*	Salicylic ..	Red, somewhat orange	Purple
			Succinic ..	Yellow	Ditto
Nitric	Rose red, fugitive, not reproducible	Ditto	Tannic ..	Orange	Ditto
			Tartaric ..	Red	Ditto
Nitrous ..	Colour destroyed ..	Ditto	Uric	*Nil*	Ditto
Molybdic ..	Purple grey	Purple	Valerianic ..	Slightly yellow ..	Ditto
Osmic	Blue	..	*c. Acid salts:*		
Phosphoric ..	Rose red, charring ..	..	Acid phosphate of soda NaH_2PO_4 ..	Orange	Ditto
Phosphorous ..	Rose red	..			
Sulphuric ..	Rose red, charring ..	Purple	Bisulphate of potash $KHSO_4$ ..	Rose red	Ditto
Sulphurous ..	Rose red	Ditto			
Titanic ..	Rose red	Ditto			
Tungstic ..	Purple grey	Bluish			
Vanadic ..	Purplish grey ..	Purple	Bitartrate of potash ..	*Nil*	Ditto

The carbonic acid appears to affect the colour of logwood in a very small degree, turning it slightly to a reddish grey, but as it is not sufficient to be of any practical use, I have put the re-action in the table as *nil.*

With logwood or hæmatoxylin paper, the rose red re-action is easily perceptible with an acidity equal to 0·2 SO_3 per 1000, and by concentrating on the paper a few times, 0·1 SO_3 per 1,000 gives a distinct re-action.

With a dried spot of logwood extract on white porcelain 0·05 SO_3 per 1,000 gives a slight re-action the first time of evaporating it. A re-action can be obtained with a solution containing only 0·025 SO_3 per 1,000, if a drop of it is added to the logwood spot several times in succeesion, adding the drops before the remainder has had time to evaporate to dryness.

Logwood affords a means of distinguishing between nitric and other mineral acids, such as the sulphuric or hydrochloric, for when logwood paper is moistened with a solution containing nitric acid and dried, a rose red blush traverses the paper, but is not re-produced on repeating the operation, and it will be found that the paper is then no longer turned purple by alkalies, as the hæmatoxylin has been destroyed. It must be borne in mind, however, that the re-action with alkalies cannot be obtained after the rose red colour has been produced with logwood through the agency of boracic acid.

The colouring matter of the paper is more readily charred by sulphuric acid and a few others than is the paper itself.

It is, therefore, possible with the aid of logwood, to detect the presence of free mineral and some fixed organic acids when mixed with volatile organic acids.

An admixture of a mineral acid with a coloured vinegar to the extent of one part H_2SO_4 per 1,000 can be readily detected by the use of logwood paper, and an admixture of 0·25 per 1,000 can be observed when using a spot of logwood extract dried on white porcelain. I presume that notice would not be taken of less quantities than that, but the limits of sensibility may be pushed still further with colourless vinegars. If, therefore, a spot of logwood extract on white porcelain, on being moistened with a drop of a sample of vinegar, and dried, gives no red colour, then the article under examination may safely be declared to be free from adulteration with mineral acids.

If, on the other hand, there should be a somewhat indefinite reaction, or a distinct rose-red colour, then the sample should be analysed by Hehner's method, since the colour might be due to the presence of tartaric acid. Logwood cannot be employed for the detection of mineral acids when mixed with lime or lemon juice, because citric acid also gives the re-action.

I find that when nitric acid is in a vinegar its presence may be detected by logwood paper, which will assume at first the characteristic rose-red colour, vanishing on drying, and after, if necessary, repeated applications of the vinegar, the red colour will no longer be observed, and a purple colour will not be given to the paper on the addition of an alkali, the hæmatoxylin having been destroyed by the nitric acid.

I have observed that when a vinegar containing free nitric acid is evaporated and incinerated, the residue is, nevertheless, alkaline; therefore, logwood paper goes still further than Hehner's qualitative test for the admixture of mineral acids with vinegar, since that is not applicable to the detection of nitric acid, moreover, it is not available with distilled vinegars, whereas the logwood re-action is.

I have made some experiments which show that logwood may be employed as an indicator in the direct titration of acetic acid in acetates, and no doubt in the titration of other organic acids, which do not give the rose-red colour with it, by adding standard sulphuric acid to a known quantity of the salt in solution, until the free mineral acid re-action with logwood is just perceptible. I have not yet had time to pursue this branch of the subject further, but propose to take it up on a future occasion with special reference to the assay of crude commercial acetates.

Logwood does not readily lose its sensitiveness. I happened to leave some logwood solution in an open vessel in my laboratory in December last. In the middle of March I made some logwood paper from this, purposely leaving it exposed, and it still remains sensitive.

These re-actions of logwood may be used conversely for the detection of logwood when employed as a colouring matter in wines, &c. I coloured some sherry slightly with it, and on dipping a piece of filter paper into it and drying, I found that ammonia gave a purple colour to it; then, on moistening another piece of the paper with nitric acid, and drying, a fugitive rose-red colour was produced; but ammonia would then no longer give to it a purple colour. The characteristic reactions of hydrochloric and sulphuric acid, using the latter about deci-normal strength, were given.

In short, logwood paper had been made from the artificially coloured wine.

I next tried the behaviour of the natural colouring matter of port wine, and for that purpose I dipped some filter paper into the wine and dried it. Ammonia gave it a dirty

green colour. Moistened with nitric acid and dried, a rose-red colour was not produced, but in place of it a yellow, which was not afterwards changed by ammonia.

The colouring matter of claret behaves in precisely the same way.

I have not yet had an opportunity of observing the behaviour of other colouring matters which are occasionally used for colouring wines, when treated in a similar manner, to see if logwood may be distinguished from all of them, but hope to be able to do so before long.

I think, however, that if a wine should be found to yield on paper a residue behaving after the fashion of logwood, it may fairly be considered to have a colouring matter other than its own natural one.

ON THE COMPOSITION AND ADULTERATION OF FRUIT JAMS.

By M.A. Adams, F.C.S., F.R.C.S.

A few months ago, when several samples of fruit jam were brought for examination, under the provisions of the "Food and Drugs Act," I was quite at a loss for any trustworthy guide to assist me in the necessary examination, and so far as I know, this field of investigation has not been much worked. On this account, therefore, I trust to be excused for offering the following remarks and figures, relating to the nature and composition of jams. I am painfully aware that a series of somewhat tedious proximate analyses have not brought to light much that is valuable, yet in so far as no such analyses have hitherto been published, they may go for what they are worth, and perhaps save others, bent on similar investigation, some little trouble, or possibly even open out suggestions for the better means of attacking the question of jam adulteration than are at present in use.

The following analyses relate to three classes of jam:—*Home made*, which of course we know to have been made of nothing but the pure fruit and cane sugar. A *commercial jam* of a *most superior* make, which we have every reason to believe is also absolutely pure, and lastly, a *commercial jam* of *very inferior* quality, which was found to consist, not wholly of the fruit which it was represented to be made of, but largely diluted with apple pulp.

The analyses show the per-centage composition as regards glucose, cane sugar, other soluble matters, ash and moisture.

The utmost range of difference in regard to *moisture* lies between 37·5, and 23 per cent., and the average of good jam is about 30 per cent.

The *Ash* in all cases is less than 1 per cent., and ranges from 0·22 per cent. to 0·95 per cent.

The *Skins and Seeds* (of course this does not include the stones of plums. apricot or damsons) are less than I expected, and range from 1·02 to 11·45 per cent.

Other Soluble Matter is a "difference figure," and, except in the case of "Steer's Apricot," in which it amounted to 14·07!!, averaged 3·83 per cent.

As of course was to be anticipated, the bulk of the substance of jam is sugar, amounting to an average on the dried substance of 88·6 per cent., and ranging from 74·77 per cent. to 96·98 per cent., but, contrary to my expectation by far the larger part

of this sugar is inverted; but in this particular comes out the most conspicuous of the differences between the several descriptions of jam experimented upon, for while on an average only 6·71 per cent. of uninverted sugar could be found in the *home made*, in Beach's there is 27·85 per cent., showing that at least in the ordinary domestic method of production the cane sugar is almost wholly inverted.

This of course, absolutely negatives any attempt at determination of adulteration, if it may now be so considered, by the substitution and artificial glucose for cane sugar in the manufacture.

I have nothing more at present to say on the chemical aspect of the analyses; from that point of view the matter is still pretty barren of indications which can assist in the demonstration of adulteration. So far as I know the only adulteration practised is the substitution of inferior fruit, or other vegetable pulp, for the more valuable fruit which it is ostensibly sold for, much in the same way as chicory is mixed with and sold as coffee for the purpose of extorting the price of coffee for the less valuable chicory. Among the many substances said to be used for this purpose in the manufacture of commercial jam, are mangel-wurzel, turnip, carrot, etc., and a common form of gelatine to fortify the pectose substances, but the principal ingredient of adulterated jam is more often apple pulp, the apples so used being refuse windfalls, which are totally unserviceable for any other purpose.

The detection of these foreign vegetable substances resolves itself into an investigation by the microscope, and is not easy; for at the outset, the cellular and fibro-cellular structures, which enter into the formation of fruits, such as are usually made into jam, are naturally similar to the analagous structures in the adulterants, and to make the matter worse, the process of manufacture so breaks down and destroys the original natural features of the tissues that often, as a matter of practice, one has to deal with a mass of debris in which it is impossible to trace sufficiently the natural structural features to permit of anything like a safe conclusion as to admixture. It is true there are a certain few characteristic structures, like the cuticles of the raspberry and currant, which are very enduring, and such as none with adequate knowledge could fail to recognize, but the main bulk of the cellular tissue composing the parenchyma of the fruits is so soft and diffluent, and so similar that their slight special peculiarities are quickly and entirely lost in the mess to which they are reduced in the making of jam. Such, however, as remains to be observed are rendered more conspicuous by certain treatment; for instance, by staining with Hoffmann's violet, the cells are pretty generally made to show up well, and by tincture of iodine, the cells of apple, to the exclusion of all other cells are stained a most characteristic pinkish purple or greenish colour in such a manner that the presence of apple may be detected with the greatest certainty and utmost ease, and within certain limits a quantitative estimation may be arrived at. In the raw apple, the development of this colour does not necessarily occur on the treatment by iodine, but always follows boiling in dilute acid, the natural acid of the fruit being usually of itself sufficient to determine the reaction.

I beg to acknowledge the assistance of Mr. L. Stansell in the conduct of these analyses.

CONCLUSION OF THE PROCEEDINGS OF THE SOCIETY OF PUBLIC ANALYSTS.

ANALYSES OF JAMS MANUFACTURED IN 1883, SHOWING PER-CENTAGE COMPOSITION.

	Glucose.	Cane Sugar.	Other Soluble matter.	Skins and Seeds.	Ash.	Moisture.
BEACH'S						
Black Currant	42·63	19·40	3·94	3·64	·44	29·95
Red Currant..	34·38	38·40	1·11	2·61	·34	23·09
Blackberry ..	29·88	24·20	6·39	11·45	·45	27·63
Raspberry ..	36·20	28·48	0·98	5·06	·30	34·56
Strawberry ..	30·90	35·91	2·94	2·44	·28	27·53
,, ..	20·00	41·45	3·82	3·29	·40	31·06
Gooseberry ..	51·88	12·11	4·19	2·39	·22	29·21
Apricot ..	32·67	30·44	1·75	1·42	·34	33·38
Plum	43·62	22·58	3·45	2·43	·53	27·39
,, ...	37·68	29·88	0·40	1·26	·44	30·34
Damson ..	38·18	23·52	5·00	2·40	·34	30·56
Average ..	35·67	27·85	3·09	3·49	·37	29·52
HOME MADE						
Black Currant	55·01	7·67	3·31	8·44	·81	24·76
Raspberry ..	55·58	2·85	6·81	7·63	·48	26·65
Strawberry ..	57·23	2·27	3·17	3·03	·37	33·93
Gooseberry ..	60·42	3·99	1·11	3·35	·66	30·47
Plum	51·41	5·59	7·35	2·58	·35	32·72
Damson ..	51·16	8·45	4·94	2·81	·59	32·72
Quince ..	40·98	16·14	7·21	2·56	·39	32·72
Average ..	53·11	6·71	4·84	4·34	·52	30·47
STEER'S						
*Black Currant	42·55	14·17	3·62	2·56	·40	36·70
*Raspberry ..	51·86	8·86	2·76	2·56	·80	33·16
*Strawberry ..	65·16	0·94	3·60	3·35	·30	26·65
Apricot ..	47·35	12·22	14·07	1·02	·46	24·88
*Plum	46·98	6·22	3·33	4·98	·95	37·54
* ,, ...	50·96	5·28	6·96	1·77	·48	34·55
Average ..	59·81	7·95	5·72	2·70	·56	32·24

* All these were largely adulterated with apple.

DO. DO. CALCULATED UPON THE DRY SUBSTANCE.

		Glucose.	Cane Sugar.	Other Soluble matter.	Skins and Seeds.	Ash.	Moisture in original substance.
Black Currant—	Beach ..	60·85	27·69	5·62	5·19	0·62	29·95
,,	Home Made	73·11	10·19	4·40	11·21	1·07	24·76
,,	*Steer ..	67·22	22·38	5·71	4·04	0·63	36·70
Red Currant—	Beach ..	44·70	49·92	1·53	3·39	0·44	23·09
Blackberry—	Beach ..	41·28	33·43	8·83	15·82	0·62	27·63
Raspberry—	Beach ..	46·78	43·52	1·49	7·72	0·45	34·56
,,	Home Made	75·77	3·88	9·28	10·40	0·65	26·65
,,	*Steer ..	77·59	13·25	4·12	3·83	1·19	33·16
Strawberry—	Beach ..	42·64	49·55	4·05	3·36	0·38	27·53
,,	Beach ..	29·01	60·12	5·54	4·77	0·58	31·06
,,	Home Made	86·62	3·43	4·79	4·58	0·56	33·93
,,	*Steer ..	88·83	1·28	4·90	4·56	0·41	26·65
Gooseberry—	Beach ..	73·28	17·10	5·92	3·37	0.31	29·21
,,	Home Made	86·89	5·73	1·58	4·81	0·95	30·47
Apricot—	Beech ..	49·04	45·69	2·62	2·13	0·51	33·38
,,	Steer ..	63·03	16·26	18·73	1·35	0·61	24·88
Plum—	Beach ..	60·07	31·09	4·75	3·34	0·73	27·39
,,	Beach ..	54·09	42·89	0·57	1·80	0·63	30·34
,,	Home Made	76·41	8·31	10·92	3·83	0·52	32·72
,,	*Steer ..	77·85	8·06	10·63	2·71	0·78	34·55
,,	*Steer ..	75·21	9·95	5·33	7·97	1·52	37·54
Damson—	Beach ..	54·98	33·87	7·20	3·45	0·49	30·56
,,	Home Made	75·29	12·43	7·27	4·13	0·87	32·05
Quince—	Home Made	60·90	23·98	10·71	3·80	0·58	32·72

* All these were largely adulterated with apple.

REVIEWS.

THE PRINCIPLES OF THEORETICAL CHEMISTRY, WITH SPECIAL REFERENCE TO THE CONSTITUTION OF CHEMICAL COMPOUNDS. By *Ira Remsen, M.D., Ph. D.Professor of Chemistry in the John Hopkins University, Baltimore.* London: Baillière, Tindall and Cox, 20, King William Street, Strand.

WHEN the first edition of this little book was published some years ago, it then struck us as supplying a distinct want, by bringing together fully, and yet within a limited space, the so-called theories of chemistry. The present edition is much improved, and the chapters on atomicity, and the constitution of carbon compounds, have been extended and revised, with the result of increasing their value. The great object of the work consists (while dealing with all the known hypotheses), in showing the exact connection of each theory of the constitution of bodies with its experimental proof, and so keeping the mind of the student clear, as to how far it is safe to run after any particular idea. To follow the author's words, we know that he considers harm has been done to the science of chemistry, by a too free use of hypotheses, on the part of those who are ignorant of the facts which suggest them. This has been, and is, particularly noticeable, in connection with the use of structural or constitutional formulæ, and it is heart-rending to see the merest tyros in chemistry, employing such expressions with a freedom which may well astonish one who knows their true significance. An experience of years, has led Dr. Remsen to the conclusion, that these formulæ are used by students without any clear understanding, and the great object of his work, is to do something to correct this evil. It must not, however, be thought that upon this point the author is a Don Quixote, with constitutional formulæ for his windmills, because, (page 102,) when discussing the various possible modes of expressing acetic acid, he says:—"It must be distinctly stated, that we cannot use the valence hypothesis, except to supplement the *reaction* and *synthesis* formulæ. We are not justified in going beyond the facts established. Here lies the danger in the use of structural formulæ. Their wholesale use, to express something about which we know absolutely nothing, has tended to bring them into disrepute, but this fact should not cause their entire rejection, for there is, undoubtedly, much of value in them, when rightly used." These words appear to us a very just estimate of a much debated question among chemical teachers, and show the care of the author in not following too much in a groove. Again, upon another page, we find the following cogent remarks:—"It cannot be denied that we are now in a period of chemistry which may fairly be called *formula worship*. By weaker minds, more value is attached to a formula, than to that which it is intended to represent. In consequence of this truth, it has happened that a large number of chemists have regarded the determination of a formula for a compound, as a great object to be accomplished, and forgotten that what we ought to know, and what is of vastly greater importance for the science, is the chemical conduct of the compound. If, knowing this, we can represent it by means of a formula, not only are we justified in doing so, but the formula becomes an efficient aid in dealing with the substance." The work, commencing with a study of atomic weight and volume, proceeds, in the fifth chapter, to deal with atomicity, or valence of elements, and this will be found to be very exhaustive and carefully written. All the various ideas of ordinary atomicity,

difference in valence of atomic and molecular compounds (which the author condemns as really an unnecessary distinction), double linkage and variable valence, are fully discussed, and the exact extent of experimental proof, upon which each idea is based, is fully detailed. Dr. Remsen finally inclines to agree with Würtz, in considering that valence really ought to mean, not the absolute power an atom has to hold other atoms in combination, but rather the power it actually exhibits in any given compound; thus abandoning the idea of valence as ordinarily defined, and substituting for it a variable idea, depending on the nature of the compound which the particular atom forms with others. The discussion of all the experimental proofs upon which we base our constitutional formulæ in organic chemistry is exceedingly plain, and will be found of the greatest value to a student already possessing some general knowledge of the chemistry of carbon. Such an one, sitting down to the last section of the book, will rise up with the whole subject clear before his eyes in a perfectly different light to what he has probably before seen it, and he will most likely heave a sigh of relief, and say to himself that organic chemistry, is, after all, not the dreadful thing he hitherto thought it. It is not a book for a beginner exactly, but for a student in, as it were, the transition stage from junior to senior classes, it will be found invaluable, and as such, has our sincerest commendation.

A SHORT TEXT-BOOK OF INORGANIC CHEMISTRY. By *Dr. Hermann Kolbe, Professor of Chemistry in the University of Leipzig. Translated and Edited by T. S. Humpidge, Ph.D., B.Sc., (Lond.) Professor of Chemistry and Physics in the University College of Wales, Aberystwyth.* London : Longman's, Green and Co.

WHILE granting a real *raison d'être* for Dr. Remsen's book, just passed in review, we cannot extend the same admission to the present work, even in the face of the Editor's hope in the preface " that it will supply a definite want among teachers and students, corresponding to that which the Editor has himself felt." If Dr. Humpidge has found so great a vacuum in respect of suitable short treatises by English chemists on this subject, that he has been driven to translate the work of a German author to fill it, then we fear he must have lived too much the life of a chemical anchorite, because their name is already legion. The Editor gives the Author's preface (which is practically a short lecture on the necessity of attending lectures, and how far the lecturer should go beyond general principles into the domain of descriptive chemistry), and takes care to state that he fully agrees with the propositions therein formulated. This is very much like putting up a mark to shoot it down again, because it is the exact principle upon which most of our short manuals are compiled. While, therefore, denying any real want of such a fresh addition to this class of book *in toto*, and looking upon it simply as one produced, as is only natural, by a professor for his students, we must admit that it is very well and clearly written, and that it is quite up to, and in some few respects beyond, the common standard of such text-books. The Editor must be complimented upon seeing a chemical work through the press with so few misprints, and upon a well written appendix, dealing with the determination of atomic weights, periodic laws, &c., which was certainly sorely required as an addition to the body of the book to make it sufficiently advanced for the class of London University students for whom he translated

it. One great defect, in our opinion, is the way in which chemical theories are scattered through the book in a disjointed form. The formulæ used are reaction ones, but, in common with some other similar manuals, the explanation of the constitution of salts is deferred to the three hundred and thirty-first page, and so we have a student faced on page 100 with an equation including $SO_2 \left\{ \begin{matrix} ONa \\ OH \end{matrix} \right.$, and an explanation of what such a thing means on pages 333, *et seq.* Our own idea has always been, that before submitting an equation to the gaze of a student, some tolerably complete explanation should be given of the meaning and construction of formulæ, instead of scattering it over the book and so making the pupil at once take a horror of equations; but upon this point we know that we differ from some other writers. The work reads exceedingly well, the print is clear, the volume is handy to hold, and we have no doubt it will be found useful by the Editor's students, but there is nothing striking in it as showing the superiority of foreign over native talent. From the specimen of the Editor's work in the appendix he might have produced quite as good a book on his own account as this one he as borrowed from the German, and with as little trouble, but we suppose that the name of Kolbe, appeared a good one to conjure with, in the eyes of that section of the reading public who believe in everything foreign in preference to the native article.

HANDY GUIDE TO PUBLIC HEALTH, FOR THE USE OF MEDICAL OFFICERS OF HEALTH AND INSPECTORS OF NUISANCES. By *T. Whiteside Hime, B.A., M.B., Medical Officer of Health for the Borough of Bradford, &c., &c.* London: Bailliere, Tindall, and Cox, King William Street, Strand.

THIS book will prove a great desideratum to those for whom it is intended, for, in a compass of 160 pages, bound in limp leather, and just the size of an ordinary breast pocket book, we have a digest of the whole Acts relating to public health in every form. Besides the Public Health Act of 1875 itself, we find digests of the Sale of Food and Drugs, The Rivers' Pollution, The Canal Boats, The Factory, The Infant Life Protection, The Burial, The Artisans' Dwellings, The Contagious Diseases (Animals) Acts, besides many Orders in Council. To sum the merits of the book up in a word we should say that no medical officer or inspector with it in his pocket need ever be at a loss how to act in any emergency that he may be suddenly placed in. Having said this, so far as the general usefulness of the book is concerned, we must take very grave exception to a portion of it which professes to give information upon the duties of inspectors and medical officers, under the Sale of Food and Drugs Act, on the subject of milk. In the first place we find a table of milk analyses professing to show the percentage of added water by an old scale of Dr. Letheby's, based upon specific gravity and cream, and following this we find (page 176) these remarkable words, "The lactoscope of Professor Feser is admirably suited for rough and rapid determinations of the quality of milk. *Any sample indicated as bad* by the lactoscope and densimeter, the examination only taking a few minutes, *should be sent to the analyst.*" The italics are ours and are meant to indicate the mischievous doctrine herein laid down. There is no provision in the Act for any tampering with the samples taken by the inspector previously to their submission to the analyst. In point of fact it is quite the contrary,

because, in cases where the vendor does not require a sample, the analyst must divide with his own hands, and not even the inspector. So far as this Act is concerned, the inspector has to buy with proper precautions, seal, and convey to the analyst direct, and the medical officer has no *locus standi* whatever to interfere in any way. This piece of advice to medical officers to interfere with the duties of brother officers is a gratuitous throwing down of a bone of contention between two persons who should be ever ready to help and support each other by advice and general co-operation. But, worse than this even, it is playing into the hands of adulterators, because such a tampering with any portion of the official quantity of milk purchased by the inspector would certainly constitute a good defence to any subsequent proceedings upon the sample if found bad by the analyst. It is very possible that this blot slipped into an otherwise good book unawares, and now it is pointed out, we hope that the author will excise it in the next edition.

THE ADULTERATION PREVENTION ACT, (1880), AMENDMENT BILL.

BE it enacted by the General Assembly of New Zealand in Parliament assembled, and by the authority of the same, as follows:—

1. The short title of this Act is "The Adulteration Prevention Act, 1880, Amendment Act, 1883."

2. This Act shall come into operation on the first day of December, one thousand eight hundred and eighty-three.

3. In this Act, if not inconsistent with the context,—

"The said Act," means "The Adulteration Prevention Act, 1880:"

"Inspector," in addition to any inspector acting under the said Act, includes any other person appointed by a local authority to do or perform any act or duty which, under the said Act or this Act, may be done by or imposed upon an Inspector:

"Local authority" means and includes any Borough Council, County Council, or Town Board, respectively constituted under any Act of the general assembly.

4. After the passing of this Act no baker or seller of bread shall make, sell. or offer for sale any bread not made up into French loaves or batch loaves of two, four, six, or eight pounds in weight respectively.

5. If any baker or seller of bread shall sell or offer for sale any bread in any other manner than in French loaves or batch loaves of two, four, six, or eight pounds in weight he shall be liable to a penalty not exceeding five pounds.

Nothing in this Act shall extend or apply to bread of the class known as fancy bread.

6. Every French loaf and batch loaf shall be stamped with the initials of the Christian name or names and surname of the baker by whom the same was baked, and also with a figure or figures and letters indicating the weight of such loaf, as prescribed by this Act.

Such initials shall be stamped in Roman letters at least one inch in length at the time of stamping, and such figure or figures shall be in Arabic numerals of like length at the time of stamping; and every person baking or permitting to be baked any such loaf without having stamped or caused to be stamped thereon such initials and weight as aforesaid shall be liable to a penalty not exceeding five pounds.

7. Any person who shall sell or offer for sale in any shop, store, or building, or in any street or open place of public resort, any French loaf or batch loaf which is not stamped in accordance with this Act shall be liable to a penalty for every such offence not exceeding five pounds.

8. Any inspector may, and he is hereby required from time to time, to inspect all bread offered for sale or in course of delivery to customers within the limits of the districts for which such inspector has been appointed or acts, and, if he shall think fit, to weigh the same with fit and proper scales and weights, or require the same to be weighed by any baker or seller of bread who offers such bread for sale, or who is in the course of delivering the same to customers.

9. If any bread so sold or offered for sale shall be found deficient in weight, any such baker or seller of bread who shall so offend shall be liable to a penalty not exceeding five pounds.

(1.) But no baker or seller of bread shall be liable to the aforesaid penalty in respect of any stale bread.

(2.) And if any baker or seller of bread shall sell any loaf or loaves of stale bread which may be found deficient in weight he shall make up such deficiency by adding thereto other bread; and if any baker or seller of bread sell any stale bread deficient in weight without making up such deficiency as aforesaid, he shall be liable to a penalty not exceeding five pounds.

(3.) "Stale bread" means all bread that may have been manufactured for a period of twenty-four hours and upwards.

10. Every person who shall wilfully resist, impede, or obstruct any inspector appointed or acting under the provisions of this Act in the lawful execution of his duty, shall be liable to a penalty not exceeding ten pounds nor less than two pounds.

11. Every local authority may appoint one or more officers of police, or any other person or persons to be an inspector or inspectors for the purposes of this Act, and every such inspector shall, within the district in or over which such local authority has jurisdiction, have and may exercise all the powers and authorities by the said Act or this Act vested in an inspector.

12. In any county where the law for the time being in force constituting counties is not in operation, or has been suspended in accordance with such law, the power of appointing an inspector shall vest in any authority or body having under such law the functions or duties of the original County Council in any road district or town district constituted under any Act of the General Assembly.

13. Notwithstanding anything contained in the said Act, any purchaser of an article of food or of a drug in any place shall be entitled, on payment to an analyst appointed under the said Act of the fee prescribed for analysis, to have such article analysed by such analyst, and to receive from him a certificate of the result of his analysis in the mode prescribed by the said Act.

And, after such analysis has been made and a certificate given as aforesaid, if it appear to such person that an offence has been committed against any provision of the said Act or this Act, he may take all proceedings necessary for the prosecution of the offender.

14. Any inspector may procure any sample of food or drugs, and, if he suspect the same to have been sold to him contrary to any provision of the said Act or this Act, shall submit the same to be analysed by an analyst appointed under the said Act; and such analyst shall, with all convenient speed, analyse the same and give a certificate to such inspector, wherein he shall specify the result of the analysis in the mode prescribed by the said Act.

15. If any inspector shall apply to purchase any article of food or any drug exposed to sale or on sale by retail on any premises, or in any shop, store, factory, or place, or in any street or open place of public resort, and shall tender the price for the quantity which he shall require for the purpose of analysis, not being more than shall be reasonably requisite, and the person exposing the same for sale shall refuse to sell the same to such inspector, such person shall be liable to a penalty not exceeding ten pounds.

16. It shall not be necessary, in any prosecution against the owner of any food or drug so exposed for sale as aforesaid for an offence under the last preceding section, to prove that an application to purchase as aforesaid, was made to such owner; but it shall be sufficient to show that such applicction was made to any servant or person employed by such owner in any shop, store, factory, or place as aforesaid, or in charge of such food or drug in any street or open place of public resort.

17. Any person or inspector purchasing any article with the intention of submitting the same to analysis shall, after the purchase has been completed, forthwith notify to the seller or his agent selling the article, his intention to have the same analysed by an analyst appointed under the said Act, and shall offer to divide the article into three parts, to be then and there separated, and each part to be marked and sealed, or fastened up in such manner as its nature will permit, and shall, if required to do so, proceed accordingly, and shall deliver one of the parts to the seller or his agent.

He shall afterwards retain one of the said parts for future comparison, and submit the third part, if he deems it right to have the article analysed, to the analyst.

18. If the seller or his agent do not accept the offer of the purchaser to divide the article purchased in his presence, the analyst receiving the article for analysis shall divide the same into two parts, shall seal or fasten up one of those parts, and shall cause it to be delivered, either upon receipt of the sample or when he supplies his certificate, to the purchaser, who shall retain the same for production in case proceedings shall afterwards be taken in the matter.

19. An article of food or a drug shall be deemed to be adulterated within the meaning of the said Act and this Act in the several cases mentioned and set forth in the first schedule hereto.

20. When any wines or spirits in bulk shall be imported into New Zealand any inspector may, without any payment, procure and take a sample or samples of such wines or spirits for the purposes of analysis.

Such sample shall be taken before or at the time when such wines or spirits are gauged by or under the direction of any officer of Customs; and the inspector may for such purposes, and without any other authority than this Act, enter, by force if necessary, any warehouse, shed, building, or premises where such wines or spirits may be stored or kept.

All proceedings may be had and taken, in respect of any such sample or samples as aforesaid, in like manner as if the same had been purchased from the owner thereof, for the purpose of submitting the same to analysis, and the importer of such wines or spirits shall, for the purposes of this Act, be deemed the seller of such sample or samples.

If upon analysis it shall be found that such wine or spirits is adulterated within the meaning of the said Act or this Act, proceedings may be had and taken against the importer of the wines or spirits accordingly: Provided that no such proceedings shall be taken if the importer shall enter into a sufficient bond, to the satisfaction of the collector or other principal officer of Customs at the port or place where such wines or spirits were imported, providing that the whole of the wines or spirits from which such sample or samples was or were taken shall be exported from the colony or destroyed within a time to be specified in the bond.

If the importer fails to enter into such bond or to perform the obligation therein contained, the whole of the wines or spirits from which such sample or samples was or were taken as aforesaid shall be destroyed, in such manner as the Commissioner of Customs may in any case direct.

21. The several articles mentioned in the second Schedule shall not exceed or be less in strength, weight, quality, or quantity, or other requirement, as the case may be, than those mentioned in such Schedule.

The Governor in Council may, from time to time, prescribe the strength, weight, quality, or quantity of any of the article of food or of any drug which shall be necessary to exempt the same from the operation of the said Act or this Act.

22. Any inspector may procure, without payment, at the place of delivery, any sample of any milk in course of delivery to the purchaser or consignee in pursuance of any contract for the sale to such purchaser or consignee of such milk, or may obtain such sample, without payment, from any vessel or receptacle contained in any vehicle or means of conveyance carrying milk for sale or delivery.

Such inspector, if he suspect the same to be adulterated, or to have been sold contrary to any of the provisions of the said Act or this Act, shall submit the same to be analysed, and the same shall be analysed, and proceedings shall be taken and penalties on conviction enforced in like manner in all respects as if such inspector had purchased the same from the seller or consignor under any provision of the said Act or this Act.

The onus of proving that such milk was not being delivered in pursuance of a contract for sale or delivery as aforesaid, or was not being carried in any such vessel or receptacle for sale or delivery as aforesaid, shall be upon the person charged under this Act.

23. The seller or consignor, or any person intrusted by him for the time being with the charge of such milk, or the charge or control of any vehicle or means of conveyance carrying any vessel or receptacle containing milk, if he shall refuse to allow such inspector to take the quantity which he shall require for the purpose of analysis as aforesaid, shall be liable to a penalty not exceeding ten pounds.

24. In determining whether an offence has been committed against the said Act or this Act by selling to the prejudice of the purchaser, spirits not adulterated otherwise than by the admixture of water, it shall be a good defence to prove that such admixture has not reduced the spirit more than twenty-five degrees under proof for brandy, whiskey, or rum, or thirty-five degrees under proof for gin.

25. In any prosecution under the provisions of the said Act or this Act it shall not be necessary to prove that the prescribed fee has been paid to the analyst.

And in any such prosecution for an offence against the said Act or this Act in respect of any article of food or any drug which is not of the nature, substance, and quality of the article demanded by any purchaser, it shall be no defence to allege that the purchaser, having bought for analysis, was not prejudiced by such sale.

Neither shall it be a good defence to prove that the article of food or drug in question, though defective in nature, or in substance, or in quality, was not defective in all three respects.

26. All fees recovered for breaches of this Act or the said Act shall be paid to the local body having control in the district where the offence has been committed.

27. All provisions of the said Act which are repugnant to or inconsistent with this Act are hereby repealed.

SCHEDULES.

First Schedule in the Case of Drugs.

1. If, when sold under or by a name recognised in the British Pharmacopœia, it differs from the standard of strength, quality, or purity laid down therein

2. If, when sold under or by a name not recognised in the British Pharmacopœia, but which is found in some other Pharmacopœia, or other standard work on *Materia Medica*, it differs materially from the strength, quality, or purity laid down in such work.

3. If its strength or purity fall below the professed standard under which it is sold.

In the Case of Food or Drink.

1. If any substance or any substances has or have been mixed with it so as to reduce or lower or injuriously affect its quality, strength, purity, or true value.

2. If any inferior or cheaper substance or substances has or have been substituted wholly or in part for the article.

3. If any valuable constituent of the article has been wholly or in part abstracted.

4. If it be an imitation of or be sold under the name of another article.

5. If it consist wholly or in part of a diseased, or decomposed, or putrid, or rotten animal or vegetable substance, whether manufactured or not, or, in the case of milk, if it is the produce of a diseased animal.

6. If it be coloured, or coated, or polished, or powdered, whereby damage is concealed, or it is made to appear better than it really is, or of greater value.

7. If it contain any added poisonous ingredient, or any ingredient which may render such article injurious to the health of a person consuming it.

Second Schedule.

1. Milk shall contain not less than 9·0 per cent. by weight of milk solids, not fat, and not less than 2·5 per cent. of butter fat.

2. Skim milk shall contain not less than 9·0 per cent. by weight of milk solids, not fat.

3. Butter shall contain not less than 80·0 per cent. of butter fat.

4. Tea shall contain not more than 8·0 per cent of mineral matter, calculated on the tea dried at 100°C., of which at least 3 per cent. shall be soluble in water, and the tea as sold shall yield at least 3 per cent. of extract.

5. Cocoa shall contain at least 20 per cent. of cocoa fat.

6. Vinegar shall contain not less than 3·0 per cent. of acetic acid.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

SULPHATE OF COPPER IN FLOUR.

To the Editor of "The Analyst."

Sir,—The occurrence of sulphate of copper as an adulterant of flour, or bread, appears to have been rare at any time, and, I think, is generally believed by analysts, at the present time, to have ceased altogether. However, within the last few months, a case of this kind has come under my notice.

A sample of flour was brought to me by one of the inspectors, who informed me that he had not taken the sample in the usual manner, but that it had been given him by one of the magistrates, who had taken it from a sack of flour he had received a short time before from a miller in the neighbourhood; and he wished it sent to the analyst, as he believed something was wrong with it.

On analysing it, I obtained ·0185 grms. of CuO from 100 grms. of flour. The method I employed was to burn up the flour and extract the ash with sulphuric acid, and precipitate the copper with H_2S. The copper sulphide was dried, moistened with fuming nitric acid, evaporated and carefully ignited, and weighed as CuO.

It might be preferable to extract the ash with nitric acid, and then evaporate the solution after the addition of sulphuric acid, in order to get rid of the nitric acid.

The amount of copper present is equal to 16¼ grms. of crystallised copper sulphate ($CuSO_4$, $5H_2O$) in 4 lbs. of flour.

The flour, when tested with logwood, gave a distinctly bluish colouration, but of a very different tint to that produced by alum.

The copper sulphate can be readily detected in the sediment obtained by shaking up with chloroform, but it requires a little care in order to observe the blue colour. I found it best to place the sediment on a white surface—the lid of a porcelain crucible—and to examine, under the microscope, by reflected light, as, by transmitted light the fragments of copper sulphate appeared quite black and opaque.

I am, Sir, yours truly, W. FOULKES LOWE.

MILKING COMPETITION.

A NOVEL feature in the Newark Agricultural Show, recently held, of which Colonel Fane, of Fulbeck, was President, and Thomas Earp, Esq., M.P., was Hon. Secretary, consisted of a special prize, given by the Right Hon. Viscountess Ossington, "for the best milking cow, judged for the quality and breed of the animal, and the quality and quantity of the milk produced," the special conditions being that all animals exhibited in that class should be milked on the show ground on the evening of the first day, and that the milking for the competition should take place on the second day of the show, at a time to be fixed by the Committee.

There were five entries, three putting in an appearance. The following is the report of Mr. Alfred Ashby, of Grantham, who analysed the milk on behalf of the Committee, and it is satisfactory to note that precisely the same order of merit was assigned to the cows by the judges of the animals, Mr. R. Baker, Gaunston; Mr. H. Smith, The Grove, Cropwell Butter; and Mr. R. G. F. Howard, Temple Brewer; and by the analyst, their conclusions being arrived at quite independently of one another.

Report on the analyses of samples taken from the milk yielded, on the morning of the 15th May, 1884, by the cows entered under class 21, at the Newark Agricultural Show:—

		Per-centage Composition.				
No. of Entry and Description.	Quantity in gallons of Milk yielded.	Water per cent.	Total Solids per cent.	Fat per cent.	Solids, not Fat, per cent.	Mineral Matter per cent.
168. Shorthorn.	1·578	81·85	18·15	8·58	9·57	0·81
169. Alderney.	1·344	86·40	13·60	3·81	9·79	0·83
169B. Shorthorn.	2·375	86·94	13·06	3·59	9·47	0·83

	Total yield expressed in pounds weight.			
Specific Gravity.	Water. lbs.	Fat. lbs.	Solids, not Fat. lbs.	Total Solids. lbs.
1028·73	13·287	1·393	1·553	2·946
1034·57	12·014	0·530	1·361	1·891
1034·21	21·354	0·882	2·326	3·208

No. 168 is extraordinarily rich in fat, and is of good quality in every other respect. No. 168 and No. 169 B. are milks of good quality, the former being slightly

the richer of the two, but the quantity of it yielded was not much more than one-half of the latter.

The terms of the prize stipulate that the quality of the milk shall be considered in conjunction with the quantity; therefore, in the latter part of the table, I have given the actual weight in pounds of the several ingredients in the total yield of the milks, and, assigning their commercial value to each of these, I am of opinion that the first prize should be awarded to No. 168 and the second prize to No. 169 B.

Grantham, 16th May, 1884. ALFRED ASHBY.

MANGANESE IN MARBLE.

M. DIEULAFAIT has shown that manganese in the state of bicarbonate exists in the waters of all seas and oceans; and M. Berthelot has pointed out that, in contact with oxygen, this bicarbonate becomes bioxide. It follows that oxides of manganese must be produced in large quantity in the ocean, and sinking by their weight, must accumulate on the ocean bed. This corollary explains the existence of the large quantities of bioxide of manganese concretions and manganiferous mud found in the sea bed. It also explains the existence of manganese in the French and English chalks of the secondary period; also the fact recently discovered by M. Dieulafait, that the well-known artistic marbles of Carara, Paros, and the Pyrenees are comparatively rich in manganese. There are two kinds of Carara marble; the ordinary, which has a bluish tinge on fracture, and the statutary marble, which is very pure and white. The well-known chemical reaction showed manganese in both kinds. Parian marble, which has larger grains than Carara, also showed manganese in even greater proportion than the Carara; and the Pyrenean marbles, which resemble the Carara in being of two qualities, also contain manganese in about the same proportion. The agreement in proportion seems to indicate a similarity of cause for the presence of the manganese.—*Scientific American.*

A NEW RE-ACTION FOR THYMOL OR PHENOL.

[BY PROF. J. F. EYKMAN, TOKIO, JAPAN.]

IF a small crystal of thymol is dissolved in about 1 cubic centimeter of glacial acetic acid, and this solution mixed with about one-fifth its volume (5 to 6 drops) of concentrated sulphuric acid, a fine blue colour is produced by allowing one drop of nitric acid to flow down to the bottom of the test-tube. On shaking, the whole liquid acquires this blue colour. In presence of not too small a quantity of thymol, the liquid appears dichroic, being red by transmitted, and dark blue by reflected, light.

Phenol differs from thymol, in this re-action, by causing the appearance of a fine violet red colour.

Salicylic acid, menthol, camphol, and borneol give no colour re-action under the above conditions.—*American Druggist.*

ILLUMINATING GAS FROM FERMENTING MANURE.—M. Gayon has demonstrated to the Paris Académie des Sciences the possibility of obtaining illuminating gas in considerable quantity from the fermentation of cow and horse droppings. This material is subject to fermentations of different orders, accordingly as it is kept in a close receptacle or allowed free access of air. In the latter case its temperature rises rapidly, and there is a great evolution of carbonic acid; while in the former the temperature remains fairly constant, and there is an active production of carburetted hydrogen, mixed with carbonic acid. The evolution of carburetted hydrogen is ascribed to the agency of organisms infinitely small, but differing in kind from those found in aërated manure. These have been isolated, and have been observed to occasion the evolution of the same gases from pure cellulose. The carburetted hydrogen disengaged from fresh manure kept in a close box, one meter square, has been collected by M. Gayon and burnt before a scientific society at Bordeaux. The volume of carburetted hydrogen given off by 1 cubic meter of fresh horse droppings is about 100 liters, or 3·53 cubic feet, per twenty-four hours. M. Pasteur suggests that as this method of preserving manure in close storage retains ammonia, it is possible that in certain circumstances it might be utilised for the purpose of supplying a useful heating and lighting gas without injury to the value of the fertilizer.—*Scientific American.*

THE annual report of Mr. B. F. Davenport, Vinegar Inspector of Boston, shows a decided improvement in the quality of that article during the year ending April, 1884. In 68 cases the inspector has sent a "note of warning" to the dealer, which, in most instances, was all that was necessary to remedy the evil. In a few cases prosecutions have been instituted for violation of the law. The standard is fixed at 5 per cent. by weight of absolute acetic acid; and for cider-vinegar, a residue of not less than 1·5 per cent. of solids. The report gives the method employed for determining the acidity and solid residue of a vinegar.

LAW REPORTS.

BRISTOL POLICE COURT.—CHARGE OF SELLING ADULTERATED MILK.—Edwin Hands, residing at 19, Christmas Street, was summoned for selling 1½ pints of milk, the same being adulterated. Mr. R. Wansbrough appeared for the defendant. Police-Inspector Cooper, C Division, stated that he purchased the 1½ pints of milk, and told defendant it was for analysis. He produced the certificate of the city analyst, which showed that the milk was adulterated to the extent of eight per cent. of added water. Mr. Wansbrough drew the attention of the magistrates to the well-known fact that water was found in milk, and that the quality varied in two different milkings from the same animal. He quoted a case reported in the "Justice of the Peace," showing that an officer from Somerset House submitted a sample of milk which he had himself drawn from the cow, which was found to contain 7½ per cent. of water. The Bench were not satisfied that the water proved to be in the milk was added water, and dismissed the case.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London

No.	Name of Patentee.	Title of Patent.	Price
1479	T. Venables	Purifying the Spent Lyes formed during the Manufacture of Soap, and the Production of Liquor from which Glycerine can be obtained	2d.
1491	E. R. Southby	Manufacture of Caramel	2d.
1555	J. Imray	Extracting Cobalt and Manganese from their Ores	2d.
384	J. Cross & G. I. J. Wells ..	Filtering Media	2d.
710	E. T. Hughes	Oxidising Alcohols, &c.	2d.
1407	T. Bowen	Treating Ores or Regulus for Extraction of Metals ..	2d.
1519	A. J. Struthers	Pulverising and Treating Diamondiferous Ores, &c. ..	6d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Pharmaceutical Journal; The Sanitary Record; The Miller; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; Cowkeeper and Dairyman's Journal; Sugar Cane; Country Brewers' Gazette; The Medical Record; The Grocers' Gazette; London Water Supply, by Crookes, Odling and Tidy; Chemical Review; Independent Oil and Drug Journal and Paint Review; Science Monthly; Journal of the Society of Chemical Industry.

THE ANALYST.

JULY, 1884.

HOME GROWN SUGAR.

THE question of the cultivation of sugar beets has recently been prominently brought before the public in consequence of a company having acquired a factory at Lavenham, where a few years ago an experiment of producing English grown sugar was tried on a large scale.

Such an outcry has recently been raised by English sugar refiners that a portion of the public hail with delight the suggestion of growing in England some portion of the sugar which is annually consumed in the British Isles.

The sugar trade has recently undergone such enormous strides, and the annual consumption has increased so rapidly, while the production in our own colonies has in some cases, notably Australia, been almost sufficient to supply the wants of the entire colony, thus closing a market which would probably have in time rivalled the home market itself.

The enormous consumption of sugar in England and the large quantity which we export abroad, has naturally caused our continental neighbours to consign raw and refined beet sugar to our market, and, aided by the free trade policy of our Governments and the bounty system, they are enabled to undersell our own refiners and harass them considerably with respect to the prices obtainable for the refined article—hence the *raison d'être* for the present outcry of home-grown sugar. The experiment of growing sugar beets in this country is by no means new—at least one large venture besides that of Mr. James Duncan's, which had for its object the production of alcohol from the saccharine matter in the beet, resulted in a loss to the originator of the scheme. These two failures occurred not from any want of enterprise or lack of capital on the part of the promoters of the schemes, nor yet from the difficulty of preparing sugar or distilling alcohol; both these processes were well known and ably worked, and although it may be true that superior methods of manufacturing and refining beet sugar have recently been discovered, yet in the years 1869 to 1873, when the Lavenham factory was in operation, no complaint was made as to the inability of the process then worked to extract nearly the whole of the available sugar present in the beet juice: in some respects beet sugar making is a more certain and easier operation than manufacturing sugar from the sugar cane, because the beet juice contains little or no uncrystallizable sugar or glucose, and the presence of an excess of this substance frequently prevents the cane grower from converting his crop into a satisfactory marketable article. Add to this the fact that in our own sugar growing districts, within two or three weeks' steam from London, the estates are, to a considerable extent, in the hands of small farmers, who have neither the necessary amount of knowlege or capital to successfully

and economically produce a class of sugar which would be likely to compete with beet; in this direction a good deal remains to be done by the establishment of Usines or Central Factories working with first-class machinery, and by the most approved methods, in order to obtain the very considerable loss of cane sugar which now takes place by imperfect expression of the juice and the unnecessary formation of large quantities of molasses. It is true rich molasses produce a high class rum, but a method for the production of rum of equal quality would be certain to be devised were the quantity and quality of the molasses decreased by more careful attention to the process of extracting and manufacturing the sugar.

The closing of the Lavenham Factory in 1873 was generally supposed to be due to the fact that the farmers did not care to grow the roots, and we presume the reason for this was that the price which they were paid was not sufficiently remunerative; the present company propose to pay 20s. per ton delivered, or 22s. if the beets have been six weeks or more in pit or clamp, and they also state that they have made satisfactory arrangements with the railway company, and further that by working by recently invented methods the sugar will be extracted more easily and economically, in other words, this company ignore the reason given for the previous failure, which, so far as we can see, exists to the same extent now, and rely for their success on the fact that they have made more satisfactory arrangements for carriage, and that they are going to work by a recently invented process. The fact is that the Lavenham works would be in operation to-day had it not been for the impossibility of obtaining the raw material; the process was all right, and had it not been so, we feel sure that Mr. Duncan would speedily have arranged a method for recovering the sugar. Besides, newly invented processes are not always the most reliable, and frequently the benefits to be obtained from them are not derived until after modifications have been introduced entailing much delay and expensive work. So far as we can see there is no more chance of the present venture being successful than the preceding one, and we are afraid that the newly invented process and cheap carriage will not compensate for the shortness of supply of the raw material.

To give some idea of the acreage necessary for a factory producing 120 tons of sugar per week; 12,000 acres would have to be under cultivation, of which 4,000 would be cropped each year, this is taking the average crystallizable sugar in the beets at 8 per cent.

In order to manufacture the 950,000 tons of beet sugar, which the *Times* states to have been consumed in the United Kingdom during last year, about 15,000,000 tons of beet roots would be required.

For the factory turning out 120 tons per week, 325 tons of beets would have to be delivered each day; there would be no difficulty in arranging machinery to work up an indefinite amount of roots, but the question remains:—

"Can this quantity be delivered uninterruptedly throughout the season?"

PROCEEDINGS OF THE SOCIETY OF PUBLIC ANALYSTS.

An ordinary general meeting of this Society was held at Burlington House, on Wednesday, the 18th June. Mr. G. W. Wigner, President, in the chair.

The following paper was read :—

A Method of Determining Organic Nitrogen in Liquids, by A. Wynter Blyth, M.R.C.S., F.I.C.

The arrangements for holding the country meeting have not yet been completed and the matter is in the hands of the Secretaries.

A METHOD OF DETERMINING ORGANIC NITROGEN IN LIQUIDS.

By A. Wynter Blyth, M.R.C.S., F.I.C.

Read before the Society of Public Analysts, on June 18th, 1884.

The method of oxidation by means of sulphuric acid in excess and permanganate of potash is not a new one. The process in its details, nevertheless, was recently much improved by Vijeldahl (Zeits fur Analytische Chemie "Hefl. 3, 1883") and proposed by him as a moist process of combustion. Still more recently Dr. Petri and Th. Lehmann ("Zeitsch fur Physiologische Chemie, Band VIII., Hefl. 3, 1884") have published an account of an extremely prolonged and exhaustive research, as to its accuracy in determining the total nitrogen in urine; and have somewhat improved the details. I contributed in April of this year, to the Royal Society, a paper on the ingesta and egesta of Edward Payson Weston, and gave incidentally, a brief description of this method which I had applied with great advantage to the estimation, day by day, of the total nitrogen of the pedestrian's urine, as follows :—

Two grams of the urine were placed in a flask and 20 cubic centems of pure sulphuric acid added; heat was applied by means of a small flame for two or three hours, at the end of which time crystals of permanganate were added until the liquid was first decolourised, and then given a distinct dark pink or red tint. On now alkalising with pure oxide, all the nitrogen present was distilled over as ammonia; the distillation being assisted by a current of hydrogen gas, the ammoniacal distillate was received in a known quantity of standard decinormal acid and titrated back by decinormal soda. I have since made a number of analyses of flour and farinaceous foods, and compared four of them with combustion processes, and the results have been eminently satisfactory. I have also applied it to malt extract in solution, to cocoa, to tea and to coffee.

Two analyses of water have been made by this moist process; the result was such as from the general character of the water might be expected, but no check combustion was made, so I am ignorant as to how the two methods would compare.

It seems to be so extremely convenient and its applications so numerous, that any analyst would confer a benefit on us all, if he should make a number of comparative determinations of the total nitrogen in water, milk, broth, &c., and communicate the results to the Society.

The sulphuric acid I have used, has never been absolutely ammonia free, but it was found easy to make blank experiments and get out a constant factor, but with such a strongly nitrogenous liquid as urine, even this was not necessary, the error falling in the third decimal place; on the other hand, in the case of water analysis, an exact correction for the ammoniacal impurities will of course be important.

CONCLUSION OF THE PROCEEDINGS OF THE SOCIETY OF PUBLIC ANALYSTS.

NOTES ON SOME OLD PROCESSES OF MILK ANALYSIS AND ON A RATIONAL VIEW OF MILK STANDARDS.

BY JOHN MUTER, PH.D., F.I.C., &c.

WHILE we are all awaiting anxiously the report of the Milk Committee of our Society on the best method for milk analysis and the standards for the same, it may not be out of place (in the present dearth of fresh matter in the food analysis line) to put before the members some old reminiscences and a few additional arguments in favour of the "sliding scale" standard, advocated by several analysts, who share my views on this point. In my whole experience of milk (extending to a period considerably prior even to the passing of the old Adulteration Act, of 1872), I have in my books no record of any unimpeachably pure milk in which the sum of the non-fatty constituents fell markedly below the present ordinarily accepted limit, unless where the fat was considerably above the amount usually expected, and in this matter my experience is shared by several analysts who have had the opportunity of examining large quantities of genuine milk. Before the formation of the Society of Public Analysts, and the official adoption by it of Mr. Wanklyn's then recently published rapid process (but not of his standard, which was reduced from 9·3 to 9), those few persons who were training themselves to special experience in food, and acting as pioneers of the large body of analytical chemists now devoted to its examination, used to make first a preliminary test of the milk by taking the specific gravity of the milk and of its *serum* after coagulation, and then afterwards confirm the results by a full analysis. This analysis was conducted always by one of two processes, and although I afterwards gave them up in deference to the Society, and adopted Wanklyn's process, and the 9 standard, I have never been at all sure that it was an improvement in real accuracy. As it is possible that some of our younger members may not know what was done before the passing of the Acts, the following account may be interesting:—By the first process, a funnel, furnished with four high but narrow ribs, was fitted with a filter paper, and then filled, two-thirds of its height, with sand (which had been purified by washing in dilute hydrochloric acid and igniting). This was then placed in the air-drying oven at 220° Fahr. for some time, cooled for ten minutes in a dessicator, and weighed. Enough milk was dropped upon it so as to nearly saturate the sand *without wetting the paper*, and the whole again weighed and then dried in the oven until practically constant, always using the same dessicator for

a similar time at each weighing. The funnel and its contents were then thoroughly percolated with boiling ether, by placing it in a tin jacket into which warm water was put, and then pouring on the ether, and finally it was removed from the jacket and again dried in the oven, and the loss was fat. The residue was then treated with water, faintly acidulated, or with very weak spirit, to remove the soluble portion, which was looked upon as crude milk sugar, and then again dried, and the balance was looked upon as crude casein. The ash was taken on a separate sample. By the second process a portion of the milk was evaporated in a flat dish, and the residue taken when dried at 220° Fah. to practical constancy, and then this residue was also used for ash determination. Another portion was evaporated with plaster of Paris, being well stirred during the evaporation, and the dry residue having been reduced to powder in a glass mortar, was extracted absolutely with boiling ether. The ether was received through a filter into a weighed flat-bottomed flask, and having been distilled off, the residual fat was dried at 220° F. and weighed. The plaster remainder in the basin and filter were now treated with water, and the balance between the fat and sugar and the total was casein. I am not now putting forward the amounts of so-called milk sugar and casein as specimens of first-rate separation, but I still hold, and have always done so, that either of these processes are better in regard to the fat separation than Wanklyn's, although, of course, not so rapid. When we used these processes, the calculation from solids not fat was unknown, and we judged by a general consideration of all the figures obtained. There is no doubt the discovery of Mr. Wanklyn, *re* solids not fat, was a distinct advance, but in my opinion the great error which has all along been made, consists in a too blind adherence to that standard, and a too rigorous judging of milk upon non-fatty solids alone, without also taking into consideration the amount of fat. There can, undoubtedly, occur, both in nature and by bad sampling, cases of what I have before called "natural dilution with fat," and the non-fatty solids do not then show what they ought to do. To make this plain, let me take from my books by chance an old case, where a sample of milk, very nearly at the Society's limit, had been standing in a dish, and the sample had been dipped out by a sweep of the measure, which did not go nearly to the bottom.

Fat	4·51
Non-fatty solids	8·80
Total	13·31

and yet, on properly mixing that very same milk, we get:—

Fat	3·49
Non-fatty solids	9·02
Total	12·51

On the other hand, let us glance at the effect of skimming. Taking the milk of a good cow, used for my own family, I found:—

Fat	4·72
Non-fatty solids	9·55
Total	14·27

Now placing the milk in separators, and examining the bottom layer, we have (1), after about an hour—

Fat	3·08
Non-fatty solids	9·79
Total	12·87

(2) After about two hours—

Fat	1·43
Non-fatty solids	10·04
Total	11·47

(3) After four hours—

Fat	·35
Non-fatty solids	10·55
Total	10·90

Thus, it is evident that, taking the low standards adopted by Mr. Bell, of 2·5 fat and 8·5 non-fatty solids, without any modification on the sliding scale principle, a milkman, by taking away one-half of his cream nearly, might then add almost fifteen per cent. of water, and laugh at the inspector. It is a simple fact that, at least in the Metropolis, the knowing ones of the trade systematically skim down to about 2·5, and thus, not only sell the cream, but are enabled to add, without fear, an average ten per cent. of water.

I do not here make any suggestion as to the exact manner in which a sliding scale of solids not fat, based upon the fat found, should be applied, as that is a matter for the committee, should such an idea find favour in their eyes, but I do put it strongly as a simple matter of common sense, that there should not be the same standard for whole milk and for even partially skimmed milk. Given first an agreement to some fixed process which obtains a residue dried to fair constancy, and then regularly gets out the whole of the fat (as both the old processes I have referred to undoubtedly do) then whatever limit may be adopted for non-fatty solids should only hold good provided the amount of fat be not under a certain amount, and if it be so then I hold that for every half per cent. of fat under the limit an addition should be made to the standard of solids not fat until absolutely skimmed milk was reached, of which, by-the-bye, I have never met with an undoubtedly unwatered specimen under 9·3. Any new standard which may be proposed by our committee would be in the present state of the law practically useless unless approved of by Mr. Bell and his colleagues, and I, therefore, trust that (as both their and our only object is coming as near the truth as possible) they will see fit to give some consideration and experiment towards the approval or otherwise of the "sliding scale" system.

What is really wanted, both on behalf of the dealers and the public, is an amendment of the law similar to that shown in the New Zealand Food Act (recently printed in the ANALYST), wherein a schedule of standards is given, such schedule to be subject

to periodical additions and revisions by order in Council on the recommendation of a special Board of Experts, and all persons interested in the purity of food should unite in striving to attain this consummation so devoutly to be wished.

ON THE ACTION OF COLD CONCENTRATED SULPHURIC ACID ON LEAD AND ITS ALLOYS.

By Lucius Pitkin.

Until quite recently it has been regarded as almost indisputable that the purer the lead, the less action would sulphuric acid have upon it. In opposition to this idea, a very interesting paper was presented by Mr. James Napier, before the Glasgow Philosophical Society, a full report of which can be found in the *Chemical News* for December, 1880.

Briefly abstracted it is as follows: Sulphuric acid was shipped in cases of sheet lead, all of which either bulged badly or burst. To ascertain the cause of this action, the acid, the lead, and the gas causing the pressure were analyzed.

The acid was of sp. gr. 1,842 and the following composition, H_2SO_4 99·78—SO_2 0·02—$PbSO_4$ 0·13—$CaSO_4$ 0·07.

The lead was of extraordinary purity, containing according to the analysis Pb. 99·96—Cu. 0·04. The gas evolved was pure hydrogen.

Exposing a known surface of the lead to the action of cold concentrated sulphuric acid, gas was given off equivalent to 41 cubic inches per square foot lead exposed.

Another sample from a concentrating pan (No 1) of the same composition gave under similar circumstances, 16 cubic inches per square foot. A second sample of lead (No. 2) having a composition of Pb. 99·50 Cu. 0·08. Sb. 0·42 yielded only ½ cubic inch per square foot.

As a basis for further experiments, Mr. Napier took a soft lead not analysed, similar to No. 1, which, averaging several determinations, yielded 9·4 cubic inches per square foot. Calling this lead No. 3, the following alloys were made and yielded the following amounts of gas by the action of sulphuric acid.

I.	Lead No. 3,	99·25	0·25 cu. inch.
	Sb.		
II.	Lead No. 3,	89·88	0·10 cu. inch.
	Cu.	0·39	
	Sb.	0·75	
III.	Lead No. 3,	99·63	1·42 cu. inch.
	Cu.	0·37	
IV.	Lead No. 3,	99·64	2 cu. inch.
	Zn.	·37	

The paper was discussed by the Society, and the President in summing up, said the following points appeared proven:

1. Chemically pure lead was unsuitable for sulphuric acid evaporating pans.
2. Lead containing certain impurities, and especially zinc, was unsuitable.
3. Antimony seemed to render the lead more durable.
4. The subject required further investigation.

It is to this investigation that the remainder of this paper will be devoted.

The lead taken as a basis for the alloys which I have experimented upon, was a chemically pure lead made by Merck, of Darmstadt, and guaranteed by him. The method employed differed from that made use of by Napier, who measured the gas evolved from a known surface of lead.

In the following experiments, the action of the sulphuric acid was measured by the amount of lead or alloy converted into sulphate, which was ascertained by weighing the alloy before immersing in sulphuric acid, and after the action, cleansing from any adhering sulphate and reweighing.

In all forty (40) samples of lead and alloys of known composition were acted upon by the acid and the action measured. In some cases the results may appear anomalous, but not more so than the case reported by Napier, in which lead of the same composition gave off under similar circumstances, in one case 41 cubic inches per square foot, in the other only 16 cubic inches. In the making of the alloys, great care was taken to obtain as homogenous a mixture as possible, and in order to avoid oxidation, the fusion was performed under a layer of powdered charcoal. The making of 40 alloys was thus by far the most tedious part of the investigation.

The alloys experimented upon were those of lead with antimony, tin, bismuth, cadmium, silver and zinc. After the preparation of the alloys, they were carefully rolled to about the same thickness, and the same surface exposed in each case to the action of the same amount of acid for a like time.

The surface exposed was 2 sq. in., and the amount of acid used 10 c.c. The action was allowed to proceed 24 hours at a temperature of 20°C.

The acid employed was C. P. sulphuric acid of sp. gr. 1,825. In the tables the first column gives composition of alloys; the second, the loss of lead per sq. foot of surface exposed, the weight being in grammes; the third, the amount of gas evolved calculated from the quantity of lead converted into the sulphate.

1	C. P. Lead.	1·296 grms.	9 cu. in.
2	,,	2·088 ,,	14·5 ,,
3	,,	2·952 ,,	20·5 ,,
4	,,	2·232 ,,	15·5 ,,

Average loss for pure lead, 2·160 grms. per sq. ft.

Average gas evolved from sq. ft., 15 cu. in.

In all cases quite a vigorous evolution of hydrogen took place at the instant of immersion, while in an hour scarcely any action was perceptible. It will be noticed that the quantity of hydrogen evolved agrees quite closely with the amount given off by lead in Mr. Napier's experiments.

In the case of the alloys, however, I did not find that the addition of foreign metals produced such a change in the amount of lead converted into sulphate, as the following figures will show.

In computing the amount of gas, the loss is calculated for convenience as entirely lead.

ANTIMONY ALLOYS.

5	Pb.	100	Sb.	0·5	parts	1·872 gms.	13 cu. in.
6	,,			1	,,	2·016 ,,	14 ,,
7	,,			2	,,	2·016 ,,	14 ,,
8	,,			3	,,	1·512 ,,	10 ,,
9	,,			5	,,	1·584 ,,	11 ,,
10	,,			10	,,	1·584 ,,	11 ,,

It will be seen from this that under the conditions of the experiment, the antimony did not seem to affect the lead to such a degree as in Mr. Napier's researches, although retarding the action of the acid.

It shows, however, what a large amount of antimony may be present without affecting the solubility of the lead.

TIN ALLOYS.

11	Pb.	100	Sn.	0·5	parts	2·802 gms.	19 cu. in.
12	,,			1	,,	3·744 ,,	26 ,,
13	,,			2	,,	3·080 ,,	22 ,,
14	,,			3	,,	2·952 ,,	21 ,,
15	,,			5	,,	3·232 ,,	23 ,,
16	,,			10	,,	2·380 ,,	17 ,,

In the case of the alloys with tin, the action is in all cases augmented, but does not seem to increase in proportion to the amount of tin present.

BISMUTH ALLOYS.

17	Pb.	100	Bi.	0·5	parts	1·800 gms.	12 cu. in.
18	,,			1	,,	4·032 ,,	28 ,,
19	,,			2	,,	1·656 ,,	11 ,,
20	,,			3	,,	1·728 ,,	12 ,,
21	,,			5	,,	2·232 ,,	16 ,,
22	,,			10	,,	3·600 ,,	25 ,,

The figures in number 18 are evidently anomalous, and probably were the result of an imperfect admixture or separation of the Bi. and Pb. If they are disregarded we would have the general action of bismuth in the alloys with lead as retarding in quantities less than 5 per cent., and above that figure hastening the formation of lead sulphate.

CADMIUM ALLOYS.

23.	Pb.	100	Cd.	0·5	parts	1·728 gms.	12 cu. in.
24.	,,			1	,,	1·656 ,,	11 ,,
25.	,,			2	,,	1·296 ,,	9 ,,
26.	,,			3	,,	1·728 ,,	12 ,,
27.	,,			5	,,	1·296 ,,	9 ,,
28.	,,			10	,,	3·528 ,,	24 ,,

In regard to cadmium we have it decreasing the solubility of lead to a greater extent even than antimony, while above 5 per cent. it raises its solubility.

SILVER ALLOYS.

29.	Pb.	100	Ag.	0·5	parts	1·584 gms.	11 cu. in.
30.	,,			1	,,	1·728 ,,	12 ,,
31.	,,			2	,,	1·944 ,,	13 ,,
32.	,,			3	,,	1·584 ,,	11 ,,
33.	,,			5	,,	2·016 ,,	14 ,,
34.	,,			10	,,	2·448 ,,	17 ,,

Silver seems to exert very little influence, in small proportion, slightly decreasing the action, in large proportion slightly increasing the solubility.

ZINC ALLOYS.

35.	Pb.	100 Zn.	0·5 parts,	2·664 gms.		18 cu. in.	
36.		,,	1 ,,	2·304	,,	16	,,
37.		,,	2 ,,	3·816	,,	26	,,
38.		,,	3 ,,	2·664	,,	18	,,
39.		,,	5 ,,	4·032	,,	28	,,
40.		,,	10 ,,	4·392	,,	30	,,

The solubilities of the alloys of lead and zinc are thus greater than those of lead with any other metal experimented upon. To sum up the results of the work, it appears:

1. The metals, antimony, bismuth, cadmium, and silver in small quantities, protect lead from the action of the cold sulphuric acid; while in proportions above 5 per cent., they all, with the exception of antimony, increase the solubility.

2. Antimony, when present even to the amount of 10 per cent., decreases the solubility of the lead.

3. Tin and zinc alloys are more affected than pure lead.—*Journal of the American Chemical Society.*

ACTION OF CONCENTRATED SULPHURIC ACID, AT 100° C., ON LEAD AND ITS ALLOYS.

By L. Pitkin.

The only work of any importance done, in the estimation of the effect produced upon lead by hot concentrated sulphuric acid, is that of Bauer. The acid used by him was 170° T. (sp. gr. 1,848), the amount of lead or alloy taken 0·2 gramme, and the amount of acid used 50 c.c. A brief abstract of his work, so far as it relates to alloys used by me, is here given.

I. *Pure Lead.*—The first sensible evolution of gas was at 175° C., a stronger action taking place at 190° C., while at 230°—240° C. all of the lead was suddenly changed to sulphate.

II. *Lead and bismuth alloys.*—

(*a.*) Pb. 90 per cent., Bi. 10 per cent.

Action begins at 150° C., continues quietly to 190° C., when all of the metal is decomposed.

(*b.*) Pb. 96 per cent., Bi. 4 per cent.

This alloy decomposes more quickly than (*a*), the action terminating at 130°—140° C.

(*c.*) Pb. 99·27 per cent. Bi. 0·73 per cent.

Rapid and sudden decomposition at 160° C.

III.—*Lead and antimony alloys.*—

(*a.*) Pb. 90 per cent., Sb. 10 per cent.

A slow and even decomposition takes place, beginning at 190° C., terminating at 240 C.

(*b.*) Pb. 96 per cent., Sb. 4 per cent.

Decomposition begins at 180° C., terminating at 225° C.

(*c.*) Pb. 99 per cent. Sb. 1 per cent.

Action begins at 250°, ends at 280° C.

IV. *Lead and tin alloys.*—Sudden decomposition at 200° C.

The alloys used by me in determining the effect of hot acid were the same as those employed in estimating the action of cold acid, namely, lead with antimony, tin, bismuth, cadmium, silver, and zinc. The amount of acid was as before 10 c.c. and the surface exposed 2 sq. in., but the time of exposure was 1 hour, instead of 24 hours, as in testing with cold acid. The amount of gas given off per square foot was not calculated, as that factor would be essential only in the employment of lead for cases. The amount of lead or alloy converted into sulphate per square foot is given in grammes.

The four samples of pure lead, exposed to the action of concentrated acid at 100° C. for one hour, gave very concordant results, as follows :—

41.	Pure lead	1·308	Grammes.
42.	,,	1·152	,,
43.	,,	1·224	,,
44.	,,	1·080	,,

The effect of antimony in composition with lead is shown in the following experiments :—

45.	Pb. 100 parts,	Sb. ½ part	2·952	Grammes.	
46.	,,	,, 1 ,,	3·672	,,	
47.	,,	,, 2 ,,	3·528	,,	
48.	,,	,, 3 ,,	3·096	,,	
49.	,,	,, 5 ,,	2·736	,,	
50.	,,	,, 10 ,,	2·952	,,	

Upon immersing the alloy, very little gas was given off, and for 40 minutes the acid remained clear. It then commenced to cloud, and the alloy taken out at the end of the hour was covered with black slime. It will be seen that at 100° C. the action of antimony is not that of a preservative of the lead, as is the case with cold acid; while from the experiments of Bauer, quoted above, it seems quite likely that at elevated temperatures the alloy with antimony may be more resisting than pure lead. The relative solubilities of the alloys at ordinary temperatures and at 100° C. are by no means constant, and this forms one of the most interesting features of the investigation; thus, if at common temperatures the alloys with antimony are found more insoluble than those with zinc, we cannot predicate the same relation with acid at 100° C. In regard to the action of tin upon lead, as affecting its solubility, the following results were obtained :—

51.	Pb. 100 parts,	Sn. ½ part	1·008	Grammes	
52.	,,	,, 1 ,,	1·792	,,	
53.	,,	,, 2 ,,	0·864	,,	
54.	,,	,, 3 ,,	0·792	,,	
55.	,,	,, 5 ,,	0·864	,,	
66.	,,	,, 10 ,,	0·864	,,	

It will be remembered that one of the general results obtained from the experiments with cold acid was that at ordinary temperatures the alloys of lead and tin were more easily attacked than those with antimony or pure lead itself, and yet at this temperature we see the case reversed.

It is, however, in regard to bismuth that the most curious effects were found to be produced by the composition of the alloy. The following figures will fully explain the peculiar action of the bismuth :—

57.	Pb. 100 parts, Bi.	½ part....	24·840	Grammes.
58.	,,	,,	1 ,, ...	22·248	,,
59.	,,	,,	2 ,, ...	1·800	,,
60.	,,	,,	3 ,, ...	1·008	,,
61.	,,	,,	5 ,, ...	1·008	,,
62.	,,	,,	10 ,, ...	2·160	,,

The results given in 57 and 58 appear so exceptional, not only in comparison with other alloys, but in regard to the sudden change shown in 59 and 60, that it was decided to make experiments 57, 58, and 60 in duplicate.

57.	(Duplicate) Pb. 100 parts,	Bi. ½..	25·920
58.	,, ,,	Bi. 1..	22·750
60.	,, ,,	Bi. 3..	1·224

We here have a case in which not only the relative solubility in hot and cold acid is changed as regards other alloys, but one in which an excess of the deleterious substance seems to act as a corrective.

The alloys containing ½ and 1 part of bismuth to 100 of lead gave off gas very plentifully, not only at the start, but throughout the whole hour, while the acid became opaque almost immediately, and the lead sulphate formed could be removed in scales at the end of the experiment.

The experiments with cadmium alloy gave very constant results, and in general it may be said that, with the exception of bismuth alloy, the figures obtained from the same alloy varied much less than in the corresponding trials with cold acid.

63.	Pb. 100 parts, Cd.	½ part	..	..	1·440	Grammes.
64.	,,	,, 1 ,,	..	..	1·224	,,
65.	,,	,, 2 ,,	..	..	1·296	,,
66.	,,	,, 3 ,,	..	..	1·080	,,
67.	,,	,, 5 ,,	..	..	1·368	,,
68.	,,	,, 10 ,,	..	..	1·152	,,

The action of cadmium at this temperature seems to be neither increasing nor diminishing the action of the H_2SO_4 on the lead.

In the case of silver combined with the lead, we have the same general behaviour, six determinations with varying quantities of silver giving the following results :—

69.	Pb. 100 parts, Ag.	½ part	..	..	1·296	Grammes.
70.	,,	,, 1 ,,	..	..	1·080	,,
71.	,,	,, 2 ,,	..	..	0·864	,,
72.	,,	,, 3 ,,	..	..	0·792	,,
73.	,,	,, 5 ,,	..	..	0·936	,,
74.	,,	,, 10 ,,	..	..	1·440	,,

The action of zinc in determining the solubility of lead in hot acid is in accordance with its effect on cold concentrated acid—that is, increases the effect of the acid, but the

action is not so marked as at ordinary temperatures. The figures for the experiments are :—

75.	Pb. 100 parts, Zn. ½ part	..	..	1·800 Grammes.
76.	,, ,, 1 ,,	..	..	1·296 ,,
77.	,, ,, 2 ,,	..	..	1·152 ,,
78.	,, ,, 3 ,,	..	..	1·080 ,,
79.	,, ,, 5 ,,	..	..	1·296 ,,
80.	,, ,, 10 ,,	..	..	1·080 ,,

We can easily see from the results we have obtained the importance of testing the lead employed in H_2SO_4 working, and for this no extended analysis is required. The operation consists simply in immersing the lead in acid, more or less concentrated according to the strength of the acid with which it will be brought into contact in actual working, and at the temperature to which it will be subjected in the manufacture of acid.

Mr. McTear says :—"The simplest safeguard against risk to pans, etc., giving way would be a careful testing of the lead previous to being made into sheets. For this purpose it will not be necessary to make an analysis, but simply to put clean, thin shavings of lead into a test-tube and cover with pure, cold vitriol; the amount of action would then be clearly visible."

It is, however, clear that the action of cold acid is no sure criterion of the effect that hot acid will have upon the lead; so, to avoid error, it is much safer to test the lead under the conditions of its actual employment.

In order to briefly sum up the results of experiment, it will be advantageous to compare the average of the alloys with pure lead as unity both at ordinary temperatures and at 100° C. The following table will therefore express the average solubility or liability to formation of sulphate of the alloys in terms of lead. In each case the total of the relative solubilities is divided by six (the number of members in the class), for the average solubility of the alloys:

	20° C.	100° C.
Pure lead	1·00	1·00
Pb. 100, Sb. 1 to 10 parts	0·81	2·75
Pb. 100, Sn. 1 to 10 ,, ...	1·42	0·75
Pb. 100, Bi. 1 to 10 ,, ...	1·10	7·69
Pb. 100, Cd. 1 to 10 ,, ...	0·86	1·10
Pb. 100, Ag. 1 to 10 ,, ...	0·87	0·93
Pb. 100, Zn. 1 to 10 ,, ...	1·53	1·10

—*Journal of the American Chemical Society.*

DETERMINATION OF FAT-ACIDS IN OILS.

By Ch. E. Schmitt.

Nearly all vegetable oils are subject, more or less, to fermentation, and the fermentative action causes fat acids to separate from glycerine with the formation of free acidity. When the oil is used for soap-making or wool-cleaning the presence of the fat acids has little or no deleterious effect; but when used for machinery the case is different, as they act on the metal bearings in a similar manner to mineral acids, although less violently.

The process used for the estimation of fat acids is that of Burstyn, and is based on the property possessed by strong alcohol of dissolving the fat acids, while neutral fats are not perceptibly soluble.

The process is carried out by shaking up 100 grammes of the oil with 100 grammes of 90 per cent. alcohol. The alcohol separates from the oil, carrying with it the fat acids. By means of a separating funnel the alcohol layer can easily be removed and 20 c.c., titrated with normal alkali.

The acid obtained corresponds to sulphuric acid; this, multiplied by 5, will give the total quantity of acid as oleic acid.

A dispute having arisen about some oil purchased by a house in Lille, the author was led to examine Burstyn's process.

A portion of the alcoholic solution, equal to about 20 c.c., was evaporated, and dried at a temperature of 100° C. to 105° C., until the weight became constant. The following oils were tested :—

	Burstyn's Process.	By Weight.
Sweet almond oil	·37 ..	·28
Pure olive	·514 ..	·600
Acid olive	6·83 ..	6·
,, ,, ...	9·23 ..	10·15
,, ,, ...	12·70 ..	13·
French rape seed oil	·85 to ·90 ..	·65 to ·90
Bombay ,, ,, ...	·75 ..	·25
Dunkirk codfish	·677 ..	·422

The process of Burstyn may, therefore, be considered to give satisfactory results, although it is clear that alcohol dissolves volatile acids, which are lost by evaporation, and also colouring matters, which have no action upon an alkaline solution. Volatile substances tend to give gravimetric results lower than those by Burstyn's process, while colouring and odorous substances give higher results, as they have no action on standard alkali.

In titrating, the author has found that turmeric gives more satisfactory results than either litmus or phenolphthalein.—*Mon Scientifique*, 3 xiv., 205.

ASSAY OF CINCHONA BARK.

By A. Petit.

Prollius has shown that the whole of the alkaloids of cinchona bark may be obtained in solution by treating, say 40 grammes of the powdered bark with 800 gms. of a mixture composed of

Alcohol, 95 per cent.	67 parts.
Ether, sp. gr. 0·724	733 ,,
Ammonia	32 ,,

Comparative experiments have shown me that the bark must be in as fine powder as possible, and that, if the mixture be shaken every five minutes, the exhaustion is as complete after one hour, as it will be after five or six hours if merely macerated.

The next step is to pour off 600 gms. of the liquid, corresponding to three-fourths of the alkaloids contained in the bark, that is, representing 30 gms. of the latter.

Now add to the ethereal liquid enough of a solution containing one-fourth of its weight of sulphuric acid, so that the aqueous layer which separates shall be just acid. In general, about 20 cubic centimetres will be sufficient.

This aqueous layer contains all the alkaloid of the ethereal liquid.

The layer is separated by a suitable funnel (in fact the ethereal liquid should be in a separating funnel when treated with the acid), and the ethereal liquid again agitated with 5 c.c. of the diluted acid and 15 c.c. of water. This portion is likewise separated, and added to the former.

Now heat the aqueous liquid on a water-bath in order to get rid of the dissolved ether, then dilute it with two volumes of water, and precipitate with caustic soda in excess. On stirring with a glass rod, the alkaloids coalesce together in a mass. The same result may also be obtained by warming the liquid on the water-bath.

Transfer the alkaloids to a tared capsule and dry them at a temperature of 100° C. (212° F.).

If the liquid is not perfectly clear, it is passed through a tared filter, and the gain in weight of the latter when dried at 100° C. added to the alkaloids in the capsule.

We have now the weight of the total alkaloids contained in the 30 gm. of bark, and from this we may calculate the quantity contained in one kilogramme.

The next step is to ascertain the proportion of alkaloids soluble in ether. Proceed as follows:—

Dissolve the total alkaloids in a slight excess of sulphuric acid. Add 25 c.c. of ether (sp. gr. 0·724) and 5 c.c. of ammonia, and shake. The alkaloids soluble in ether are thereby taken up. Decant the ether: shake again with 10 c.c. of ether and decant again. Unite the ethereal solutions, let stand 15 minutes, so that the alkaloids which are but little soluble in this menstruum may deposit; decant again, and shake the clear, decanted ethereal liquid with 10 c.c. of diluted sulphuric acid (1 in 20). Separate the aqueous liquid; agitate the ethereal solution with 5 c.c. more of the dilute acid, and add the second aqueous layer to the first.

Dilute the united liquids with water to 25 c.c., heat to boiling, and saturate with pure diluted ammonia (1 in 5). As soon as the reaction is faintly alkaline, the heating is interrupted.

The sulphate of quinine will now separate in fine needle-shaped crystals.

When completely cold, collect it upon a tared filter, and wash it with a cold saturated solution of sulphate of quinine; finally dry it at 100° C. (212° F.), until the weight remains constant.

We now have the weight of sulphate of quinine obtainable from 30 gms. of bark, and, therefore, by a simple calculation, that contained in one kilogramme.

In order to prove that the sulphate of quinine thus obtained is pure, the salt is dissolved with the aid of sulphuric acid, and examined by the polariscope.

If the rotary power does not approach sufficiently close to —238·3, with sodium light, at a temperature of 15° C., the salt must be purified by a renewed treatment with ether and ammonia and recrystallization.

According to my experience, the polarimetric deviation is proportional to the quantity of salt dissolved; the amount of sulphuric acid does not influence this deviation, provided it is present in at least sufficient quantity to form bisulphate of quinine.

In practice, I prefer a solution containing one gm. of basic sulphate dried at 100° C., dissolved in two c.c., of one-tenth per cent. sulphuric acid, and enough distilled water to make twenty c.c. Under these conditions the polariscope deviation is to —110° (for pure sulphate of quinine at 15° C.). According to my experiments, it is necessary to add to the observed degree about one degree for every four degrees of temperature above 15° C.

These different treatments by acid, and the separations of the ether, are very rapidly performed if the operator has had some previous practice in these manipulations. A few hours are sufficient to make a complete assay of cinchona by this process.—*Repertoire de Pharmacie.*

REPORT ON COLOURED IMITATION JAVA COFFEE.

SANITARY BUREAU, SECOND DIVISION,
May 5, 1884.

WALTER DE F. DAY, M.D.,
Sanitary Superintendent,
New York Board of Health.

SIR,—I have the honour to report that Inspector Lucas, on March 15, 1884, obtained a sample of coffee known as "green" imitation Java from a well-known firm of coffee-dealers of this city. This sample he submitted to Dr. Waller for analysis. I transmit herewith Dr. Waller's report on the same.

The report states that the sample contained lead, copper and arsenic. The amount of the two latter substances is given as corresponding to 1·585 grains of copper arsenite (Scheele's green) per pound of coffee. The amount of lead present was not ascertained but it is now being estimated. The above amount of arsenite of copper would indicate the presence of about $\frac{1}{24}$ grains of Scheele's green, or about $\frac{1}{53}$ grains of arsenious acid, in each half ounce of the coffee, the quantity necessary to make up a cup of the beverage. I was informed that the coffee in question was produced in Central America, and was subjected in this city to some process, which altered its characteristics so as to cause it to resemble Java coffee.

This process is as follows: The coffee in bag is subjected to a high degree of moist heat. This ripens or matures the berry, and is also said to extract from it a bitter substance known as caffeo-tannic acid. In ripening, the colour is changed from a green to a brown tint, the shade of brown being lighter or darker, according to the length of time the coffee is subjected to the maturing process. The process is analagous to what occurs in the hold of a vessel carrying coffee from Java. I can find nothing harmful in it, except that in the case of certain South American coffees, I am informed, it enables the dealers to sell them for Java. The light coloured Java coffees are also matured by

the above method. Two advantages are claimed for this process: (1) it improves the drinking qualities of the coffees; (2) it enables the dealers to meet the demand for dark coloured coffees.

The proprietor of the mill in which the coffee in question was treated admitted to me that, in addition to the maturing process, he had formerly used yellow-ochre to give the coffee a more uniform tint. Yellow-ochre is a ferruginous earth, and is produced in nature by the decomposition of iron pyrites. It is a well-known fact that these pyrites almost always contain arsenic and other metals. Dr. Waller stated to me that the samples of coffees analysed had probably been coloured by yellow-ochre, and that the poisons found had been thus introduced.

In investigating this subject I received information which led me to inspect the mills polishing Rios and other coffees. These were situated in Brooklyn, and were found to be using a variety of agents for colouring purposes. I obtained from one mill, samples of the following colours: Chrome-yellow (chromate of lead), silesian-blue, yellow-ochre, burnt-umber, venetian-red, drop-black, charcoal, and French chalk. Two samples of mixed colour were obtained from the other mill. They are now being analyzed.

Coffee was first polished by kneading it in the bag. It was soon discovered that better results were obtained by revolving the coffee in cylinders with powdered soap-stone. Experiments with colouring matter followed, and finally resulted in the use of the colouring substances above-named.

I reported the facts of these cases to Commissioner Raymond, of the Brooklyn Health Department, whose investigations have verified my own. He informs me that he has summoned the proprietors of the mills before him to show reasons why they should not be prohibited from colouring coffee.

The names of the mills in which coffee is coloured as above, have been forwarded to the secretary.

Respectfully submitted,

CYRUS EDSON, M.D.,
Chief Inspector.

The following is the report of the analyst on the above-mentioned coffee:—

NEW YORK, April 21st, 1884.

I have the honour to report the following results of the examination of the sample of raw coffee (No. 1,229) submitted to me, the suspicion with regard to it being that it had been artificially coloured, and its original appearance otherwise altered.

The specimen was found to contain lead, arsenic and copper, in small amounts.

An attempt was made to remove the dust presumably containing the colouring matter by agitation with dilute acid. The results on about an ounce of the coffee so treated were as follows:—

Removed by shaking with dilute acid, contained	0·0139	grain copper.
Found in the beans after this	0·0231	,,
Total	0·0470	,,

This would be in the proportion of 80 parts of metallic copper per million of the raw coffee, corresponding to 1·585 grains of copper arsenite (Scheele's green) per pound.

Respectfully submitted,

E. WALLER, Ph.D.,
Chemist.

FORBIDDING THE USE OF POISONOUS COLOURING MATTERS.

After the New York City Department of Health made public the fact that arsenic and lead had been found in coffee, which was dressed and changed in appearance, as it was alleged, in two mills in Brooklyn, Commissioner Raymond, of the Brooklyn Health Department, took the matter in hand for investigation with the view to stop the use of poisonous substances in the re-dressing of the coffees. The chemist of the Brooklyn Board found the lead in the form of yellow chromate, but did not find arsenic or copper, though he did find celestial blue—a preparation of Prussian blue. Commissioner Raymond immediately ordered the discontinuance of the use of anything which can be at all injurious to health in the preparation of the coffee, a compliance with which the mills immediately promised, and to which the commissioner says he is going to see that they adhere by careful analysis from time to time. The order of the commissioner is as follows:—

"Whereas, It appears from evidence taken this day that the chromate of lead and celestial blue, containing Prussian blue, has been used in the colouring of coffee; and

"Whereas, In the opinion of the commissioner, such colouring matters so used are dangerous and detrimental to the public health; Therefore, the use of the said substances in the colouring of coffee is prohibited."

ADULTERATION OF POWDERED PEPPER.

Professor Charbonnier, in the *Répert de Pharm.*, directs attention to an adulterant which is not a new one, but at present appears to be very extensively employed in France, particularly for white pepper. This is the putamen of olives, known in commerce as *grignon d'olive* (olive pits) or as poivrette (little pepper), a name probably given to it to create the impression that it contained some of the properties of pepper. These olive pits were formerly burned up and used as manure (*engrais*); now it is found more advantageous to sell them at 25 or 30 francs for 100 kilos., and to use them for the adulteration of pepper. According to the treatment to which they are subjected, a grey or white powder is obtained, adapted for the adulteration of powdered black or white pepper. The hard shell consists of elongated stone cells, resembling those found in the epicarp of black pepper; but, since white pepper is deprived of the pericarp, the adulteration of its powder with ground olive pits is readily detected, under the microscope, by the large number of stone cells.

The same adulteration may be detected, according to Dupré, by dusting the powder upon a liquid composed of equal parts of glycerine and water, upon which the powdered pepper will float, while the powdered olive pits will sink.

COPPER IN JAM.

D. V. GALIPPE, in a communication to the Société de Biologie, states that French jams and preserves contain the following proportion of copper, but adds that daily experience on a large scale shows that its presence is not dangerous:—

Gooseberries	kilogramme,	gr.	0·0272
Cherries	,,	,,	0·0152
Plums	,,	,,	0·0248
Greengages	,,	,,	0·0160
Quince	,,	,,	0·0020
Apricots	,,	,,	0·0176
Strawberries	,,	,,	0·0112
Pears	,,	,,	0·0136
Oranges	,,	,,	0·0192
Pineapple	,,	,,	0·0224

MILK INSPECTION.

IN order to prevent the adulteration of milk, the Brooklyn authorities recently stationed policemen in the different locations of Greenpoint, ordering every driver of a milk wagon to visit Dr. W. A. De Long, Health Inspector, at the station-house, where samples of milk were taken for testing. About 50 samples were tested, and, with one exception, found up to the required standard.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

TO THE EDITOR OF "THE ANALYST."

GENTLEMEN,—A circular, dated 3rd June, 1884, which deals with the working of The Sale of Food and Drugs Act, 1875, has been sent by the Local Government Board to the Sanitary Authorities throughout the country. It contains an extract from a circular of that Board, dated 30th September, 1875, in which the following paragraph appears:—"Another important amendment will be observed in section 14, which requires the purchaser to notify to the seller, after the purchase has been completed, his intention to submit the article purchased for analysis, and to offer to divide it into three parts, each to be marked and sealed or fastened up. If such offer is accepted, he is to deliver one of such parts to the seller and one to the analyst, and to retain the third himself for production in case of proceedings. If the offer is refused, the purchaser is to divide the article into two parts, retaining one for himself, and delivering or sending the other to the analyst."

But section 15 of the above-named Act reads thus:—"If the seller or his agent do not accept the offer of the purchaser to divide the article purchased in his presence, the analyst receiving the article for analysis shall divide the same into two parts, and shall seal or fasten up one of those parts and shall cause it to be delivered, either upon receipt of the sample or when he supplies his certificate to the purchaser, who shall retain the same for production in case proceedings shall afterwards be taken in the matter."

Prosecutions under this Act have repeatedly broken down for no other reason than that every detail of proceedings laid down on it has not been literally complied with. It would, therefore, appear desirable that an official memorandum, emanating from the department of Government charged with the supervision of the administration of the Act, should be in accord with its provisions in every detail, otherwise the officials of any authority may be led into error, and, as not unfrequently happens, a flagrant adulterator go unpunished through a technical flaw on the part of the prosecution.

I am, Gentlemen, your obedient servant,

Grantham, 21st June. ALFRED ASHBY.

ANALYSTS' REPORTS.

A FEVER-PROPAGATING DAIRY.—At Greenock, the Medical Officer reported, regarding a recent outbreak of enteric fever among west-end families that, on inquiry, it was found that these families received supplies of milk from the same dairy. The dairy was visited, and, while the apartment in which the milk was kept was clean and tidy, it was ascertained that the place where the milk vessels were washed was in close proximity to a large dung stead and piggeries and stables—all so constructed and arranged as to keep the adjacent area, which was unpaved, saturated with excrementitious matters. A certificate prohibiting the sale or delivery of milk from the premises was granted, but the proprietor at once secured more suitable premises, and was therefore allowed to carry on the business as before. Since the change was effected no fresh cases had been reported.

LAW REPORTS.

Supplying Adulterated Milk to a Workhouse.—At the Clerkenwell Police Court, on June 5, Messrs. Patey and Co., milk sellers, of Ferry Street, Lambeth, were summoned by Sanitary-Inspector Rouch for having, on the 18th ult., sold milk for consumption at the St. Pancras Workhouse, which had been adulterated with 20 per cent. of added water, and which was deficient in butter fat to the extent of 60 per cent. The defendants were further summoned for having consigned milk to the same workhouse on the 22nd ult., which was adulterated with 14 per cent. of added water, and which was deficient in butter fat to the extent of 40 per cent. Mr. Ricketts, solicitor, prosecuted. Inspector Rouch stated that he attended the St. Pancras Workhouse on the evening of Sunday, the 18th ult., and awaited the arrival of the milk supplied to the institution by the defendants, who were the contractors. On four churns arriving in charge of a man, witness took a pint of milk from one of the churns, placed it in a bottle, and afterwards submitted it to Dr. Stevenson, public analyst, who informed him that the milk contained 20 per cent. of added water, and was deficient in butter fat to the extent of 60 per cent. He stopped some more milk at the door of the workhouse again on May 22nd, and on another pint of milk being examined it was found to have been adulterated with 14 per cent. of added water, and was deficient in butter fat to the extent of 40 per cent. The manager to the company, who said he managed the business for Mr. Arnold Goldie, made the defence that the company sold the milk as they received it from the country. Mr. Barstow said this was a very bad offence, and he should impose the highest penalty. He ordered the defendants to pay a fine of £20 on each summons, or £40 in all, and costs.

Important Judgment under the Adulteration of Food Act.—In the Exchequer Division, on Monday, before Mr. Baron Dowse and Mr. Justice Andrews, judgment was given in two cases stated for the opinion of the Court by the magistrates at Enniskillen Petty Sessions, consequent on their conviction of Noble Hilliard and another at the prosecution of the Enniskillen Board of Guardians for having supplied to the workhouse buttermilk and milk adulterated with water. The defendants were contractors, and when the milk was delivered at the workhouse the master took a sample which he divided into three parts, one of which he returned, another he gave to defendant's messenger, and the third he enclosed in a box, with the name Noble Hilliard upon it, and sent it by rail to Dr. Cameron, for analysis. On Dr. Cameron's certificate the magistrates were satisfied that the milk was adulterated, and they consequently convicted the defendant. Two objections were taken by Mr. Irwin, solicitor for the defendant—first, that the sample forwarded to Dr. Cameron ought to have been sent by registered letter, as he resided more than two miles distant, and therefore there was not sufficient evidence to satisfy the magistrate that the milk analysed was that delivered by the defendant; and second, that the delivery was complete, and the milk had passed out of the defendant's control. Both objections were overruled by the magistrates Baron Dowse, in delivering judgment, did not attach much weight to the objections raised at Petty Sessions, and said Mr. Hart, who had argued the case with ability, had raised five points here. First, that there was no purchase at all under the statute. If that was true the whole jurisdiction failed. A second contention was that section 14 of the Act of 1875 governed the case completely, and that proper notice of the intention to analyse was not given as prescribed by that section, and it was a condition precedent to success in the prosecution. The other points were as to the identity of the sample, and that the Board of Guardians could not maintain the prosecution as being a Corporation and not a person. But the main and central point in the case was whether the proceedings were governed in an essential degree by section 14; because, if so, it would be difficult to say that Mr. Hart's argument was not right. The way the argument was used was by traversing all the points he made. In his (the learned judge's) opinion the judge relied on for the defendant in the case of Parson *v.* the Birmingham Dairy Company ought not to be followed. He agreed that the section was not confined to public officers, but referred to every purchaser who purchased with the intention to analyse; but he did not consider that the section governed the entire Act of Parliament. If a man purchased an article of food in contravention of section 6, he could within a reasonable time have it analysed. The other points made he overruled, and held that the magistrates' decision was right, and ought to be affirmed with costs. Mr. Justice Andrews concurred.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Pharmaceutical Journal; The Sanitary Record; The Miller; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; Cowkeeper and Dairyman's Journal; Sugar Cane; Country Brewers' Gazette; The Medical Record; The Grocers' Gazette; London Water Supply, by Crookes, Odling and Tidy; Chemical Review; Independent Oil and Drug Journal and Paint Review; Science Monthly; Journal of the Society of Chemical Industry; The Law of Adulteration, by Herbert.

THE ANALYST.

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RECOGNISING the great interest felt by all analysts in the Conference upon the subject of "Food Adulteration and Analysis," held the week before last at the Health Exhibition, we have gone to the expense of securing a *verbatim* shorthand report of the proceedings. We have made no attempt to in any way summarise the remarks of the speakers, or to suppress such portions of the discussion as do not coincide with our views, merely referring to them as "flippant" or "loose" remarks (which has been done by certain special journals), but we give the whole, as actually spoken, both for and against the present state of the law. It not being desirable that the size of any particular volume of the ANALYST should be increased and placed out of uniformity with past years, we have, to bring such a mass of matter within reasonable limits, printed the whole in smaller type than usual. Even then it has been found impossible to include the whole in one number, and the remainder of the second day's proceedings will be given in our September number, when we hope there will be space enough to finish the whole. The importance of publishing as much as possible this month must be our excuse for omitting all legal reports from the present number of the ANALYST.

PROCEEDINGS OF THE CONFERENCE ON FOOD ADULTERATION AND ANALYSIS HELD AT THE INTERNATIONAL HEALTH EXHIBITION ON 14TH JULY, 1884.

THE PRESIDENT (Dr. Odling) opened the Conference, and said: The Executive Committee had invited the Institute of Chemistry, over which I have the honour to preside, to hold a Conference on the important subject of the adulteration of food, and the means of analysis of food. We hope on a subject of this kind, to which so much attention has been paid on the part of so many eminently qualified to treat the question, that a discussion of considerable interest may arise, and that some good in the way of increase of knowledge as to the points of difficulty may be arrived at. We have the benefit of the presence and co-operation of a considerable number of gentlemen who occupy the important position of public analysts, and we hope from them to derive a considerable amount of information bearing on the subject, and in the undertaking we are fortunate in having the services of Dr. Bell, of the Laboratory of Somerset House, who has taken the trouble to prepare a paper, taking the subject all round in its general bearings. He then called upon Dr. Bell, who delivered the following address:—

FOOD ADULTERATION AND ANALYSIS.

By Dr. JAMES BELL, F.R.S.

ADULTERATION, in its widest sense, may be described as the act of debasing articles for pecuniary profit by intentionally adding thereto an inferior substance, or by taking therefrom some valuable constituent; and it may also be said to include the falsification of inferior articles by imparting to them the known appearance of commodities of superior quality.

The evils of adulteration may be viewed either from a sanitary, moral, or pecuniary standpoint, and it is no doubt chiefly in its relation to the health of the people that the subject of Food Adulteration and Analysis has been chosen for a Conference in connection with this Exhibition.

Of the sanitary evils of the adulteration of food there cannot be the faintest doubt, and even on this ground alone the practice merits the severest condemnation. This is the case when the substance added merely reduces the nutritive value or characteristic property of the food, but the offence becomes highly criminal when the adulterant also possesses properties injurious to health.

The moral aspect of this question should never be lost sight of. No man can continuously practise deception without losing self-respect, and, also, when detected and exposed, the respect of his fellow-citizens. Moreover, in such circumstances, a feeling of uncertainty on the part of the buyer is created, and his first idea on the receipt of a commodity of somewhat lower quality than usual is that it must be adulterated. The honest vendor thus shares with the dishonest one the general penalty of suspicion, and the transactions of nearly all dealers in articles of food are viewed with distrust.

But it is from the pecuniary standpoint that the question is most often viewed by the general public, for the primary cause of adulteration is a desire for unjust gain, to be obtained either at the expense of consumers, or by taking unfair advantage of competitors in trade.

If the adulterated article is sold at the ordinary price of the genuine commodity, the customer is robbed of the amount represented by the diminished value; whereas, if it be sold as genuine, though at a proportionate reduction in price, the unfair competition tends either to seriously injure their honestly-disposed rivals in trade, or, what is but too often the case, to drive them into a similar course. Attempts have sometimes been made to estimate roughly the amount of pecuniary loss suffered by consumers owing to the adulteration of different articles of food, but, for my part, I have never been able to see that any reliable data were obtainable upon which to form even the rudest approximate estimate.

The practice of adulteration is by no means of modern date, but has existed, more or less, from time immemorial. There is evidence that it was practised by the Greeks and Romans, and it has probably been co-existent with the development of commerce.

The earliest enactments in this country in reference to food appear to have had a much wider scope than those of recent years, for they embraced the quality as well as the genuineness of the article, and dealers in foods or drinks which, from whatever cause, were considered as unwholesome, were fined once or oftener, and then, if found incorrigible, were condemned to bodily punishment. The first enactment on the Statute Book is the 56 Henry III., cap. 6, passed in 1266. Under this and subsequent statutes or "Assizes," the baker was to be punished if he sold bread light in weight, or made from unsound wheat, or at too high a price in relation to that of wheat; the brewer if he was not sufficiently liberal with his malt in proportion to the price of barley; the beer-retailer if he sold ale drugged or short in measure; the vintner, if his wine was drugged, corrupted, or unwholesome; and the butcher, if he sold diseased meat.

When we consider the difficulty which at the present time we experience even with increased knowledge and appliances in suppressing adulteration, it is not to be wondered at that the machinery of those days failed to put an end to the evils complained of.

With the exception of one or two Acts relating to the adulteration of bread, all the legislation upon articles of food from the time of George I. to the year 1860, had reference to the protection of the revenue, and therefore only indirectly guarded the health or pocket of the consumer. The Acts within this period related principally to tea, coffee, beer and porter; and, if we are to place any reliance upon the words of an Act of Parliament, the adulteration of tea a hundred years ago must have attained very alarming proportions. The Act, 17 Geo. III., cap. 11, states that great quantities of sloe leaves, and leaves of ash, elder, and other trees and shrubs were then being manufactured and sold in imitation of tea, to the injury and destruction of great quantities of timber, woods, and underwoods.

In the year 1851 there was considerable agitation amongst planters and others interested in the production and sale of coffee, in consequence of the falling off in the consumption of that article caused by its wholesale admixture, as permitted by Treasury Minute, with chicory. Petitions were presented to both Houses of Parliament on the subject, and it was perhaps the general attention directed at that time to this matter which induced the proprietors of the *Lancet* to perform a public service of the highest value. In 1851 and several following years, at their own expense, they instituted an extensive inquiry into the character of the food, drink, and drugs sold in London, and engaged chemical and microscopical analysts for that purpose. The results showed that adulteration prevailed to an alarming extent, and that in many cases the adulterants were of a nature highly injurious to health. The Editor of the *Lancet* showed his confidence in the analysts employed by publishing in that journal the results of the analyses, whether favourable or otherwise, together with the name and address of the vendor. The increased public attention thus caused, resulted in an inquiry by a Select Committee of the House of Commons in 1855, which reported that adulteration of food, drink, and drugs was very prevalent, and that some of the adulterants used were of a poisonous nature. Following upon that report, and as a consequence thereof, the first general Act in this country was passed in the year 1860. This Act may have exercised to some extent a deterrent effect, but beyond this the practical outcome of it was but small, for the appointment of analysts was permissive, and the obtaining of samples for analysis was left to private purchasers. Another Act was passed in 1872, extending the right of appointing analysts to boroughs having separate police establishments, but still left such appointments optional. A most important provision, however, was made for the purchase of samples by local officials, and the right was given to private purchasers to have samples analysed on payment of a small fee.

The adoption of the Acts of 1860 and 1872 was by no means general, but was principally confined to London and the large towns; and even where adopted, the action taken was often of a very restricted character. The prosecutions which ensued, however, were sufficiently numerous to cause a general outcry from tradesmen about alleged miscarriages of justice; and in answer to petitions from most of the large towns, the Government decided to appoint another Select Committee of the House of

Commons to inquire into the working of these Acts. This Committee reported that while the Acts had done much good, they had likewise done considerable injury, as many heavy and undeserved penalties had been inflicted upon respectable tradesmen, and that such injury had arisen partly from the want of a clear understanding as to what constitutes adulteration, and partly from the conflicting opinions and inexperience of the analysts employed, some of whom appeared to have evinced a great want of discretion. It was recommended that the Acts of 1860 and 1872 should be repealed, and that a new, extended, and compulsory Act should be substituted for them. The chief amendments suggested were the inclusion of the fraudulent abstraction of an important property of any commodity, such as the removal of cream from milk, as a punishable offence; the examination of tea on importation; better regulations for obtaining samples, and for securing the appointment of qualified food analysts. To meet an important want provision was also made for obtaining an independent analysis in case of dispute.

A great improvement had evidently taken place since the previous Parliamentary Committee had sat in 1855, especially in regard to the deleterious nature of adulterants used, for this Committee concluded their Report by expressing their belief that it will afford some consolation to the public that in the matter of adulteration, they are *cheated* rather than *poisoned;* and that if deleterious substances are occasionally used for the purposes of adulteration, they are used in such minute quantities as to be comparatively harmless. Further, as a matter of policy, they pointed out that they did not consider that Parliament desired needlessly to hamper or fetter trade, still less to interfere between the buyer and seller with the view of regulating prices, or attempting to assist the consumer in ascertaining the real money value of any marketable commodity.

Upon the lines indicated in this Report was framed the Bill which passed into law as the Sale of Food and Drugs Act, 1875, and which is the Act now in force, though amended in some respects by the Sale of Food and Drugs Amendment Act, 1879. I shall now pass on to consider, 1st, the object of these Acts; 2nd, the machinery provided for attaining that object; 3rd, how far the Acts have succeeded; and, 4th, analysis in relation to adulteration.

The title of the Act of 1875 states that it is "to make better provision for the Sale of Food and Drugs in a pure state." Although expressly intended to suppress adulteration in food, drink, and drugs, the word "adulterant" or "adulteration" does not occur in any of the clauses, for the reason, I believe, that no definition of these terms could be framed to meet all practical requirements. The sale of mixtures is freely allowed, provided that the nature of the commodity sold is brought to the notice of the purchaser before the sale is completed, so that if necessary it may be declined, and that no ingredient has been added so as to render the article injurious to health.

The fundamental idea of the Act is found in section 6, which enacts that "no person shall sell to the prejudice of the purchaser any article of food, or any drug, which is not of the nature, substance, and quality of the article demanded by such purchaser." Here is a clause capable of a very wide definition, but I think the spirit of the section is fairly expressed by Mr. Justice Mellor in delivering judgment in the Appeal Case of Hoyle *v.* Hitchman, when he says, "The offence intended to be prevented by the Act was the fraudulent sale of articles adulterated by the admixture of foreign substances which would necessarily be to the prejudice of the purchaser, and those words were inserted only to require that such adulteration should be shown to have been made;" and further, "if the purchaser asks for a certain article, and gets an article which, by reason of some admixture of a foreign article, is not of the nature or quality of the article he asks for, he is necessarily prejudiced."

It would thus appear that for a purchaser to be prejudiced within the meaning of this clause, it is necessary that the article sold should contain some admixture of a foreign substance not specified at the time of sale; and therefore that the purchaser is not legally prejudiced when the article sold is of low quality but genuine. This view will be found confirmed in the twelfth Report of the Local Government Board, in which it is stated that "the Sale of Food and Drugs Acts are not designed to prevent the sale of poor articles, but that of adulterated articles." It has been urged that samples should be judged by those of average quality, which the purchaser might reasonably expect to get: but this was evidently not the view of our legislators, for Parliament deliberately abstained from fixing limits of quality for natural products, whether in a raw or prepared state.

I come now to the means provided for suppressing the adulteration of food. The Local Authorities of each city, metropolitan district, county, or borough throughout the United Kingdom, have now the power to appoint inspectors and duly qualified analysts for the purchase and analysis of samples, and should they not appoint an analyst voluntarily, they are required by the Act to do so when called upon by the Local Government Board in England, or a corresponding authority in Scotland and Ireland. When any sample purchased, according to the provisions of the Act, is found adulterated, the vendor can be summoned before a magistrate, and on conviction fined in a sum not exceeding £20 where the adulteration is simply to the prejudice of the purchaser. When, however, the adulterant renders the article injurious to health, the maximum penalty is £50 for a first offence, and six months' imprisonment subsequent convictions.

On payment of a fee not exceeding 10s. 6d., a private purchaser may have any article analysed by the public analyst, and, if found adulterated, the vendor, if the provisions of the Act have been complied with, may be prosecuted and fined as if the purchase had been made by the inspector. The requisite official machinery has not been provided in all places, and the Local Government Board do not appear to have power to enforce the appointment of inspectors, nor the purchase of a sufficient number of samples to ensure the efficient working of the Act.

I find, on inquiry, that though analysts have been appointed for most places in England and Wales, there were no fewer than sixty-three boroughs and three counties in which no samples whatever

were analysed during the year 1883, and in many other places the number analysed was very small.

In Scotland, out of thirty-two counties only seven have yet appointed analysts, and of these two have had no samples examined for six years, while a third has only had one sample, and a fourth only three samples analysed during the last three years. Of 167 royal and police boroughs, thirty have appointed analysts, thus showing only thirty-seven appointments for the whole of Scotland out of a possible total of 199, or about one in five.

In striking contrast to Scotland is Ireland, where an analyst has been appointed for every place except one borough and one county.

In considering some of the general results which have been obtained by the working of these Acts it would manifestly be unfair to institute a comparison between the years prior and subsequent to the Act of 1879, which laid down minimum strengths for spirits, so I confine my statistics to the last three years for which returns have been issued by the Local Government Board. I regret that I have been unable to obtain complete returns for Scotland and Ireland, so the following data for the years 1880, 1881, and 1882, showing the total number of samples analysed in each year, with the percentage of samples reported as adulterated, refer to England and Wales only.

Year.	Total Number of Samples Analysed.	Percentage Reported Adulterated.
1880	17,673	15·7
1881	17,823	14·6
1882	19,439	15·0

The percentage of samples found adulterated varies, as might be expected, somewhat from year to year in the various commodities; but on the whole, and so far as these returns show, it is practically stationary.

These are the only data available, so far as I know; and valuable as they are for comparison from year to year, there are several reasons why they afford only a roughly approximate idea of the extent to which adulteration is practised in this country. On the one hand, the samples are nearly all purchased by inspectors, many of whom are personally known to the tradesmen,—the object for which the purchases are made being perfectly well understood;—whilst some districts throughout the country are inadequately, if at all represented. On the other hand, a large number of samples are returned as adulterated where the amount is so small that no proceedings are instituted; and to these may be added samples of which adequate notice of admixture had been given at the time of purchase, and also samples of impure well-waters, which are sometimes classed as adulterated. I may also mention that of 528 samples purchased by private individuals in one year, the percentage found adulterated was 25, as compared with only 14·5 per cent. in the samples purchased by the official inspectors during the same year; but this may partly be accounted for by the fact that a private purchaser has generally good grounds for suspecting adulteration before going to the trouble and expense of having the article analysed. The small number of samples submitted for analysis by private purchasers has been more than once commented upon by the Local Government Board, and shows, I think, that the expense of the analysis, together with the trouble involved in the event of a prosecution, are more than private individuals are willing to bear. Perhaps this is not surprising when it is considered how small an amount individually they have at stake, and how readily they can, when dissatisfied, change their tradesmen.

The working classes, especially, who form the bulk of the population, and are the greatest sufferers from adulteration, can hardly be expected to take action on their own account if only by reason of the expense; but there is often the further impediment of the analyst being many miles away, and doubtless in such cases his name and address are not always generally known.

It is much to be regretted that an evident unwillingness has been found on the part of some local authorities to bring these Adulteration Acts into operation. The Acts are practically a dead letter in some districts even where nominally complied with, owing to the small number of samples purchased, or the conditions under which the purchases are made. In the twelfth Report of the Local Government Board it is stated, that in some cases "scarcely any attempt is made to conceal the official character of the buyers, or the purpose for which they are buying;" and the Board add, what must be perfectly obvious, "that unless the samples obtained by the inspector are of the quality ordinarily sold to the public, the object of the purchase is frustrated."

In some districts the local authorities have been much discouraged by the small fines imposed by the magistrates, even when the offence has been committed more than once. There can be little inducement for them to carry out these Acts energetically when they find that after going to all the expense and trouble of the purchase and analysis of samples, and taking the necessary legal proceedings against a fraudulent tradesman, the heinousness of his offence is assessed by the magistrates at such a trifling sum as cannot in any view be held to be a deterrent penalty, but one readily covered by the illegitimate profits of a few days.

The tendency in recent years has been to place increased discretionary power in the hands of magistrates. For many years prior to 1879, their discretion in matters of fines in Revenue cases was limited to reducing penalties to not less than one-fourth of the amount named in the Act. By the Summary Jurisdiction Act of 1879, however, they were given full discretionary power in first offences, but the former restriction remains in force for second and subsequent offences. Some such regulation may be found desirable under the Sale of Food and Drugs Acts, especially in cases where the vendor is the actual adulterator.

In discussing the relation of analysis to adulteration, it is not my intention to review the various

methods of analysis, but merely to refer briefly to some of the analytical difficulties experienced in dealing with the subject. When the adulterant differs chemically or microscopically from the article to which it is added, as when alum is added to flour or bread, or wheat flour to mustard, the detection of the adulterant is only dependent upon the skill and experience of the analyst. But when the adulterant is similar in character to, or identical with, one of the constituents of the article to which it is added, we are met at the outset with a formidable obstacle in the fact that natural products of all kinds vary greatly both in composition and quality, and the problem presented for solution is then whether lowness of quality is due to natural poverty or to adulteration.

There are butters, for instance, so rich in quality that they would admit of a large addition of foreign fat, and still yield analytical results within the limits of genuine, but poor, butter. Again, it is well known that the milk yielded by some cows is of so low a quality as not to be equal to that from other cows with a large proportion of added water. Further, there are some teas which, regarded from whatever test of quality we may apply, are so rich that they will bear a considerable admixture of partially exhausted tea-leaves and still yield results equal to those from other poorer, but yet genuine, teas. This is the difficulty which, more than all others of a scientific nature, stands, and I fear will continue to stand, in the way of the entire suppression of adulteration.

Unfortunately, the history of food analysis shows that this difficulty in dealing with natural products has been increased to some extent by the adoption of different processes of analysis, which, in the hands of various chemists, have yielded results differing so materially as to lead to contrary opinions upon the same sample. To my mind, it is therefore most important that whatever analytical process is used, it should yield absolute, and not comparative, results.

There are, however, occasions on which differences of opinion between analysts may be expected to arise, as, for instance, when the microscope has to be depended upon for the detection and estimation of the adulterant. Any want of concord between analysts in respect to their estimate of the proportion of adulteration in such cases as the presence of barley-meal in oatmeal, or rice flour in ground ginger, should not be made too much of, as the certain proof of admixture is the main thing to be desired, and it can make but little difference whether the percentage of the adulterant be returned, say, as 15 or 20 per cent.

It is frequently urged that certain "limits," founded upon the analyses of samples of average quality, should be laid down and legalised for natural products, below which such products should be deemed to be not "of the nature, substance, or quality of the article demanded," but the adoption of such "limits" might lead to grave difficulties. It is the opinion of practical men that it would be unwise to adopt any legislative measure with respect to limits of quality which would tend to discourage production, and diminish the supply of any article of food. It would manifestly be an economic blunder, if, for instance, in order to raise the quality of milk by one half of 1 per cent. on the non-fatty solids, the actual production were to be diminished by 10 per cent. in quantity.

Following these views, it may be of interest to particularise some of the principal articles of food, and the results of the analyses of samples under the Adulteration Acts of 1875 and 1879. I have taken the data from the Local Government Board's Reports, founded upon Returns make by the Public Analysts, and of which an able Summary for the five years, 1878 to 1882, will be found in a valuable "Handbook on the Law of Adulteration," by Thomas Herbert, published by Knight and Co., of Fleet Street.

Milk.—Beginning with milk, we find that it differs from most other natural food products in that it is sold to the public, and, as a rule, consumed, in its natural state; also in that it is difficult, from a general inspection of its appearance, or from its taste or smell, to form a fair idea of its quality; and further, in that within the same town or district it is mostly sold at a uniform price, except in special cases for nursery purposes.

The judging of the quality of milk may therefore be considered to be largely dependent on analysis, and having regard to the facility with which it can be adulterated, the public require a greater amount of assistance in order to secure a supply of genuine milk, than they do in the case of almost any other article of food. I have little doubt that in course of time, with the increasing means of education, the public will become more skilful in judging of the quality of milk and other commodities, and will be able frequently to detect those instances of gross adulteration which may now pass unobserved.

The range of quality in the milks obtained from healthy and well-fed cows is very considerable. Taking the non-fatty solids of the milk as a criterion of value, I have found in common with others that the percentage varies—with a few exceptions on either extreme—from 8·2 to 10·8 per cent. It is evident that a milk of the higher value might be subjected to a good deal of watering—about 25 per cent.—and still yield the results obtained from the poorer, but still genuine, milk.

This opening to sophistication which the differences in the quality of milk permit, is not less, but even exceeded in the case of butter, owing to the greater range in its quality, a point I shall shortly have to notice.

For a long time it was contended that cows which gave milk containing less than 9 per cent. of non-fatty solids were either diseased or starved, but this notion may now be said to be dispelled, for the more the matter has been investigated the more has such a position been found untenable.

Milk yields very variable proportions of fat. The percentage is sometimes as low as 2·2, and occasionally rises to as high as 6. This great range of difference affords facilities in some instances for the abstraction of part of the cream, and unfortunately renders the analysis in such cases of but

little value in protecting the public against this species of fraud—a circumstance much to be regretted when the high value attached to the fat of milk is considered.

As to the necessary groundwork of milk analysis, chemists are universally agreed. The data sought for are the percentages of fat, non-fatty solids, and ash; but, in order that the results of one analyst may compare with those of another, the processes employed for determining these data require to be uniform, and the methods themselves must be such as will yield accurate results.

As proceedings under the Adulteration Acts are of the nature of a criminal prosecution, it is essential that the analysis should not indicate mere comparative results, but that the constituents relied upon for forming an opinion should be expressed by those weights or percentages which shall set forth the true quantity in the substance analysed, as absolutely as the most skilful analysis can provide.

About 6,300 samples of milk are analysed yearly in England, of which 20 per cent. are returned as adulterated. The offences are practically confined to addition of water and abstraction of cream, but occasionally preservatives, such as boric acid, designed to prevent the milk from turning sour, have been found, and also, but still more rarely, sugar and colouring matters.

While admitting that in some districts the milk-sellers may be adequately sampled, yet, taking the country as a whole, the total number of samples analysed appears to me to be insufficient to show to what extent adulteration is generally practised, or to act as an effective bar to the practice.

Butter.—The supply of good, wholesome, and genuine butter for the public use is a desideratum. Fortunately, however, in this they are able in a great measure to become their own judges. They can readily distinguish between what is sweet and rancid, and can discover a butter which is heavily loaded with salt, and often detect the presence of an excessive amount of water. In fact, the public can practically protect themselves against most forms of butter adulteration, except that arising from the admixture of foreign fat.

Butter is another illustration of the difficulty with which chemists have to contend, arising from the wide variation in the composition of the article in a pure state; and, as in the case of milk, it is essential that, in order to avoid differences in results and contrary opinions, the method of analysis adopted should be such as to effect a complete and accurate separation of what is termed the soluble and insoluble fatty acids. It is now generally admitted that the percentage of fixed fatty acids found in genuine butters varies from 85·5 to nearly 90·0 per cent., so that the addition of something like 40 per cent. of a carefully selected foreign fat to the richest butter, would still leave the percentage of insoluble fatty acids within the range of a genuine butter.

As in the case of milk, chemists are agreed upon the lines to be followed for the determination of the genuineness of butter, and differences can only arise from variations in processes followed for the attainment of the necessary data.

About 1,200 samples of butter are analysed yearly, of which 15 per cent. are reported against. The adulteration consists in the substitution or admixture of foreign fats, and occasionally in the introduction of an excessive amount of water.

In connection with this subject, I may mention that the manufacture of artificial butter compounds from animal and vegetable fats has, in recent years, attained enormous proportions in the United States of America. These compounds, known as butterine, oleomargarine, suine, etc., are in the opinion of high authorities legitimate articles of commerce, if sold under names which properly indicate their origin and composition.

If manufactured in a cleanly manner from sound fats, they are perfectly wholesome, and afford the poor a cheap and useful substitute for butter, especially during the winter months, when good butter is both scarce and dear. I see, however, that the Legislature of the State of New York has, at the instigation of the farming interest, resolved to suppress the manufacture and sale of such compounds within the bounds of that State.

This decision was based upon the evidence given in what is said to have been a very one-sided investigation, and in which it was stated that such compounds contained deadly germs; that the workmen engaged in their manufacture were subject to loathsome diseases; and that by their use the death-rate of New York had increased at an alarming pace. Putting aside such undoubtedly exaggerated statements, it is highly probable that with the increased demand there may have been less care exercised in the manufacture than at first, and that in some cases impure or decomposed fats may have been used, but these are grounds rather for sanitary supervision than for the suppression of the trade.

Cheese.—It is considered that the consumer can in a great measure protect himself in his purchases of cheese. The range of prices plainly shows him the different qualities, and he can exercise his judgment in selecting the kind best adapted to his taste and pocket. I am not aware of any instance in which an adulteration of cheese has been reported. Colouring matter is the only foreign ingredient employed in its manufacture, but this is a necessity to satisfy the public taste as regards colour.

The successful manufacture of factitious butter from animal and vegetable fats has naturally suggested their substitution for milk fat in cheese, but there is no evidence that "butterine cheese" has yet found its way into the English market. When it does, there are adequate chemical tests to distinguish it from the genuine article.

Bread.—About 1,100 samples of bread are analysed annually, of which, on the average, 6 per cent. are shown as adulterated. The principal adulterant is alum, which was reported in one case as

being present to the almost incredible amount of 1,305 grains, or nearly 3 ounces to the quartern loaf. I do not think it would be questioned that so large an addition of alum must be injurious to the health of the consumer. The amount usually added, however, is comparatively small, being only about 30 to 40 grains in the 4-pound loaf, and whether then injurious to health or not is a matter in dispute, there being both chemists and medical men who take opposite views on this subject. When the objects for which alum is added are considered, that it is either to enable unsound flour to be used, or to cause the bread to appear to have been made from better flour than has really been the case, its use should be strongly deprecated, and its presence treated as an adulteration.

Tea.—The number of samples of tea analysed by public analysts is small, and the cases are very rare in which adulteration is reported. This, no doubt, in part, arises from the scrutiny which tea undergoes on importation, which has had the effect of discouraging, in great measure, the trade in adulterated teas.

The manufacture in this country of spurious teas from the leaves of other plants, or from exhausted tea-leaves is extinct; for the low price at which genuine tea can now be sold holds out but small inducement for the increased risk under the present adulteration Acts, of manufacturing and selling a spurious article. The methods of analysis adopted for the detection of the adulteration of tea are fairly effective, and the only form of sophistication which could be practised with any chance of success is the admixture by the Chinese of partially exhausted tea-leaves.

Coffee.—About 1,250 samples of coffee are yearly analysed, of which 18 per cent. are reported as adulterated. With rare exceptions the sole adulterant found is chicory, which, it may be mentioned, is the only substance that can legally be added to coffee without requiring the payment of a further tax in the form of a stamp duty.

The adulterants of coffee all consist of vegetable matter, and allowing that the analyst is acquainted with the structure of the different vegetable tissues, their detection by the microscope becomes a matter of certainty.

In connection with coffee it may be noticed, and the remark applies equally to all substances on which a Revenue duty is imposed, that the interests of the public are largely though indirectly protected by the constant supervision and inspection which such commodities undergo, either in their manufacture or sale, so that before such articles in the adulterated state can come into the hands of the public analyst they must have evaded those safeguards which the restrictions of the Revenue Acts provide.

That such a result is brought about receives confirmation from the fact that it is seldom that a prosecution arises under the Food and Drugs Act, for the adulteration of a dutiable article with a marketable commodity not liable to duty.

Spirits.—Whisky, gin, rum, and brandy are the only articles under these Acts which are required to be sold at not less than a specified strength, unless otherwise declared at the time of sale.

These spirituous liquors are in a different position to natural products, for being in all cases mixtures of manufactured spirit and water, the relative proportions of which are readily ascertainable, it was not unreasonable for Parliament to fix a minimum proportion for the essential constituent alcohol (defined in terms of proof spirit), below which the retail purchaser was to be considered "prejudiced," unless made aware of the fact at the time of sale. It is true that the percentage of alcohol is but one factor in determining the commercial value of spirits, and that a purchaser may receive better value for money in a well-matured spirit below the minimum strength, than if he were supplied with a less-matured article at or above that strength. The alcoholic value, however, is the only one which can be accurately estimated, and about which, therefore, analysts may fairly be expected to agree.

About 2,000 samples of spirits are annually analysed, of which 25 per cent. are reported as adulterated, but only in very isolated cases has any other adulterant than water been found. This is a striking refutation of the opinion, so frequently expressed, that most of the evils of spirit drinking are due to adulteration, and no better illustration could be afforded of the frequency with which inferiority of quality is confounded with adulteration. On several occasions samples of whisky have been sent to me from districts where the people were said to be injuriously affected by drinking the spirit, and I have never met with an adulterated sample, but the spirit was invariably of a raw and immature character. The changes that take place in the maturing of spirit, whereby it loses its fiery character, and the deleterious traces of fusel oil become changed into comparatively harmless flavouring ethers, are not well understood, and it is impossible by any mode of analysis at present known to separate spirits into the two clearly defined classes, of those which are new and deleterious, and those which are sufficiently matured as to be harmless, this being rendered all the more difficult by the common practice of blending spirits of various ages and flavours in order to get a mixture having a certain recognised character.

In some measure, to meet this difficulty, an effort was made a few years ago by a well-known Irish member of the House of Commons, an effort which is now being renewed, to move the legislature to enact that whisky before being sent out for consumption must have been kept in warehouse for at least one year. This attempt, however, did not succeed through the trade difficulties which were found to beset such a plan.

The obstacles in the way of controlling the quality or genuineness of brandy are even greater than in the case of whisky, as its production is carried on outside this country, and the practice of adding a certain proportion of plain spirit and a mixture of sugar and flavouring matter to real brandy, has become fully recognised in the trade, and is allowed for in the purchase and sale of this article.

This addition of saccharine matter has a marked tendency to obscure the naturally harsh character of brandy, and to cause its coarse and immature nature to pass unnoticed by the public generally, while whisky being free from sugar at once appeals to the palate in cases where the spirit is of a new or fiery character.

That the circumstances indicated create formidable difficulties in the application of chemical tests to brandy suspected to contain added spirit is clearly evidenced from the fact that there does not appear to have been any successful prosecution under this head in connection with the Food and Drugs Act.

Beer.—This, from its position as the national beverage of this country, is of especial interest and importance in its relation to analysis and adulteration. Prior to 1847 beer could be accurately and legally defined as a fermented beverage prepared from malt and hops, but in that year sugar was allowed to be used. Fifteen years later, namely, in 1862, the hop duty was abolished, and revenue interference with the use of hop substitutes ceased; then, in 1880, the malt duty was removed, and brewers were allowed by the Beer Act of that year to use any materials whatever capable of being used in brewing. There is no legal limitation as to the strength or original gravity of beer, nor as to the degree to which it shall be fermented, or, in other words, the proportion of alcohol it shall contain. It is, therefore, impossible to give a clear and concise definition of what beer ought legally to be. The former definition, and still popular idea, that it is a fermented beverage prepared exclusively from malt and hops is neither supported by revenue law nor by present trade practice, for there may now be legal beer without either one or the other, or even without both.

Under what circumstances then can a purchaser of beer be deemed to be prejudiced? The Local Government Board have stated that "it would seem to follow from decisions in the High Court of Justice that a purchaser in demanding beer must be held to mean the article ordinarily sold under that name, and that it would be to his prejudice to sell him, as beer, an article not of the nature, substance, and quality of that ordinarily sold as such, whether containing ingredients injurious to health or not." It is not easy to fix a basis or standard of quality for the article ordinarily sold as beer, for it is my experience, as well as that of other analysts, that even in the same town the money value of beer sold under the same name, and at the same price, differs by as much as 50 per cent. from whatever point of view its value may be considered. Suggestions have been made that, as in the case of spirits, minimum limits of strength, based upon original gravity, should be laid down by Parliament for the several well-recognised sorts of beer; but there would be many objections to such a course, more especially where the value of the beer depends more upon its character or flavour than upon its strength.

An Association has been formed to cause the ingredients from which the beer has been made to be declared, but I fear that those who expect analysts to be able to prove or disprove the truth of such declarations rather overrate the present capabilities of chemical science.

A popular notion has long prevailed that no article is more manipulated than beer, and it is therefore satisfactory to find that there have been comparatively few prosecutions for the adulteration of beer, and, so far as I know, the only adulterant found has been common salt. Now the amount of common salt naturally present in beers varies widely, some of those containing the largest proportions being held by the public in high repute. As salt is added as an antiseptic, and really increases the keeping properties of some beers, it has been contended that the public cannot have been much prejudiced in those cases where a small quantity has been added, but where the total amount present is within the limits of a genuine beer held by them in high estimation.

It was my intention to discuss in detail several other subjects of interest, including wine, but it appeared to me that if I did so, the paper would prove too lengthy and tedious for the opening of a Conference.

I may say, however, that in most articles of food there has been a very great improvement in recent years as regards adulteration, and that the gross and deleterious forms of sophistication which are stated to have been extensively carried on at one time are now practically abandoned.

For example, the only substances which are now found in cocoa are sugar and starch, and in mustard, flour and turmeric, and these additions are not considered as adulterants so long as the preparations are not sold as pure or unmixed articles.

Again, in the manufacture of confectionery, not only has the use of earthy substances been discontinued, but the employment of pernicious colouring materials has practically disappeared, and harmless, vegetable colours are now almost universally employed.

Even in pickles and preserved vegetables it is now rare to find the colour heightened by the addition of a salt of copper, and the colour of cayenne pepper is no longer improved by the use of red lead.

In fact, in whatever direction we look, the same improvement is observable, judging from the Reports of the Public Analysts to the Local Government Board, and the absence of prosecutions.

Before concluding I desire to express my opinion that the machinery provided by the legislature for the suppression of adulteration is fairly efficient, and only requires to be vigorously worked by the various local authorities in order to be productive of great good to the community. I trust that this Conference will be the means of stimulating the authorities to a more zealous administration of these Acts, and particularly of directing their attention to the advisability of obtaining samples for analysis from every part of their district, and with such precautions as will insure the purchase of articles in the state in which they are ordinarily supplied to the general public.

I cannot conclude, however, without expressing my sense of the efficiency of the work which has been, and is now being done by public analysts, not only in their official capacities, but in regard to

their contributions to analytical science, of which their works on bread, milk, and butter, may be cited as well-known examples. It has been the least pleasant part of my duty to have to differ from them, as sometimes they have differed among themselves at one time on actual results of analysis, and at another on the deductions to be drawn from practically similar results, but such instances should not affect the confidence with which the general ability and high services of public analysts ought to be regarded.

The CHAIRMAN, after expressing on behalf of the audience their thanks and his own for Dr. Bell's very complete and interesting paper, which was characterised by its fairness and impartiality on the subject which he had kindly consented to bring forward, proceeded to say—

I think moreover I may venture to express, on behalf of this meeting, our cordial agreement on several of the statements which he has put forward, and I think I may take it on myself to declare how very largely the public is indebted to the labours of those many gentlemen who undertake, so ably, the office of Public Analysts, and how largely purely analytical chemistry has advanced in consequence. It is gratifying to hear from Dr. Bell, that there has been so large an improvement in recent years in adulteration, and that the gross and deleterious forms of sophistication which are stated to have been so much carried on at one time are now abandoned; so far we may regard the Adulteration Acts as a success. We further feel, I am sure, with Dr. Bell, that there cannot be the faintest doubt of the sanitary evils resulting from the adulteration of food, and accordingly, in connection with this Health Exhibition, we may congratulate ourselves on that means of adding to the public health, which has resulted from the working of the Adulteration Acts. It will now be my province to invite your discussion on the very many points which will occur to any of us, in reference to the large number of topics introduced to our notice by Dr. Bell. We admit that the Acts, upon the whole, work well—the question arises whether they might not be made to work better; whether they are not susceptible of amendment; whether they do not in some points imperatively call for amendment. If the matter before us was nothing else than the repression of adulteration, it is obviously true that the Acts might be very considerably amended in respect to their efficiency; but there are other conditions, and we cannot conceal from ourselves that, to some extent, varying in extent, Acts of this kind are more or less prejudicial to trade and invention. That is a point we have to guard against. We are all interested in the supply of pure and honest food; we are interested in not interfering with its abundant and cheap supply, and with the improvements in the methods of production, especially in those articles of food which are more or less of an artificial character. I fear, if an adulteration Act had been in vigour years ago, what he has told us as to beer would not then have been found to be quite so just. I say, we have to regard on the one hand the desirability of securing wholesome and pure and honest food, and at the same time of not interfering with the abundance of its supply or with the progress of improvement. Now, with regard to these questions, it is not for me to express my opinion upon any point, but rather to invite the expression of yours; but I will say something as to the necessity of an amendment of the Acts, and to know how far the Act should or should not be altered in certain particulars—how far it may be necessary to amend it so as to insure its general applicability. There are parts of the country where these Acts are not in really active working order. It appears that the Local Government Board have power to enforce the application of the Act so far as the appointment of analysts is concerned, but not as regards inspectors or analyses of any or of a sufficiency of samples. Another point is how far is it necessary or desirable to amend the Act in such a way as to ensure the examination of a sufficient number of samples. It appears in many cases that although the Act is, to a certain extent, in force, the number of samples is so small, that it can have no influence upon the character of the supply in the district. Another point is, how far it is possible to secure that the articles submitted to the analysis of the public analyst are the actual articles which are being supplied to the public in that neighbourhood. Here, of course, the question comes in as to how far the duties of the inspector are interfered with by the knowledge of his person and office, and how far it would be advantageous to bring about the examination of a larger number of samples by private people. Another thing is the repressive effect of punishment—that there should be some limit to the power of reduction of fines in the case of second or subsequent convictions, as in Inland Revenue cases. Another point, which naturally suggests itself is, how far there should be an increase or diminution in the stringency—for instance, Dr. Bell has told us that beer is qualified only by this definition, that it must be the article ordinarily sold under that name, and the question is whether matters should be left in that open state, or if it be desirable to leave them so in regard to beer, whether it would not be well to do so with regard to other articles; if for beer, why not for butter, cheese, etc.? Another question arises as to how far the use of chemical agents is allowable. We all know that many samples of beer contain bisulphate of lime, and I am not aware that any beer-producer has ever been interfered with on that account, yet milk dealers are soon interfered with when they use boracic acid. As regards bread, bitartrate of potash was introduced formerly, and this has more recently been replaced by some of the hypophosphites of lime. Another point which I will put forward as a suggestion—how far the adulteration of human food restrictions can be extended so as to include food for cattle, which is also an object of interest to us, and how far the work of the public analyst might not be directed to certain articles of food, such as syrups, fruit essences, many of which are neither more nor less than chemical compounds; and, again, to mineral waters, and on what terms and conditions. Another point, and one of some delicacy, is as to how far the mode of settling differences of opinion, or differences of statement between analysts—how far that mode is altogether satisfactory, or how far it might be possible to subject it to some improvement. I

mean the mode which is adopted of referring these matters to the Inland Revenue Chemical Department. This is a very unusual proceeding. Generally the different chemists or doctors are placed one in face of the other in the witness-box, and the judge and jury are left to decide between conflicting opinions. Occasionally some particular expert is called upon to act as a referee, but only by the consent of both parties. Then comes the important point raised by Dr. Bell as to the desirability or not of the fixation of standards of quality in articles like milk and butter, which are subject to great variations in their quality, for a customer might be more prejudiced by buying an inferior genuine article than by buying a high quality article subjected to adulteration. A question, therefore, will arise how far these inferior articles should be allowed, and how far any regulation of this kind would limit the supply. If, as Dr. Bell has suggested, a limit which would augment the non-fatty solids of milk by one half of one per cent. would really reduce the quantity of the supply some ten per cent., then, I think, the proposition would scarcely meet with approval. Opinions, however, will differ as to whether or not it would have this effect; then how far would it affect the average result in the way of bringing down the higher quality milk to this lower standard, nevertheless it may have the effect of improving the general average. One more point is the difficulty of analyses by reason of the range of variation of the natural standard in certain products: what should be the standard in milk, and what in butter? We all know that very considerable differences of opinion have arisen, and have led to discussion with regard to what should be the standard which should serve as a means of expressing the proportion of water added to any particular milk. Nevertheless, it is a very important point, and with a little mutual tolerance we shall be enabled to discuss it here without any undue warmth. Then the modes of analysis—the meeting must decide as to that, but we may discuss the desirability of obtaining results which are expressly designed to obtain exact percentages. Another point of considerable importance is, that some of these adulterations are undoubtedly added with the object, and with the result, of improving, as a marketable or eatable article, the materials of food to which they are added; for instance, as in the case of bread, we know that alum does add to the appearance of the loaf. The question, therefore, arises as to how far may these qualities be obtained from some alteration in the method of production without the addition of alum.

These are the chief points which have occurred to my mind, but the Conference and my colleagues here would be glad to hear the free expression of opinions by the gentlemen here present, so well able to express them.

Dr. VOELCKER: On the tender point of the sale of foods and drinks, I venture to express the opinion that a very great deal of good would be done if the Adulteration Bill included the adulteration of cattle food. The public have no idea to what extent adulteration of cattle foods is systematically practised in England. It is astonishing to foreigners when they come to England and are told of the extent to which they are adulterated. It is true that of late years, owing to the energy displayed by the Royal Agricultural Society of England (who have taken a very bold course in some cases, and have published the names of the offenders), that the adulteration of cattle food has somewhat diminished, but still it is very largely practised now, and I have no hesitation in saying that if five or six hundred specimens of linseed-cakes of a definite and specified character be taken, leaving out the mixed cases, which are professedly sold as mixed cakes, a very large proportion would be found to be adulterated. In the same way, food meal, such as refuse from starch manufactories, Indian corn-flour, etc., is frequently adulterated, and a great deal of harm is done to the cattle who feed upon this, as, for instance, by eating rice-meal adulterated with gypsum. Then, again, a great many cows are poisoned by cake which is adulterated with mustard-seed or rape-seed which grows in the fields; there is no difficulty in obtaining pure linseed, reasonably pure, only containing about 5 per cent. of foreign matters. A few years ago there were a few mills who refused to grind pure linseed, but, undoubtedly, this has somewhat diminished. I will further confine myself to matters with which I am intimately acquainted. I have had a very large experience in these matters from my official connection which various societies, and especially as the consulting chemist to the Royal Agricultural Society. I have been brought into close contact with all matters connected with agricultural produce—milk, butter, and cheese. It has been stated that it was a great advantage to fix a definite standard of quality for milk; well, if so, why did you not fix it high enough and upon a reasonable and sound basis, and not as it has been done, on questionable analyses of the subject? The fact of the case is that the present standard adopted by public analysts is far too low, and I venture to say that from half to three-quarters of all the milk sold in London and elsewhere is partially skimmed and not of the nature of the milk as furnished by the cow. A good deal of the cream is withdrawn and water is added. I have found as much as 8 or 9 per cent. of fine butter fat in good Alderney cows' milk, and, of course, this you would have to pay dear for; but when it comes down to 5 per cent. it is certainly partially skimmed, and it is due to the fact that public analysts have more or less made known among those trading in milk that a certain low limit was fixed above which no action would be taken. The estimates hitherto made are far too low, and this, I believe, is owing to the examination having been conducted on the imperfectly dried residue of milk, the presence of the additional water rendering, of course, the result lower in proportion to the bulk and weight. The difficulty of fixing any standard is that milk is subject to such great variations—at certain times of the year milk is naturally poorer in quality than in others; in spring, for example, when the fresh vegetables contain a larger proportion of water, whereas at this time of year the milk should naturally be richer, from the greater maturity of the plants from which the cows derive their nourishment. Still, with all these variations, I think we ought to fix upon a certain minimum, and I cannot help thinking that 3 per cent. of pure butter fat and 8 per cent. of non-fatty residue would be more in accordance with the propriety of

selling milk of fairly pure average quality. I have been told by dealers, why should we furnish 3 per cent. of fatty residue when we can furnish less for the same price? and even if certain honest dealers sold milk of this standard they would be undersold and discouraged by the multitude of other dealers who are disposed to take advantage of the present state of the law. You may take it for granted that as a general rule milk dealers will not furnish better milk than they are obliged to do. With regard to cheese, I do not altogether agree with what Dr. Bell says as to butterine cheese, that it has not yet found its way into the market. I think there is a good deal in the market; the exportation from America of oleo-margarine cheese is largely on the increase, and there is something to be said for this oleo-margarine cheese. I have tasted excellent cheese of this kind, and as long as it is sold for what it is I do not see any objection to such cheese. Some of the oleo-margarine is used in the manufacture of Dutch butters, and there is probably a good deal exported every week to Holland, which comes back again as the best Dutch butters to England. As long as the materials employed are of a wholesome character and palatable, there can be no objection to their use. A good deal of cheese in England is unsaleable, and if by the admixture of these materials it can be made a marketable article no great harm is done and no great disadvantage is inflicted on the public; the whole thing is that it should be sold for what it is and not for what it is not. In conclusion, perhaps I may be allowed to give a few words of caution to public analysts. They have, it is evident, done a great deal of good during the last few years. The adulteration of food has certainly greatly diminished, and the exertions of public analysts to do their duty have been more and more recognised by those in authority; therefore it is not altogether with the view of finding fault with them that I make the remark that perhaps a little caution would be a very desirable quality with some public analysts. They should not jump to the conclusion that an article is adulterated because a certain thing is present which has really nothing whatever to do with the particular character of the article of food under examination. Only a few days ago—last week in fact—a sample of cream was submitted to me; my impression was that starch, in the shape of thick starch paste, might have been used. I applied the usual test, and found some, but the quantity was so small that I knew at once that starch had not been added for the purpose of adulteration, especially as under the microscope only an odd granule or two could be found. This turned out to be due to the cream having been strained through a new calico sieve, and so some small quantity of starch had thus been introduced. A gentleman sent me some milk not long since which he said gave a purple-coloured ring, and he thought something dreadful had happened; however, under the microscope and subsequent chemical tests, I readily found it was an aniline dye—here the milk had been passed through a red-coloured calico. These were typical cases, where a little care and inquiry showed that the articles were not really adulterated.

A lady in the audience here expressed her wish to know whether there was a society to enable poor people to have their food analysed, also whether there is a public analyst for Ramsgate.

The President said there was no society with that object in view, but analyses could be obtained for the sum of 10s. 6d.; he added that there was a Public Analyst for Ramsgate and he resided in Canterbury.

Dr. DUPRE, public analyst, said: Public analysts have unfortunately very rarely the opportunity of bringing their case before the general public, and I very gladly avail myself of the opportunity of stating the case from the analyst's point of view. I hope both manufacturers and dealers are present, and will give us their opinion on the opposite side. In the first place, I take it, adulteration has very much diminished, more particularly in such articles as fall more generally under the Act—such as milk, bread, coffee, and spirits—but the diminution is not as great as it might have been for various reasons, the first and foremost being the apathy of the general public.

Now, I take it the Acts have been passed for the protection of the public, and only secondarily for the protection of the honest trader; but, unfortunately for the primary object of the Act, the public analyst does not receive any support whatever from the public, either in the way of samples or by expression of opinion as to the proper carrying out of the Act. The result is that the public analyst finds himself opposed by all those who practise adulteration—not by any means a small class. Further, he finds himself opposed by certain associations, old and new, who, I think, ought to look upon the analyst as their greatest benefactor; but they do not think so, and they consequently rush in with counsel, witnesses, and what not, to stop the particular prosecution; and the public analyst, not having any support from the public, very often fails. And perhaps I may here state what is his position—a position very often misunderstood. The sole function of the public analyst is to analyse any food, drug, etc., which may be brought to him by the inspector or by any one of the general public who complies with the provisions of the Act. The analyst has nothing whatever to do with buying the articles, or with any subsequent prosecution. He simply gives a certificate, and, if necessary, he must be able to support in the witness-box the truth of the certificate. He does not know where the articles come from, he has not the slightest interest in the prosecution, and he is absolutely neutral. The second case where the Adulteration Act is not as effectual as it might be is on account of the ridiculously low fines often inflicted. I cannot do better than refer to milk, an article of the greatest importance, and yet it is the one which is the most largely adulterated, owing to the ease with which it can be done. It is therefore desirable that the milk delinquents should be severely punished, whereas we find that frequently the fine is put at so low a figure as 10s., which can be easily recouped, as it only means the sale of some twelve quarts of water in the shape of milk. The result is that much discouragement is given to the authorities in putting the law in action. Now, from the nature of things, it is impossible to frequently analyse the milk from the same dealer; it would be scouted as persecution, and the result is that he easily recovers his fine, and it is actually a premium upon adulteration. To show what perhaps might be done by the public if they took more

interest, I may add that in my district inspectors used to be in the habit of going round on the week days only, and in a couple of weeks the samples improved wonderfully. Once, however, they went round on Sunday, and what was the result? Instead of 1 in 6 as generally, the proportion was 6 in 7—but the next Sunday every sample was genuine.

As to the standard, the Society of Public Analysts have only fixed a low limit below which milk is considered to be adulterated. This limit was very difficult to find, because milk varies within wide limits, but variations below the Society's limit are confined to a very few animals, and never can exist in the milk of a whole mixed dairy. Is it right that the general public should be deprived of their proper quality of milk because a single cow sometimes gives milk below that standard? In regard to this point—and I hope whatever I may say about Somerset House may be understood to be said with the highest respect, because what they have done they have done with great success, although they have made a mistake in the matter of milk. It would be an injustice to Londoners if they were prevented getting their milk of a standard up to nine per cent. because certain cows give considerably under that quality. By enforcing this limit, some milk would doubtless be withdrawn from the market, but the public would only gain thereby. Well, the word adulteration is very frequently made use of, but the word is not mentioned at all in the Act, which simply says, "The article shall be of the nature, quality, and substance demanded." It would be well if the Act did not sometimes require an impossibility of the analyst. Unfortunately the schedule gives a form of certificate to be given by the analyst, and it must be literally and exactly filled in, or the prosecution may fail. We are, therefore, absolutely bound to follow that certificate, and to say that such and such an ingredient is present in such and such a proportion, and I assert, without fear of contradiction, that while it is very easy to certify that the article is not of the nature required, it is yet impossible frequently to say what is the nature and the quantity of the ingredient added. I think therefore that the public analyst ought to have the option of saying that the article submitted to him is not of the nature and quality required, but that he is not able to state what is the absolute quantity of the added material. I may speak of wine, for example; it is comparatively not a difficult matter to say whether the colour is genuine or not, but it is impossible to say what is the nature of the colouring agent added, and, therefore, in such a case, the only result is that we are obliged to pass the article because, if the analyst varies the form of the certificate, then the prosecution fails. I am aware that this is a great stimulant to research, and the analyst seeks to ascertain a means of arriving at the quantity, but so long as this is not possible, I do not think the law ought to ask us to do impossibilities. Now as to some of the points raised by Dr. Bell: he thinks public analysts have raised their standard of milk too high for the non-fatty solids, and too low for the creams; but why have we done so? because we are not sufficiently supported by the public. If an unfortunate public analyst gives a certificate that 2·5 parts of fatty residue shows skimmed milk, down comes some association to argue that it is quite right and natural, because, when milk stands for some time in the tub, and is served out a basinful at a time, the cream gets taken off, so that later on, of course, the proportion gets low. This may be the case, but it need not be so with a little care. I have made very many experiments, and I find that if you have good milk to start with, you may go on serving several gallons without reducing the cream below the standard. With regard to the question as to the addition of preservatives, at first sight, if the matter be of a harmless nature, it would seem right to allow it to be used, but on further consideration grave doubts arise as to this. Milk is an article which has to be treated with very great care, and unless the milk-dealer is cleanly in all his apparatus and dwelling, the milk is apt to turn sour. Now, if he is allowed to add anything to keep his milk from turning, the public lose this safeguard, and the milk may be kept in dirty rooms and in dirty utensils without readily showing the absence of sufficient care and cleanliness. I look upon this ready turning of milk as a very fortunate circumstance, and as one of the great safeguards which the public have against carelessness in its manipulation. In the second place, a milk-dealer at present cannot skim off much cream without the fear of making the milk turn, and I have noticed that whenever I have a milk which is low in cream, there is generally boracic acid present, and this is added to prevent its turning sour while he is removing the cream.

Now, as to spirits, it is very often stated that fresh raw spirit is injurious to health, because it contains fusel oil, but there is absolutely no evidence to prove this. Dr. Parkes sent me some specimens of spirits from China and the Cape, which were said to have played havoc with the sailors who indulged in it freely when on shore, but it turned out that the one which did such havoc contained much less fusel oil than ordinary whisky! Some years ago there was considerable discussion about this in Sweden. The Swedes were given to brandy drinking, and it was often said that the disastrous results which so frequently followed were due to drinking the fresh spirit. A commission was appointed, and they discovered that it was not due to the fusel oil, but that this raw spirit was much liked, and, consequently, that more of it was drank, and thus it was the quantity that caused the evils, and not the quality. I hope this conference will arouse the attention of the general public on the question of pure food, because I am firmly convinced that it is only by the co-operation of the public we can ever hope to suppress adulteration.

Mr. WIGNER: I must confess that my own opinion is that Dr. Bell has taken too favourable a view of the action of the Act up to the present, although I agree that it has done much good, I do not look upon the amount done as nearly sufficient for the machinery brought into play. I take it for something very much like a disgrace that, after we have had an Act at work for eight or nine years, yet the average of adulteration should still be 17 or 19 per cent. according to the class of goods selected for analysis. Dr. Bell quoted statistics taken from Mr. Herbert's book, but they are not as full as would be desirable and not by any means accurate in all respects. I have here some others which will

illustrate what I mean. Taking the six or seven years, 1875 to 1881, the reduction in the percentage of adulteration in seven years is only from 18·1 to 16·6, a very unsatisfactory result indeed for seven years' work. Taking again the case of milk, the adulteration of milk has increased since 1879 by nearly three per cent., and grocery shows only a reduction of two per cent.; therefore I think it is clear that an alteration is wanted, and I am of opinion that schedules of limits should be enacted of such a character that very inferior articles should be excluded, even at the risk of some inconvenience. I think there is just as much reason for excluding from retail sale a milk which has only eight per cent. of fatty solids, if it be the result of a badly fed or diseased cow, as if this poorness in quality were the result of adulteration; and if the cow be incapable of producing milk of better quality, then the best thing would be to send the cow to the knacker. We may in this country learn something by observing what has been done in other countries. Our 1875 Bill was the result of a compromise, because when it was introduced it contained this remarkable clause "that if the article sold was sold in accordance with the custom of the trade or locality then the vendor was exempt," and it was to suit the spirit of this clause that nothing like standards were introduced, although the clause itself was subsequently removed. With reference to Dr. Voelcker's statements as to cattle food, I may reply that the agricultural party in the House interfered with the introduction into the Bill of a clause relating to cattle foods. In America more than $\frac{2}{3}$ of the United States are under adulteration acts. They are nearly uniform in the different States, and with two exceptions all of these have limits, and with one or two more exceptions these are the limits of the Society of Public Analysts. It is therefore illegal in America to sell milk containing less than 9 per cent. of non-fatty and 2·5 of fatty residue, and I think this ought to be used as a standard, because I have heard no complaint from the United States that this standard is too high. Now, again, take the case of France. The Paris Act is a municipal one. It is much more stringent than ours and much more thoroughly enforced, but the same standard has been adopted, and although it has been in operation five years I have not heard of any case of a successful appeal. The matter of milk is looked upon more seriously than here, as you will see when I tell you that in that city, which is less than half the size of London, 24 inspectors are employed to take samples, and they go in couples to the shops and examine whatever they please, and then take what they think proper to the Laboratory, and in this way some 900 samples per month are analysed. The result of that on milk in Paris is shown by the fact that the average adulteration is only from two to three per cent., while the average here is 17 per cent. of watering, and 17 per cent. of skimming: that is to say, that in these two ways $\frac{1}{3}$ the value of the milk is taken away. I think that furnishes the strongest reason for suggesting the use of a limit, and that the limit should be much higher than the limit adopted by Dr. Bell. Then as to two or three other points in connection with the Act; there is one point which has certainly been a success, viz., the section which provides for the examination of tea, the adulteration of which has been entirely suppressed, and the effect of the change in 1879 on the limit in spirits has had the same effect. Now, passing from that to the imperfect mode in which the Act is enforced in the country. The Local Government Board have the power to appoint analysts if the local authority refuses to do so, but as they have no power to pay him any salary, these appointments are in reality never made. This applies also to the number of samples which should be purchased. It has been put forward that one sample should be analysed for every thousand inhabitants—a very moderate estimate truly, but it is seven times more than is purchased actually. Next as to the certificate of analysts. This is certainly a most cumbrous document, and unfortunately it is not made incumbent upon the chemists at Somerset House to use it for their reference certificates; and I think that differences may often have arisen in this way. The public analyst is obliged to say that nothing has occurred to interfere with the analysis, yet milk sent to Somerset House is frequently decomposed, and that fact ought to appear on the certificate, because it bears on the second point, that the certificates of Somerset House ought frequently to say not that the analysis can or cannot be confirmed, but that there is nothing to show that it is right or wrong. Many cases must occur with Dr. Bell where he cannot say the analyst was not right, but he is utterly unable to say that he was wrong, and I think the weight of opinion should go to the analyst who made the analysis while the milk was fresh. What would be the effect of raising the standard of milk as to limiting the quantity? I think it would be very small; it is true that milk used in the country districts for butter and cheese would be withdrawn from those uses, but these might just as well be imported so long as we can get the milk pure, and if the milk area were slightly increased in extent it would make up the required supply.

I was sorry to hear the remarks of Dr. Voelcker in reference to the necessity for more care on the part of public analysts, especially bearing in mind that in the two cases he cites in only one of the two was a public analyst involved; and yet in both cases it would have been an analyst's duty to condemn the cream. In the first case, it is true, it only contained traces of starch, and they were probably derived from the unwashed piece of calico used to strain it, but if the dairyman had allowed the piece of new calico to be used he thoroughly deserved to be caught; and certainly I should say the same thing as to the case where the aniline had been introduced.

I think, sir, there are so many other gentlemen who wish to speak that I shall leave the analytical part untouched. I shall simply say my opinion is in favour of passing a resolution to strengthen the hands of those who desire to introduce changes into the law as it at present stands.

Dr. ATTFIELD: I shall only allude to one point, and that is as to the proportion of articles of food and drink which are said to be adulterated. The public draw rough conclusions from what is said in a Conference like this, and from what is published from year to year respecting the results of the working of this Act, and I think the one rough conclusion which they will draw is that of all the articles of food and drink which they consume 15, or 16, or 17 per cent. are adulterated. Now, I

should not like it to go forth to the public that that is the truth, for what is the truth is this: that of the articles which have been examined by the officers under the Act, 15 per cent. are simply *said* to be adulterated. Why, sir, if we take as a matter of common sense the number of different articles which are placed on our table, I suppose we shall come to the conclusion that something like 30 or 40 different articles are brought before us in the course of a day, and that in the course of 365 days means thousands of distinct purchases are made for a household. Now, is it to be supposed that of these thousand articles 17 per cent. are adulterated? Sir, as a chemist of 25 years' experience, I protest against it. I have examined vast numbers of articles of food and drink, and a still larger proportion of drugs, and I say this, that of all the articles which are placed upon our tables in the year, and of the drugs which we are unfortunately obliged to introduce into our bodies, that not one in a thousand is adulterated. It has been my lot to be asked, during the past 10 or 12 years, to be the chemical adviser of a body of traders who have been liable to be charged with adulteration, and although it was not greatly to my interest I consented to advise them whenever they might be threatened with a prosecution; and in some 25 cases in which this occurred I have had to advise that in about 20, or $\frac{4}{5}$ of the cases, that they defend the action, and in the course of defending the action of these 20 cases, where the matter had to be tried before the various impartial tribunals, out of the 20 cases of prosecution how many have been dismissed? 19. In several of those cases it has not been a matter in which the legal officers on one side have been put in the box against men like myself on the other side, but in which a few questions put by the counsel for the defendant to the witnesses for the prosecution have been sufficient to upset the case. Now, I make no charges of any kind; at the same time no man is perfect, and if in the 25 cases brought before me I could advise that in $\frac{4}{5}$ of the cases the prosecution be opposed, and that practically in the whole of those cases the defendant was found not to be wrong, then I say that if one chooses to think, if one chooses to make an inference, that in 19 cases of alleged adulteration the charge broke down, I say you ought to take off at least 12 from the percentages alleged to exist, and I therefore do not believe in drawing deductions from any such figures.

Mr. HEHNER: After the ridiculous remarks to which we have just listened, I cannot allow the point involved to remain over, but will proceed at once to refute them. Upwards of 18,000 analyses have been made by public analysts every year, one-fifth or one-sixth of which are declared by them to be adulterated. If what Dr. Attfield says be true, then the obligation on the backs of public analysts is somewhat heavy. This Act has been in operation some ten years, and on the 200,000 samples examined since it came into force, about one-fifth have been found to be adulterated—wholesale injustice must have been inflicted upon the trading public, and that by the public analysts. Now it is notorious that anything can be proved by statistics, but analysts were not appointed to produce statistics. I think the aim of those who supply samples is to do the greatest amount of good with the limited amount of money they have at their disposal, and the aim of the inspectors is to catch the greatest number of fraudulent tradesmen, and, therefore, inspectors who might certainly be stricter, do not proceed to buy samples of what they think may be good; they do not try to get the average quality, but to get a large number of bad samples by means of the small means they can dispose of, and so we only really get at the class of people who adulterate. Dr. Attfield is very fortunate in only getting 1 in 1,000 of adulterated articles on his table, and if it be admitted that there be adulteration at all, then it may be inferred that if Dr. Attfield has been fortunate enough to escape these adulterations, somebody else has had them. This is particularly the case with poor people, who buy their commodities by the pennyworth or the halfpennyworth; it is they who get the adulterated specimens, and not Dr. Attfield, who probably buys in large quantities at the Stores the extremely numerous articles with which his table appears to be covered. It would be as easy to get genuine samples as to get adulterated, but it is no part of our object to do this. Now I think, although it has been shown in the statistics put forward by Dr. Bell, that the percentage of adulterated articles is the same as some years ago, yet every public analyst has noticed a decrease, not in the actual percentage of adulterated articles, but in the amount of adulterating material added. Formerly milk used to be adulterated to the extent of twenty, thirty, or even sixty per cent.; now, it is nearer ten per cent., and, in this respect, the statistics will not show the good effect of the working of the Act.

Improvement has been effected in other directions bearing more on the nature than on the quantity of the material employed for adulterating purposes. Formerly it was a common thing to find cayenne pepper adulterated with red lead, and many other examples might be given. At the present time poisoning is no longer to be feared; only cheating remains.

In reference to the compulsory appointment of analysts, I may observe, that although they must be appointed by the Local Government Board, when the local authorities have declined to appoint them, the Board has no power to compel them to get samples analysed; what is the consequence? In one town that I am acquainted with, where the Adulteration Act is not in force, but where in the country it is strictly enforced, a very curious and characteristic effect is to be observed. Anywhere outside the limits of the town the average of the samples is high; but then what do we see? As soon as a milk-dealer, for example, gets inside the town, he goes to the nearest pump and waters his milk. A certain proportion of samples ought to be insisted upon—so much for each thousand of the population. It should not be left entirely to the governing body of the town or district, which, composed as it is in a large number of cases of influential tradesmen, whose interest it is not to have any analysis performed at all, and to take every opportunity for stifling inquiry. Dr. Bell has been exceedingly complimentary to public analysts in acknowledging that a considerable amount of strife has taken place between them, when their cases have been referred to him. Of the many thousand samples which have been analysed, a very small number have been referred to Somerset House—every year only

some twenty-five or thirty cases, a very small proportion on the total number of analyses. Even on this very small number, in only about one-half have the analysts been contradicted. Minute as this proportion is, it is in reality much smaller, because it is frequently not a question of fact at all, it is simply a matter of opinion. In the cases alluded to, they were nearly all cases of milk adulteration—it is a question of difference in quantity, and not as to the fact of its being present. With so many thousand analyses some mistakes are sure to be made, but the exceedingly small number of these mistakes reflects, I think, great credit on the general body of analysts. The great grievance is, that we have to refer our analyses to a Court of Appeal at Somerset House, which is in reality far less experienced than we are. They have, perhaps, some six hundred cases in the course of the year, where we have as many thousands.

Dr. DE CHAUMONT: There can be but one opinion as regards the success of this conference, and I think that we may felicitate ourselves that so much has been attained.

I only wish, for the consumer's sake, that I could take the roseate view that Dr. Attfield does, but I must say that I cannot by any means declare that only one in a thousand articles submitted to my examination was adulterated. In the matter of milk alone not only on account of its importance as a food, but of the extreme ease with which it is tampered with, the proportion is larger, very much larger than has been suggested. With regard to the question of how we are to deal with the cases of analysis, I quite agree with the suggestion that a good deal of loose statement is made as to the presence of adulteration in articles of commerce. It has been stated to me that a good deal of beer sold in my neighbourhood was adulterated with tobacco; I examined several samples, but the result was that none was found. Then as regards spirits, it was supposed that the spirits sold at one of the establishments in the neighbourhood were adulterated with tobacco. Well, some samples were sent me, but I found no tobacco except in one case, and that I attributed to the fact that the man who brought me the specimen, had put his pipe in the same pocket as the bottle containing the sample. There was one point which is very important, and that is whether we ought to deal with articles as avowedly articles of commerce—prepared articles, that is to say—or whether we should deal with them as articles which ought to be supplied in a pure state. As regards beer, as such a variety of material is used, no special standard can be laid down, but I venture to say, that this is only one aspect and does not apply to such articles as milk, butter, or cheese. But with regard to milk, I think we are entitled to demand to have it as it comes from the cow, as I have mentioned in this room before, at a Milk Conference which took place here, when there was a very interesting discussion on the subject. One gentleman suggested that we should take milk as an article of commerce, and as having different standards of value, that if he had very rich milk it was hard that he should have to sell it at ordinary prices, whereas if he took the cream away, it would still keep to the standard of poor milk, but this would be very bad for the public. The milk tends to undergo change, and we have no security for the means adopted to bring it down to the standard of poor milk. The water added may be pure water, but we have no guarantee that it may not be drawn from a filthy well in the vicinity of the farm-yard; therefore there can be no excuse whatever for this suggestion. With regard to the question of butter and cheese, I think we may apply similar rules. Butter is manufactured to a certain extent, but the chief point in which it differs from the natural product is in the addition of colouring matter, but this is in deference to the taste of the public, who prefer it, and the same in regard to cheese. Now, I think the Adulteration Act may be amended in this way, that no mixtures of any pure articles ought to be tolerated; that coffee, if sold as coffee, ought to be sold alone, and no mixture with chicory should be allowed; and the same principle may be applied to many other things. With regard to the difficulties which the Adulteration Act has met with, they are many. One of the difficulties is the different modes of analysis and the uncertainty of the best mode, the necessary experience of analysts, and too much dogmatism. But I think we may safely say that these have, for the greater part, been got over; but there is certainly one difficulty which remains, and will I fear remain for a long time, and that is that this Act like many others is beyond, is above the standard of morality of the present time. I say this advisedly, for where any tradesman would certainly scruple to take money out of your pocket by pocket-picking, yet he sees no objection to doing this in an indirect way by adulterating the articles he deals in, so as to obtain a larger profit, yet it is indisputable that one is just as immoral as the other, only public opinion does not back us up in this case, and this view prevails very much with magistrates in this country. Then, if you insist upon applying the penal clauses of the Act and fine the recalcitrant tradesman repeatedly, people say it is persecution, but supposing that a man belonging to the criminal classes picks your pockets, and is taken up before a magistrate and is punished, and on coming out proceeds to pick your pocket a second time, do you think the policeman will not take him up because he had just been taken up? Until we reach this point of making it felt generally, that adulteration is a distinct wrong against society, there will not be very much chance of getting it carried out to its fullest extent; there is no doubt, that in France it is carried out in a much more despotic manner, but I think the machinery of the Act should be extended so much that it will no longer be worth while to adulterate at all, and that when the man is convicted of adulteration, then that he should be disgraced as if he had been taken up for picking pockets.

As a large number of names were still inscribed to speak, and as time was short, the Chairman put it to the meeting, whether it would not be desirable to adjourn the further discussion of this important subject till the next day at the same hour, and this resolution was carried, with but one dissentient voice.

15th July, Adjourned Discussion.

The Chairman commenced the proceedings by calling on Dr. Muter, to address the Conference.

Dr. Muter: In continuing the discussion upon the subjects so carefully brought before us in Dr. Bell's very thoughtful paper, yesterday, and afterwards so ably sketched out and divided into heads by our respected President, I hope I shall not permit myself to descend into those personalities and contentious matter which has been brought into the matter yesterday, by people who wish to run down the public analysts. I do not wish to go through the whole of the heads that our chairman has mentioned, but I propose to inquire, in support of Dr. Bell's paper (1), Did adulteration really exist to a marked extent before the passing of the Act of 1872, and has that adulteration been checked to any extent by the passing of the Acts? (2) I wish to inquire whether the Act as it at present stands ought to be amended, and in what direction, and whether and how far we ought to follow the doctrine of limits or standards? Now, in the first place, did adulteration really exist before 1872, and was that adulteration, if it so existed, deleterious adulteration, or, was it only of the nature of what has been called "commercial immorality"? Now, in his paper, Dr. Bell has ably collected from the reports of the *Lancet* commission, and other sources, instances in support of the contention that adulteration did exist. I have, perhaps, got some small title to speak on this point, seeing that I am one of the two or three remaining living analysts who really trained themselves to food analysis before the passing of the 1872 Act, having been engaged on a commission like that of the *Lancet*—I mean the commission of the *Food* Journal. Now, I was looking back last night to those old results in 1870 and 1871, and I find that out of twenty-three samples of coloured sweets purchased all over London by the editor of the *Food* journal, thirteen were adulterated by a regular painted coating of chromate of lead, and three of them also contained streaks of vermilion as well, thus proving the deleterious adulterations which really then existed. As regards the ordinary "commercial immorality," out of forty-seven samples of coffee sold as pure in that year, thirty-one samples were more or less mixed with chicory, and in seventeen cases the chicory itself was mixed with something else. Now, my object in bringing up this old story is that it is not merely hearsay, but I stand here as a living witness that such things did exist some years ago; and I also mean to assert that the passing of the Act has produced a wonderful amount of change and benefit to the public. During the first year or two after the Acts were passed we still could get hold of those painted sweets; but, for the last few years, of the many hundred sweets brought to me by the inspectors, not one of them has contained any deleterious colouring matter, and I say, therefore, that the Act, as it stands, has stamped out all adulterations of this description. What actually takes place now is only a form of "commercial immorality," namely, selling one article for another. One other thing I may say on this point. In looking over the books of the South London Public Laboratory, where the work is done for something like seven districts and boroughs, I find that since 1872 we have examined over ten thousand samples of food, and out of these ten thousand we have had occasion to have our certificate brought into court upwards of a thousand times, and I am happy to say that in every case, except one, that certificate has been supported. Now, that is, in my opinion, a practical answer to the experience of one of the speakers yesterday, who, after announcing himself in a very loud voice as the analyst to a Defence Association, tried to bring forward a statement to the effect that it was all very well for Dr. Bell to quote the public reports of the Local Government Board, but let them be brought into court, and they would be put out before an independent tribunal. In proof of this he instanced twenty cases where he had conducted the defence, and where, in nineteen out of twenty cases, the analysis had been quashed. Fortunately, exceptions only prove the rule; and at this moment it will not suit the present stage of my remarks to say why these nineteen prosecutions failed. Let us say for a moment that they failed through the fault of the analyst; but against that let us compare the number analysed all over England—nay, compare even the limited experiences of South London only, where over a thousand prosecutions have taken place, and in only one case, so far as I can recollect, has there been a chemical failure—I mean a distinct conflict of chemical evidence—and then, what is the logical answer? It is not long ago since I happened to be speaking to a very eminent foreign scientific gentleman, who expressed to me his astonishment at our having a body of chemists like that of the public analysts, who go on, year after year, in the fierce light of public criticism, and make so few mistakes. Nobody is infallible; we must all make mistakes; but I say that the errors that have been made by public analysts are extraordinarily few considering the enormous amount of samples which have passed through their hands. Now, as regards the effect of the Act at the present time, just let me recall another circumstance. I find that in the first year that the Acts came into operation, in the districts of Lambeth and Wandsworth we prosecuted for adulteration equal to twenty-five per cent., and in Lambeth it was even worse; in Wandsworth, this last year, it has come down to six and a half per cent., and in Lambeth to twelve per cent. I think you will agree with me that there is direct proof of the benefit of the Act; you cannot say anything against these statistics, because the action of the local authorities has been alike throughout. In Wandsworth, especially, where the Act is carried out in a most excellent manner by the local authorities, there is an inspector whose sole duty is the collecting of specimens, and notwithstanding this he can only get six per cent. of adulterations, and I say this is a real proof of the benefit derived from the working of the Act. Now let me pass to the second point—that is, ought we to be satisfied with the Act as it now stands? In my opinion we ought not to be quite satisfied, because there is no reason why what is done with excellent results in one parish should not be done in another. Now, I purposely limit my remarks to my own personal statistics; I take my own particular districts; and I find in one district, where the inspection is very complete, where the amount of samples amount

to never less than four hundred annually, the percentage of adulteration sinks to six. In the next district, where the number of samples only amounts to three hundred annually, there we only succeeded in reducing the adulteration from twenty-five to twelve per cent. Then I can follow it in other districts, where I get perhaps only twenty or thirty samples in the whole year, and the most of them are invariably bad; and then, lastly, I come to the famous district of Newington, where I, as public analyst, have never received a sample in my life; but, I really think, if some of the newspaper editors were to have some samples purchased in those districts, there would be some rather astonishing revelations. Admitting, then, that the Act requires some amendment, what are the points in which it requires alteration? The first thing that strikes me is that we ought to have a compulsory appointment of inspectors. The Local Government Board can make it compulsory to appoint an analyst, but local authorities are not obliged to appoint an inspector, and therefore the analyst gets nothing to analyse. Now I say the inspector ought to be nominated compulsorily, and I say it ought also to be made compulsory that the number of samples purchased in the course of the year should bear some reasonable ratio to the number of dealers in food within that district. Perhaps it might be too much to expect, but really every dealer ought to be visited at least once within the year. Particular dealers ought not to be singled out and "sat upon" by the inspectors, but a regular system should be instituted, and a sample taken from every dealer. I therefore think an important point would be the compulsory purchase by a compulsory inspector of a certain compulsory number of samples annually. Now the next point, and here I may differ from Dr. Bell; if I listened to his paper aright, he expressed the opinion that it was perhaps not desirable to have too many limits or standards. Now, I am going I fear to the other extreme, for I am prepared to say that the true reform which is wanted in this respect is that our Act should be assimilated in many respects to the New Zealand Sale of Food and Drugs Act. I consider that the fixing of limits (remember I do not mean standards, but limits below which the dealers shall not go)—I think that the fixing of reasonable limits—not too high, but reasonable, fair, honest limits, is a point upon which we all agree. We had the case very prominently brought before us in the discussion on milk by Dr. Bell, and he pointed out what a very variable thing it was, and then, unless I misunderstood him, he said that he considered that the fixing of a limit for milk would tend to restrict the trade output and be commercially disastrous. I do not believe this, because it seems to me that if you have a variable article like milk you ought to take the lowest possible honest milk, and there's your limit, and below that your milkman must not go, but he can go above it as much as he pleases. He can say to the public I supply a better milk than So-and-so who waters down to the limit, and the man who sells the best milk will, in the long run, I cannot doubt do the best business. Why reasonably low limits should affect the trade at all I cannot see; perhaps other speakers may show this, but I confess I am unable at the moment to understand it. Now this is the proposition I am about to make as regards the amendment of the Acts. I hold that there ought to be a permanent Commission appointed by law; that this Commission should consist of an eminent chemist appointed by the Government (Dr. Bell), another eminent chemist appointed by the body of public analysts, and, thirdly, it should contain a man to represent the Chamber of Trade, so that the Trade would have a practical voice in this Commission. I do not limit the Commission to three, but there should be a commission on this basis. Now it should be the duty of that Commission to examine in turn all the ordinary articles of food and drink, and to lay down a limit of quality below which the articles shall not sink, and then when that Commission makes its report (which it would do at certain stated times) an order of the Queen in Council should be sufficient to give effect to such limits. Here we have an end of all heart-burnings, the traders themselves would have a voice in the Council, and everybody would know what was the limit of "commercial immorality." I am not proposing a chimerical idea, but I suggest a scheme which has been already adopted in New Zealand during the last year to the extent of commencing a schedule of standards, and ordering this schedule to be added to from time to time by the Governor in Council, on the recommendation of a Commission of Experts. My commission is not to be composed only of experts, but is to contain a representative of the traders as well, and once fair and honest limits were laid down, I believe the Act would work much more smoothly. Now, just one word before I leave the question of limits, on the subject of milk. There has been a great talk about milk, and I have rather radical views as to milk. I think the great mistake that has been made by everybody, both by analysts and others, is, that they have been too anxious to draw hard-and-fast limits, hard upon one particular quality of milk. Now, it seems to me you ought to have a sliding-scale limit, as I call it. It has always been my experience (and that experience has not been small, for I was just calculating out before I came here that it extends to over 6,000 analyses of milk), that when the non-fatty solids in unwatered milk became low there was invariably an increase of fat in the milk, and I have always, from the first, made a practice of never condemning a milk even when the non-fatty solids fall to 8·5, if that milk contained an excess of cream, because I look upon it as a fact, that what you lose in one you gain in another. I say, that our standards should be so fixed that provided the cream is over a certain limit, that it does not matter if the non-fatty solids are rather low; on the other hand, let the cream get under a certain proportion then the milk has been skimmed, and the non-fatty solids require to be present in a larger proportion. I would judge the milk upon a certain standard; if the fat exceeds a certain amount, and if the fat is less than a certain amount, then judge it upon a more strict standard, and in that way the public always get full value for their money. These views are, perhaps, a little radical, but I hope still that before many years are over our heads we will have a commission appointed which will have the power to make limits, and will adopt milk limits of that sliding-scale nature which I am now advocating. That is all I had meant to say to-day as regards the principal topic, but since I came into the room, I

have been asked by some of my colleagues to refer a little to some remarks that were made yesterday in, I venture to say, rather questionable taste, and to answer them. In the first place, Dr. Voelcker (a man who, as a general chemist, we must all esteem) made, in my opinion, rather a step in the direction of bad taste, in giving what he called a little advice to public analysts. This advice was, that public analysts should not be too hasty. Very good advice, and I do not object to anybody advising me! I am very pleased to have advice, but the question arises, do I deserve to have advice given me? Have I done that which entitles me to a sermon? Now, when a man gives advice he presumes he has a right to put himself in that superior position whence he can give such counsel, and that he has a sufficient reason for giving it. Now, Dr. Voelcker, no doubt feeling this, did show a fancied ground for giving advice, but let us here recall what it was. In the first place, there was a very serious case in which some cream had been sent to him which he ascertained to contain starch, but "I am not going to jump to a conclusion like a public analyst," said he to himself, and he sent to the place the cream came from and asked, What did you filter your cream with? Cloth, sir, was the reply. Was it new? Yes, sir. Oh, all right, then the starch came off the new cloth used for straining, and so its presence is an accidental circumstance; therefore *moral*, "Do not jump to a conclusion." Here, however, is a difficulty; a man must be in a particular position before he can do these things. If our friend who has given us the advice had been in the position of a public analyst, who does not know where the specimen comes from, and who is bound to say by law what it does or does not contain, he would have had to state that he had found some starch, and to leave the other party to explain the matter. The same remark applies to the other cream, where aniline was present. A public analyst would have been obliged to certify to its presence, and I am bound to say I think a conviction would have been justified on the ground of carelessness. Another amusing thing is, the matter of the 20 prosecutions which failed, alluded to by the loud-voiced speaker of yesterday I have already mentioned. You all doubtless imagined from his indignation that they were very serious failures, and that the adulterations did not exist at all, but unfortunately—that is, unfortunately for his argument—the failures were not attributable to this. Here is a case in point; there was a public analyst who had some scammony sent him to examine—now scammony, as you are probably aware, is rather an expensive drug, and therefore more likely to be adulterated—well, in this scammony he finds chalk, unmistakable evidence of the presence of chalk, and in a large proportion. The public analyst on referring to the official pharmacopeal description finds that scammony should not effervesce on the addition of hydrochloric acid, and it does so effervesce. What is the analyst to do? it is not a question for him as to how the chalk came there; all he is concerned to know is that it is present, and he reports accordingly. The case comes into court, and the defence—our friend who addressed you yesterday—stands up to explain the presence of this chalk, which he considers the most natural and innocent thing in the world. He says, in effect, that you must not mind the chalk being there at all, it is not an adulteration. Scammony root grows in a chalky soil, and therefore not unnaturally gets mixed with chalk in spite of all the care imaginable, and, moreover, as the resin is exuded into little shells from the incisions made into the root by the poor, innocent Turks, what is more natural than that they should put some chalk into the shell to stop it sticking. What has that to do with the analyst? The explanation was plausible and succeeded, but then the analyst had only to say whether the chalk was there, or whether the drug was pure, and he had not to occupy himself with all this funny story, about the Turks and the chalk. Nearly all these failures in prosecutions which this gentleman spoke of yesterday, have been of that nature. Here is another example of much the same sort. There was an analyst who had brought to him an article which was called milk of sulphur, and he found it to contain much sulphate of calcium, and the authorities took the matter into court. It was explained by our friend that milk of sulphur formerly naturally contained this ingredient, and that the public always preferred it in this form. Well, that was all right, I suppose, and accordingly the case was put out of court. This, however, was nothing against the analyst. It was simply a question for him, as to whether natural scammony root or sulphur contained carbonate or sulphate of calcium, but whether their presence was admissible was a question of law, and the proper way of settling such questions is by legal proceedings. Why, then, say the analyst jumps to a conclusion, because the prosecution does not succeed on a point totally unconnected with chemistry, and which could only be settled by a court of law? I think I have said enough to show you that the attacks which have been made, from time to time, upon public analysts are in many cases unjust. We do our best to tell the true *chemical* facts, as truly and exactly as we can, and with what *legal* results follow we have nothing to do. It has been said, Why do not analysts warn the authorities not to prosecute in debatable cases? but I can only say, that in practice I have twice done so in matters of drugs, and been plainly, but firmly told, to mind my own business!

(*To be continued in our next.*)

REVIEW.

The Mineral Waters of Europe, including a Short Description of Artificial Waters. By C. R. C. TICHBORNE, LL.D., etc., and PROSSER JAMES, M.D., etc. Baillière, Tindall, and Cox, 1883.

This book contains the most complete descriptions which we have yet met with of the Continental and some of the English mineral waters. It is far superior to the Appendix to Squire's "Companion to the Pharmacopiæ," which has hitherto been the most reliable source of information on saline springs.

The present work makes no pretence to deal with those waters which are used for bathing only, and very little effort to deal with those which are not bottled and offered for sale in this country. This makes the book more practically useful for English reference, because more reliable, and it enables chemists and medical men to select a water of the class needed, with the almost certainty of being able to procure it in bottle in this country.

The joint authorship of chemist and physician is a happy thought, for each supplies the other's deficiencies, and the analyses given are more complete than might have been the case if it had not been absolutely necessary to furnish a medical man with the information required for the publication of a therapeutical opinion.

Nearly all these analyses have been made for this work, and there are one or two good features in the way in which they are published, to which we would draw special attention. The results are given in grains per gallon, and with the salts combined in the most probable way. A skeleton analysis of each water is also given, stating simply the amount of salines, antacids, purgatives, and iron in ½-pint. This enables a comparison to be made between the different waters with more facility than by a comparison of the larger number of ingredients contained under any one of these heads.

The authors call attention, on several occasions, to the great discrepancy between the analyses published on the bottles and circulars of mineral waters, and the results which they have found on actual analysis. This, no doubt, needs attention, for the published results are, in many cases, so old as to be absolutely worthless.

There are a few errors which at present, sadly disfigure the book, and should be corrected if a fresh edition is called for—for instance, the statement that the mineral matter of blood corpuscles amounts to 81·20 per cent.

CORRESPONDENCE

[The Editors are not responsible for the opinions of their Correspondents.]

TO THE EDITORS OF "THE ANALYST."

HOME-GROWN SUGAR.

4, The Sanctuary, Westminster, S.W
July, 1884.

SIRS,—As owners of the works now in course of construction at Lavenham, referred to in an article in your current month's issue, we shall be glad to be allowed to call your attention to some facts relating to these works, and to our proposal to re-introduce into this country the beet sugar industry as a manufacture from home-grown produce, and at the same time to correct some misapprehensions into which the writer of the article in question has fallen.

And first as to the failure of the works when in operation some fifteen years ago. The reasons for the non-success of Mr. Duncan at Lavenham may be stated simply under three heads, only one of which was alluded to by your correspondent, and that but partially.

(1) That at the time the works were started the price of wheat was 55s. per quarter, whereas the present price is about 36s. 6d. to 37s., and although the farmers, who at that time began to supply Mr. Duncan with roots, found the then price of wheat a sufficient basis on which to form a ring, with the intention of forcing the price of beets up to 25s. a ton, under the very different conditions which now exist, and with wheat at present prices, no such combination need be feared; the farmers are well satisfied to sell at 20s. a ton, and we have had offers from substantial men occupying large farms in the Eastern Counties, to deliver roots to us another year at 16s. even; and as good land may be had there for 20s. an acre, a satisfactory profit would be left for the growers even at this price.

Farmers are already asking us to enter into contracts for next year.

(2) Mr. Duncan's process, so far from being "all right," as your correspondent says, was clearly at fault from an economical point of view. He boiled the syrup at Lavenham, and then transferred it in tanks to his refinery in London, where it was finished by his alum process. It is needless to point

out the heavy additional railway freight thus incurred in the removal of the syrup. The process of this company is, on the other hand, a direct one, the whole make of sugar is procured from the beet juice at once as refined sugar, at a very considerably less working cost than the alum process involved, whilst with us the finished sugar can be distributed from the works direct to the consumer.

(3) Mr. Duncan laboured under difficulties which will not exist for us.

Under the process worked by him the refuse waters from his factory, with charcoal, and especially the small rootlets from the beets, were all turned into the river running past the works, polluting the stream very seriously, and, by the fermentation and decay of the vegetable matter thus set up, creating a considerable nuisance, and killing the fish for several miles down. An injunction to stop this was threatened, and was one of the causes which led to the stoppage of the works.

In our process we use no charcoal, and the small rootlets, instead of going to pollute the stream, are diffused, and yield a higher percentage of sugar than the large roots themselves.

The three reasons given above for the non-success of Mr. Duncan's operations at Lavenham, then, do not threaten us.

The figures given by your correspondent as to the acreage necessary to supply our factory with roots, are somewhat wide of the mark. He says that 4,000 acres must be under beet cultivation in each year to supply a factory producing 120 tons of sugar a week. Some of the principal growers in this country give eighteen tons of roots as the yield per acre, while Dr. Voelcker puts it as high even as from twenty to twenty-five tons. The chief growers, however, in Mr. Duncan's time have stated that their average yield of roots was sixteen tons per acre, and taking for the moment eight per cent. as a correct estimate of the yield of sugar from the roots (although we expect to get not much less than ten per cent.) then 4,000 acres × 16 tons per acre = 64,000 tons of roots, yielding at eight per cent. 5,120 tons of sugar, which, in the campaign of 100 days, or say fifteen weeks, would give, not 120 tons, but (5,120 ÷ 15 =) 341 tons per week. The roots required for an out-turn of 120 tons of sugar per week of seven days would be only 215 tons per day, instead of the 325 suggested by your correspondent. We purpose to turn out 140 tons of sugar per week, and shall only require 250 tons at eight per cent., or 200 tons at ten per cent. per day. We apprehend no difficulty as to this quantity being "delivered uninterruptedly throughout the season."

Apropos of the acreage of land required, we may mention that to our knowledge one large farmer in France has grown beets on the *same land for four years in succession* with the best results.

One word as to the 950,000 tons of beet sugar said to have been consumed in the United Kingdom last year.

The Board of Trade returns give 1,050,000 tons as the total of both cane and beet sugar consumed during that period, and of this the beet sugar would very little exceed 550,000 tons. May we add that every ton of this sugar which can be produced from home-grown beets is a clear gain to both the owners and occupiers of land, and indeed to the whole agricultural interest in this country, and a successful issue to our undertaking will mean an advantage spreading far beyond the profit accruing to this company.

Yours, &c,

BOLTON AND PARTNERS, Limited.

TO THE EDITORS OF "THE ANALYST."

SIRS,—May I be permitted to point out what appears to me to be the most important deduction to be drawn from the paper of Dr. Muter, printed in your July number?

It is simply that the "solids not fat" should be calculated upon the aqueous portion of the milk, *i.e.*, after deducting the fat.

Surely this would be a much more scientific method of getting at the constant (?) ratio, than the present one of including a factor so liable to vary, either naturally or by fraud, as fat.

It would be very interesting if Dr. Muter would calculate the percentage of "solids not fat" in the way suggested, and see how nearly the results agree in the instances he quotes.

It might be convenient to take the water alone, and not the aqueous fluid as a basis against which to compare both the "solids not fat," and "fat."

I am, &c.,

87, Bold Street, Liverpool, July 24th, 1884. A. C. ABRAHAM.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Pharmaceutical Journal; The Sanitary Record; The Miller; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; Cowkeeper and Dairyman's Journal; Sugar Cane; Country Brewers' Gazette; The Medical Record; The Grocers' Gazette; London Water Supply, by Crookes, Odling, and Tidy; Chemical Review; Independent Oil and Drug Journal and Paint Review; Science Monthly; Journal of the Society of Chemical Industry; The Law of Adulteration, by Herbert.

THE ANALYST.

AUGUST, 1884.

PROCEEDINGS OF THE SOCIETY OF PUBLIC ANALYSTS.

THE country meeting of the Society was held on Saturday, August 16th, at the Royal Hotel, Matlock Bath.

The Secretaries regretted to say that, owing to illness, their President, Mr. Wigner, was unable to be with them, a communication which was received with general regret. In the absence of either of the Vice-Presidents, Dr. Charles A. Cameron, of Dublin, past Vice-President, took the chair.

A letter was received from Mr. A. H. Allen, F.C.S., F.I.C., giving a summary of the paper announced for the meeting on the "Keeping of Milk Samples." The mode of keeping suggested by the author consisted mainly in the addition of a known proportion of alcohol to the fresh sample. Mr. Allen's letter stated that, as he was just leaving for Canada, he was unable to be present, and expressed regret that time had not allowed of his writing his paper out in time for the meeting. As soon as the paper is received from Mr. Allen it will be published in the Society's proceedings.

Considerable discussion followed, in which Messrs. Baynes, Carter Bell, Kingzett, Wilkinson, Estcourt, Smetham, Hehner, and Dyer took part. Among the criticisms evolved by the summary of the paper, was a fear lest the volatility of the preservative re-agent suggested might sometimes vitiate the results.

Mr. H. W. Lake, assistant to Mr. F. W. Toms, was elected an Associate of the Society, and Mr. Frank Scudder was proposed as a member.

A vote of thanks was passed to Dr. Cameron for acting as Chairman.

After the meeting the members dined together and passed a very pleasant evening, a considerable number of them staying at Matlock for a few days, and making some very enjoyable excursions to Dovedale and other places in the neighbourhood.

Before the meeting separated, it was unanimously resolved, on the suggestion of Dr. Cameron, to hold next year's country meeting of the Society in Dublin.

PROCEEDINGS OF THE CONFERENCE, ON FOOD ADULTERATION AND ANALYSIS, HELD AT THE INTERNATIONAL HEALTH EXHIBITION.—SECOND DAY.

Mr. GROVES, the Secretary, here read the following communication from Mr. BANNISTER:—

Dr. Dupré and other analysts, who spoke yesterday, attempted to draw a great distinction between the limit of the public analyst and that of Somerset House. In this statement the fact is quite overlooked, that the methods of analysis are not the same, and, therefore, that the results are not accordant; the method of ascertaining the amount of solids not fat, laid down by the public analyst, is to dry the residue for three hours, and then calculate the proportion. In our laboratory (that is, the laboratory of Somerset House), the solids not fatty are dried until the weight is constant, and from experience we know that 8·5 of solids obtained by our way, are equal to 9 in the way followed by the public analyst. Many of them are alive to the unsatisfactory manner of the public analyst's method, and Mr. Hehner says that much more concordant results are obtained by our way as compared with the method of drying for three hours. It has been said, that the result of our method is to lower the limit to 8·5 per cent., but it is not a lowering of the standard, but only a difference in the methods of working, and it is unfair to attempt to induce the public to believe otherwise, simply because we work in a way which gives constant results; we gave the three hours' method a good trial, but abandoned it many years ago. With regard to the assumption that milk varies in composition, it is pleasing to know that this fact is now conceded, for I remember very well when many analysts held that milk only varied according to different cows, and that it was childish to suppose that any cow gave below the minimum.

In considering this Act you must bear in mind what was the distinct intention of the legislature, and this intention is still expressed by the Select Committee of 1874, which says, too high and "rigid a standard has been fixed by some analysts, and no sufficient allowance has been made for some natural variations in milk; 10 per cent. of milk solids may be more difficult to obtain under some conditions than 12 or 14 per cent. under more favourable conditions. Allowance should, therefore, be made for these actual variations, which some purely scientific chemists seem to have overlooked." It is evident from this that the legislature could not agree with the views of the analysts, and it is equally evident to me, that if some stringent regulations are to be enforced, we must get further powers under the Adulteration Act.

The SECRETARY also read the following communication from Dr. WALLACE:—

With regard to the possibility of having a standard, I think it would do very well to have a standard not too low, say 8·5 per cent. of solids not fatty, and 2·5 fat, or 8·75 and 2·75, and that in any case when the quantities came below these standards, the milkman should have the opportunity of proving his innocence by having the cow milked in the presence of the analyst. In the case of a man having a dozen cows, it should be no defence that one of his cows gave milk of unusually low quality; in any new Act both ought to be considered. The analyst should be paid not by fees, but by fixed salary, at not less than £1 per 1,000 of the population, and not fewer than 1 sample for every 500 inhabitants. There should also be a provision for employing an under-inspector, working in his everyday apparel, because it is usual to take samples by employing inspectors who are frequently police-sergeants, and who, at all events, are well-known to the dairymen and shopkeepers, which of course results in good samples.

Mr. BARHAM: I am not used to speaking from a public platform, and I must, therefore, claim your indulgence. I am sure we were very much delighted yesterday, and very much instructed by Dr. Bell's very able paper. I take it that, at an International Health Exhibition a discussion as to the Adulteration Act is of the very first importance, and it is very pleasant to see so many public analysts present, but I must say I see with regret that the other side are not present. I take it what we want is not to hear one man's ideas, but to endeavour as far as we are able, to insure a supply of pure food to the inhabitants of this country. Now, I think that instead of public analysts setting themselves apart from the traders, and looking upon them as a separate class, they would do better to call the traders in, and to tell them how to assist them in carrying this Act into force. I may say, that I had no wish to intrude myself upon you to-day, but a friend had left my name, and requested me to address you, and perhaps having given evidence before the Royal Commission, some seven or eight years ago, and as representing some 300 dairy farmers, and being deputed by the metropolitan dairy farmers, I have perhaps some right in appearing here. I think I ought to say at first, that I have the greatest respect for public analysts; but I dare say all will admit, that just as there are dairy farmers and dairy farmers, so there are public analysts and public analysts. Those gentlemen who are members of the Society of Public Analysts know very much better where to draw the definition than I do. Now, l'rofessor de Chaumont, yesterday, spoke about commercial morality, and he said we should never get rid of adulteration until the scale of public morality was higher. Now, as a dairyman, I think that some years ago trade was conducted by barter—it was before my time I admit, but still it existed, and then people bartered one article for another; and both were satisfied. Now, I ask you, Why should I sell my milk without water when beer has 50 per cent. or more? What as to drugs, about which, I confess, I am anything but sure? What about the lawyers, do they skim their milk, or rather, don't they cream it regularly once in a while? If I go into a horse repository and buy a horse, is the horse-dealer prosecuted if I am foolish enough to pay a big price for a horse which isn't worth a pound for each leg he stands upon?—no, if I know so little about it and get hold of a spavined old animal,

I have myself to thank; and yet they say that many dairymen are worse than horse-dealers. Then I go into a furniture shop—if I ask, Is this real Spanish mahogany? "Oh yes, sir," says the furniture dealer, "the finest mahogany ever brought into the country, I can guarantee it;" but it is Honduras, it is veneer, and yet no one would think of prosecuting the furniture-dealer. If I go into a linendraper's, the cloth I look at is warranted the best Welsh flannel, but it turns out to be half cotton. What can I do? can I have it analysed, and proceed against the linendraper for adulterating his cloth? No, it is absurd on the face of it. Then, are dairymen to be the only pure people in the world? I don't see why they should be the scapegoats of the community. Now, I should like Dr. Voelcker to be apprenticed to a dairyman—I won't say for seven years, for he would probably commit suicide before then; but only for seven weeks, and try to get off the cream during the strawberry season to which allusion has been made, and see if it is possible, and still keep the milk. Then with reference to the boracic acid and bisulphate of lime, it was a question whether that should be permitted or whether it ought to be forbidden—perhaps you will value my opinion for what it is worth, and I say emphatically, that it should be forbidden. I have no right to have my children dosed with boracic acid to save the dairyman a few quarts of milk; no doubt it would entail a certain amount of waste, but the public must, I suppose, pay for it in the shape of increased price for the article. I will not be personal to-day, but were I inclined to be so, I should take exception to a public analyst writing sensational articles to papers, saying that milk bought by this official was very generally adulterated, and then writing a testimonial to a particular dairy-farm, saying their milk was uniformly of good quality—indeed, all that could be desired. I think, if I belonged to a body of public analysts, this state of things should not be permitted to exist. Now, Dr. Dupré who spoke yesterday, spoke with reference to the adulteration of milk, and as to the quantity of water he found in the Sunday morning samples; but he named his own remedy; he said, when the inspectors had been round one Sunday, the Sunday following all the samples were excellent; he need, therefore, only send an inspector round once a fortnight, and Sunday adulteration will be a thing of the past. Mr. Hehner said that the Adulteration Act had worked great benefit generally, and that whereas milk used to be adulterated to the extent of 50 per cent. or more of water, that he really now only found 20 per cent., and frequently only 10; but what did Mr. Wigner say? he said it had increased instead of diminished during the last few years. I am sorry he is absent, for he might have explained the difference of opinion; but, however, I will take what he says. I do not see why what he said should not be accepted as true, and he said the percentage had increased during the last five years. The only inference that I can draw is, that the analysts and inspectors are no earthly use, and that we should be better without them altogether. Well, then, some gentleman, whose name I forget, referred to the Paris arrangement. It has often been said that we English are, more than others, anxious and willing to disparage ourselves, and to say, Oh, these things are done much better abroad. I heard the Secretary of the Royal Agricultural Society say the other day, that he would not drink half a pint of English milk, or allow half a pound of English butter to be brought into his house, because he found all these things so much better managed abroad. Now, is this true? and, in any case, I must say I think it is an extraordinary assertion on the part of the Secretary of the Royal Agricultural Society. He said it in very good faith no doubt; and if so, why is it? Why, because he went abroad as the Secretary of the Royal Agricultural Society of England, and of course everything was got ready in consequence; he was taken to model farms, and tasted model products, just the same as we should do if we received a letter to say the Secretary of a French Agricultural Society was coming to visit us. Well, now, I have made the supply of milk to Paris my study, in and all round Paris, and I have seen the whole process from beginning to end. I peeped in at every stage of the process; I don't know whether I asked too many questions, or whethey they thought that I wanted to know too much; but at last I had the door shut, so to speak, in my face. Now, the milk there is boiled—it is cooked milk; the cow is milked over night and the milk is boiled; it is mixed with the next morning's milk, and off the mixture goes to the market, for there is only one delivery of milk in Paris per day, and not two as you have in London—a double service. The consequence is that in the hot weather, after 1 or 2 o'clock, not a drop of fresh milk is to be had. One day I went round to twenty or thirty milk dealers in company with a friend, who spoke Parisian French, and tried to get some fresh milk, saying it was for a sick baby, and not a drop could I get. They said, well, it is not quite fresh, it is beginning to turn, but they offered me some bicarbonate of soda to sweeten it with, and that is all I could get for my alleged sick baby; it is dreadful! And yet the Paris supply of milk is said to be so much ahead of ours. Depend upon it there is no city in the world where the milk supply is so abundant and so good as in London—my remarks are not alone applicable to Paris. I have studied this question in many cities abroad. I repeat, without fear of contradiction, that nowhere is the service so well organised as here.

Now, as to the standards, I was very pleased to hear Dr. Muter's speech on this subject. Now, what is my idea? certainly I would stop water being added to milk, not a single drop would I allow; but this is my difficult point, and this is what I cannot reconcile with my morality, that an analyst goes into court and swears that a given specimen of milk contains so much water—has he found the water? No, he has only found the solids remaining after all the water has been evaporated, and he goes deliberately and swears that he finds a certain amount of water. Dear me! Where did he find it? It may be a correct inference, but it is only an inference; that is a point which I strongly object to. Another gentleman compared dairymen to pickpockets, and said that there were some dairymen who would scorn to put their hands into your pockets and take out sixpence; but this is the offence an analyst convicts a man of when he charges him with watering his milk. A man who

waters his milk is as bad as the man who puts stones in his coals, or any other form of fraud; it is a very grave offence. You know that Shakespeare says—

" He who takes my purse, takes trash;
But he who robs me of my good name
Takes something which enriches not himself,
And makes me poor indeed;"

and I can assure you many traders fall under that impression, and great bitterness of heart is the result; and I think great care should be exercised before a possibly innocent man is convicted of such an offence. Now that is what I want analysts to do. By-the-bye, some years ago, when the first Act was brought in, our Society invited the Society of Public Analysts to meet us and work up to a standard with us; but this they declined. What we want them to do is to give us a right means of detecting added water; we want something to do that, and if they will give us that you will do more to stop adulteration than all the fines in the world. Now, as regards working up to the standard, as we have heard nearly twelve analysts and only one dairyman, perhaps I may venture to take up this point, although I have already taken up a good deal of your time and attention. Now, you must know that the cow has often been called a machine for making milk, but, unfortunately, we cannot control her as we should control a steam-engine; we cannot turn on the steam just as we want to; and with the best food the same cow may produce a certain class of milk; we sell that milk and we are convicted of adding water to the milk. Well, now, with reference to when you send in the certificate of adulteration: well, what do you do? You take, I will suppose, your standard of non-fatty solids at 9, and at that point you do not give a certificate of adulteration, but if it should come down to 8·5 or even 8·75, what do you do? do you say that the difference between 8·7 and 9 represents the amount of adulteration? No; you take 9·3 as the standard, you raise your limit, and you say there is so much water, not the original difference, but the difference between the actual and the raised standards. Now, is that right or proper?

Very well now, there is such a thing as a Dairy Show held in London every year, and, perhaps, one of the most useful classes is the class for the milk prize. Now, that prize is given to the owner of the cows who give the most milk of the best quality, allowing for the time since calving—it is the duty of every proprietor of a cow to feed his cow, as well as ever he can, so as to get the most and the best milk. Well, I don't know whether you gentlemen read anything besides THE ANALYST or not, but if you read the reports of the Dairy Farmers' Association you will find these figures you will find in the breed of shorthorns—and these figures are taken by five judges, so there can be no doubt as to their accuracy and impartiality—now, the non-fatty solids were 8·5. These were the shorthorn breed, in good condition, well fed—not one of those a gentleman said was to be taken to the knacker's yard, I imagine; the fat was 4 per cent. The next cow gave 8·8 non-fatty, and 3·7 fatty solids; the next, non-fatty 8·4, fatty 4; the next, 8·8 non-fatty, and 3·1 fatty; another, 8·4 non-fatty, and 3 1 fatty; but we got one where the non-fatty solids were only 7·8—a healthy cow, well fed, and in the best possible condition, gave the fat 3·9 per cent. and non-fatty as 7·8 per cent. Now, of twenty-three cows of this breed, twelve gave less than 9 per cent. of non-fatty solids, the average 8·9 of non-fatty, and 3·7 of fatty solids: why, the milk of half these cows would have been condemned by an analyst! Now, for the Jerseys; these cows give the richest milk in the world, and yet one gave 8·8, another 8·5, and another 8 of non-fatty solids; this is four out of twenty whose milk would have passed for being adulterated with water. I will not trouble you any further with this, except to say of the Dutch cows here, their average of all the cows is 11·8, and the fat is very near 3, so that the average of all of them is less than 9 per cent.

Well, now, I will tell you the remedy apart from analysis—a remedy which will give you pure milk independently of public analysts. Give orders in your house never to pay less than fivepence a quart for your milk; you milk dealer will not cheat you, he won't water his milk, he will tremble at the idea of losing your custom. Now, if we were working like the brewers, if our results were to be obtained as Dr. Richardson once said, " that drawing milk was a barbarism, that we ought to mix it in its component parts at the chemist's," then I acknowledge that the position would be different; when we can prepare milk like that then we can give you any standard you like to ask. Well now, is it at all likely that you would go into a butcher's shop and say you wanted a joint of meat with a certain percentage of fatty and non-fatty constituents, and would you be likely to get it? and yet milk is always to have a certain amount of solids. It is almost impossible to do this, unless you make your standard sufficiently low, and I think that is really what you ought to do, and then leave people to rely upon the reputation of the firm they deal with as to the quality of the milk above that standard. Well now, with regard to butter fats—well, that is very difficult; if you ask me what you ought to have I will readily agree with you at 3 per cent.; but I say this, that if you insist upon having 3 per cent, there is not a firm who will not be fined sooner or later. You know that alteration is constantly going on in milk; it is not still five minutes; you know perfectly well that the constituents change rapidly, and that to-morrow morning the lighter portions will be on the top and the heavier at the bottom; why, the change is going on not only in the shop but in the cow's very udder! What is the result if you take too high a line? Some Sunday morning when Dr. Dupré's man is out (Dr. Dupré rose to protest against any suggestion that the inspectors were acting under his direction)—when his, the dairy-keeper's, man has over-slept himself, and, instead of properly milking his cow, he scamps it; and this is obviously not to the advantage of the dairykeeper—who is probably also in bed, being Sunday morning—and not having the right quantity of milk, he brings it up to it by means of the pump, and his employer is fined.

Then, again, when the milk comes by rail some hundreds of miles, of course, a certain amount of churning goes on; everybody has seen that. I have frequently seen the globules of fat floating on the top on the arrival of the cans, and in this way ½ per cent. may easily be lost; and when the milk stands in the shop the cream collects on the top; if the inspector comes in early he gets a good specimen, and then he says, of course, we knew he was coming, and perhaps a month after he goes in later and gets a bad specimen from the bottom of the can.

Well now, as to alterations in the Act, I certainly should like the Acts altered myself. What will I suggest? Well, we are at a good deal of trouble: dairymen are not orators, and cannot speak at public meetings, and the consequence is, they have a good many things said against them which they do not deserve; but two or three years ago they asked the House that the Adulteration Act should be altered, and, extraordinary to say, it was altered: a little Act was brought forward saying that the milk should be sampled at the railway stations (clause 3, chapter 30), and it gave power to the inspectors to go to the stations to take samples of the milk. Well, I don't think it is carried out in three stations in London (Dr. Muter rose to state that it was carried out in Lambeth). Then, clause 14 of the previous Act, in which it says that inspectors shall *offer* to divide the article into three portions. We think this should be altered into, "the inspector *shall* divide," etc., for it frequently happens that a dealer, confident in his honesty, says No, I don't want a sample; and then he is at the mercy of the inspector. Then there is another point, and that is *written warranties*. We have heard that when one of these fraudulent traders says it is no fault of his, that he sold the milk just as he received it, he is told he should buy his milk with a written warranty. Well now, you know he purchases his milk twice a day: you would think that if he agreed with a wholesale man to be supplied by him with pure milk, warranted pure for twelve months at a good price, and that under a warranty, that if the milk was found to be under the limit he could proceed against the wholesale man, but it is nothing of the kind; our judges say, You must have a warranty with every consignment. You see it is impossible to do this; no farmer is going to get up at four o'clock in the morning to sign a separate warranty for every can of milk he sends up to London. Then, again, a mention was made of the Act providing that the analysts, where the milk has undergone any change, have to make special note to that effect. Well, I think a summons ought to be issued within—say—a week, and then analysis on the other side could be conducted with some chance of getting a just idea of the actual state of the case; but there is one thing with reference to the Adulteration Acts, and that is this, if you want the Act carried out, you must make it the people's interest to carry it out; there is more heart-burning over one honest man who is convicted unjustly—there is more annoyance and bitterness against the Acts among his fellow-traders, than there is in 500 just convictions.

Owing to the time getting near when the room would be required for another conference, the president requested the gentlemen who intended to speak to restrict their remarks to ten minutes.

Dr. STEVENSON: I have no intention whatever of replying to my friend, Mr. Barham; he of course represents a large and important interest, and I have listened with the greatest respect to anything he had to say. I cannot help feeling, however, that if one could get at his own private opinions he would be inclined to fix a higher standard for milk than he admitted in his speech. I am rather unwilling to fix upon any absolute standard for this most important commodity. I thoroughly agreed with Dr. Muter that when a milk is rich in cream or butter fat, we must make allowance for the solids not fatty, but I must object to any such standard as that proposed by Dr. Voelcker, for although I believe our milk supply in London is much improved, it is not what it ought to be. I believe if this standard were adopted we should have a depression in the quality of our milk supply by ten or twelve per cent., and I think that the standard should be fixed at the lowest limit compatible with natural milk of a healthy cow. There is one other point, and that is, that the analysts, speaking "before God and man," as a certain speaker somewhat rhetorically described it, say, in their certificate, that a given specimen contains so much water: now I have signed some 10,000 certificates under the Act, and I have never signed anything of that kind. You will find that the analyst only expresses his opinion that there is so much water. I have observed that a good many of the general public are present, and I should like to impress upon them that we wish to have more of the articles supplied to us by the general public, and I would especially impress upon those who are connected with public institutions—such as hospitals, infirmaries, etc., to have their milk, drugs, etc., examined frequently. It is astonishing how few samples we get from such institutions of that sort. I have had the opportunity from time to time of examining supplies from hospitals, infirmaries, etc., and I have been surprised to see what adulterations in the article of drugs they get; it is said, of course, in defence of the very inferior article supplied, that the managers contract at a figure at which the articles cannot be supplied, but it still does not exonerate the trader from the breach of commercial morality: if he contracts to supply an article at a price at which he knows it cannot be legitimately supplied, it does not justify him in passing a spurious or adulterated article. I think public analysts would do well to direct their attention to drugs. I say this because I see many reports of the pharmacists, and I can vouch for a great many that they are supplied with all purity and precision; but there are a certain class of men who supply medical men, hospitals, etc., at cheap rates, and with inferior articles. In one instance, a compound senna mixture—a preparation familiar to most of you, I expect, and the efficacy of which depends on sulphate of magnesia and senna, but as the first is very less expensive than the latter, the senna was conspicuous by its absence, with disastrous effects upon the aged poor and sick, for whom it was intended. There is still one other class of adulteration to which I wish to refer, and that is the kind of fraud which is perpetrated when articles of inferior character are sophisticated by something which gives them a good appearance, for instance, alum in bread; fortu-

nately this is in a great measure a thing of the past, but I think I should have liked to have heard this discussed, as to how far it is legitimate to utilize inferior articles in this way. It is well known to you, sir, that there are certain classes of food products, such as flours, which are in an unsound state, and a good sound loaf cannot be prepared from them, and yet by the addition of alum, a very good presentable loaf may be produced. My opinion is, that if we make a good loaf with the addition of alum from inferior flour, we are presenting the public with a more wholesome substance than if the alum had not been added, but this does not cover the question. If the opinion of the customer were asked about it, and his consent were obtained, I could understand the morality; but I do not see it when the inferior article is made to look like a good article, which it is not, and the price of the better article charged for it. I repeat, I should have liked to have heard the question discussed from this point of view, as it is one of immense importance.

Mr. EASTON: I must admit that yesterday I sat like a steam-engine under pressure, and it was very interesting to hear the reply of Mr. Barham. I feel it an impossibility to continue a discussion which has been so exhaustively touched upon by Mr. Barham; one point, however, he did not allude to, and that is that dairymen have no antipathy to public analysts as a class, but against certain individuals who are not quite fit for the position they occupy, whose certificates have been the means of ruining many honest traders. The statement has been made, that out of 1,000 samples certified as adulterated, only one had been lost when the certificates were brought into court. Now does it ever occur to the public how many of these cases in which convictions ensue are ever contested? There are hundreds of samples of milk taken from dealers, where convictions ensue, where the man does not attempt any opposition to the case—he does not take a contrary opinion. I should like to know in how many of these 1,000 cases was there any contestation. I have known cases where four per cent. of water was certified to, and on application to Somerset House, a certificate was returned different entirely from that of the analyst. A gentleman who spoke yesterday, Mr. O. Hehner (it may possibly have been with a feeling akin to superior knowledge), stated that he had analysed more samples than Somerset House; now is Mr. Hehner aware of the fact that Somerset House have taken 600 various samples, and yet Mr. Hehner has 6,000 samples of the same sort: have you had cows kept especially for this purpose? or have you been taking indiscriminately from a general source, and as a general average of analysts. It was my good fortune some two years ago to be dining with Dr. Tidy, and upon that occasion Dr. Tidy was rather vicious against a large number of medical men who assembled at that banquet. He said, the poor you have always with you, and so have you the doctors; and he went on to say that the ills of men were mainly imaginary, and so long as they continued to exist the medical man would thrive; but I do not imagine the truth of the inference. As to the statement that the adulteration of milk has dropped from fifty per cent., the Adulteration Act only having been in force since 1872, it is quite within the limits of possibility that within a few years adulteration itself may come to an end, and then I hope we shall dispense with the public analysts.

Mr. HELM: In the course of the speeches of yesterday a very serious charge was made against Dr. Bell and his colleagues in their capacity of referees. Two gentlemen in a very high position as public analysts made a very serious charge for adopting the standard they had at Somerset House, and that they had taken diseased or improperly fed cows to judge from; but what in the world could be the motive for doing anything of the sort? and they did nothing of the kind—they sought all round London, and even as far away as Somerset and Derby, to get fair samples. These two gentlemen told you that the limits adopted by the Society of Public Analysts were 9 per cent. non-fatty and 2·5 fatty, but to-day I have been perfectly bewildered by the figures brought forward by different speakers, for the past President of the Society has said he would pass milk at 8·5 per cent.; but because we at Somerset House have agreed to pass it at 8·5 per cent. we are told our cows are ill! Well, now, as Mr. Barham has said, it is not usual to accept bad or diseased cows at Dairy Shows, but these cows have given Dr. Dupré another grievance. Dr. Dupré has abused the authorities at Somerset House on the ground of the lowness of their standards, and says they have lowered the standard of milk by taking too low a standard. Yesterday Dr. Dupré was rather more moderate, and said that occasionally a single cow might give below 9 per cent., but a whole dairy never. Well, now, I have the results pointed out by Mr. Barham of these cows' milks, and accepted at Islington, which were not analysed at Somerset House but by Professor Voelcker, that out of a total of 79 cows 33 gave below the standard, and that out of 23 short-horns 13 have the audacity to give below the Society's limits, of the Jerseys 3, and out of the Guernseys 4, and out of 6 Dutch cows 4 were below; and as to the fact of a dairy never coming below, the mixed milk of the entire lot would be pronounced adulterated according to their standard—so much for these cows. Well, what do we do? we send round inspectors, and out of 238 samples 134 were adulterated according to the Society's standards. How then, in all reason, could we adopt a standard of that kind? out of four dairies 3 came below the Society's standard. Now these gentlemen, at a recent case at Manchester, have told us they always report a sample below 9 per cent. What must we think then of Dr. Muter, who will pass milk at 8·5 per cent. if the fat be good? and Dr. Stevenson, if he does the same thing? Well, sir, the time is very limited, and I know Dr. Bell will reply to many of the statements which have been made, and I am sorry I have not the opportunity of making this mention yesterday. Well, now, you all noticed that Dr. Bell very studiously avoided anything which might bring him into collision with the public analyst, but Dr. Dupré stated that he was glad to air his grievance against Somerset House, and I can assure you Somerset House is equally glad to have the opportunity of explaining themselves. The paper of Mr. Bannister took away part of what I intended to say with regard to it, but you all know that the Society of Public Analysts adopted their standard on a

basis suggested by Mr. Wanklyn, that was to dry the milk for three hours, take the fat out of it, and the difference was the non-fatty solids. Of course, if you leave any water in the milk it swells the amount of the non-fatty solids, and it has been shown that by drying the non-fatty solids to dryness, that is until the result is constant, 8·5 per cent. is equal to 9, which is the standard adopted by the public analyst. Why, then, are our cows diseased, if our 8·5 per cent. is equal to your 9 per cent.? Well, now, coming to what can be done to make the Act more effective, we are all agreed, for we all agree to get the best article we can, we have a bias against fraud, and we have been trying all we can do to get a standard. I can tell you there is no work which causes us so much anxiety at Somerset House as one of those referred certificates. I can assure you it is quite a cloud off Dr. Bell's head when the certificate can be approved. First, the Act is very inefficiently worked throughout the country, and I should be very glad to see some means of getting it more effectually carried out. Dr. Muter has suggested that an inspector should be compulsorily appointed, and a very fair number of samples purchased; but what is the use of compelling a man to purchase samples if he does it in a policeman's uniform? I think something further is required, and that the Local Government Board, where they suspect that the Act is not properly worked, ought to work it themselves in one way or another; but unless local tradesmen and local councils can be overridden in some respect, I fear the Act will never be thoroughly efficient.

Mr. ANGELL: I think the position I stand in here is unique, because it is the first time that a public analyst has had the opportunity of speaking in just such a meeting as this. For the first time we have the representatives of the upper house who have come down amongst us—the gentlemen in power and authority set over us as referees. I say we have never had an opportunity of speaking before these gentlemen, and it was one of our first grievances that we could never approach them. Now the day has come, and we are exceedingly glad to have met face to face with them, and with those people who regard public analysts as people to be objected to.

Now for the remarks of a gentleman who spoke on behalf of the dairymen; he made a brilliant and interesting speech, but he spoke of it as though it were a game with two sides, and then he seemed to try to prove that two blacks were white. After that, some misunderstanding on his part was made with regard to what was said yesterday. He seems to have got mixed up between a statement made by one gentleman that the percentage of cases of milk adulteration had increased, and the statement of the other gentlemen that the proportion of added water had decreased. This same gentleman told us something about the fact that we could not tell added water from other water. Now, it makes me think of one instance which has occurred to me when I was lecturing to the Botley Agricultural Association, and after some pains to show them why we should believe in a comparative standard of such a supply as milk; that nature, if she gives the animal this secretion for the nourishment of the young, it would, from the most abstract point of view, be expected to be somewhat constant, and also attempted to prove it to be the case by experiment. Now, after all my pains, one of the farmers present got up and said: "Now, just look here, Mr. Angell; I have listened to you and all that, but can you distinguish the added water from the other?" Of course I admitted I could not. "Well," said the farmer, "then you can sit down, for if you can't do that you are not much good anyway." And we were told much the same thing to-day. Milk takes up a good deal of our time now, and it is not altogether undesirable that it should be so, seeing the great importance of the subject.

Turning for a moment as to beer. It was said by one speaker yesterday that there is a very great difficulty in establishing the composition of what is sold to us as beer. It frequently happens to us in my district that question arises as to the quality of the beer which is sold, and they send me a great number of samples, but owing to the fact that there is no absolute criterion we are obliged to certify that they are sound, unless we find something deleterious. Now, I see a way out of this difficulty; all the multifarious compounds of sugar, and more or less edible bitters, should be sold under the name of *Ale*; but if a man asks for a glass of *Beer* he should have nothing else: a product of malt, flavoured with hops. Let *ale* be anything wholesome in the shape of what is now known as beer, and the word *beer* be restricted, as I have said, to a product of malt and hops alone. This would meet the difficulty, and I don't see that it would interfere with the trade at all. Yesterday, Professor Attfield was clever enough to give us some very astounding allegations, but I regret to see he is absent to-day, though I asked him to be present. For that reason I shall not go so indignantly to work as I had intended; but I think when such statements are made they should be made with very great caution. The very first thing he said was to give you a caution that you should not be led away by *ex parte* statements, but I claim for public analysts a very much more independent position than that of Professor Attfield in connection with the prosecutions. In several of these cases which he quoted I was the analyst, and I ask you which of the two is likely to make an *ex parte* statement—myself, or the man who is intimately connected with a very powerful Trade Union—which comes down with counsel and chemical adviser, and that adviser it is an open secret is the man in question? They bring down parts of pharmacopœias, and strive to prove their case from one or other of them, and if by means of a quotation from some antiquated, worm-eaten old pharmacopœia, they can manage to elicit something in their favour they exult, and would seek to convey the impression that when a case is dismissed you must look upon it as though an error on the part of the analyst had been detected. There are such things as differences in opinion, and therefore it is objectionable we should speak of the analyst's certificates being dismissed when, if we should inquire into the matter, it would prove to be something outside of, and independent of it. I will say in conclusion, with regard to Professor Attfield's statement, that I was

about to refer to certain special cases where he is known to have said that citrate of magnesia need contain no citric acid and no magnesia; and in one case where, by a process best known to himself, he really found a very faint trace of soda carbonate in the bulk of sulphate of lime—a process by the way which he has kept secret to the present time; but in his absence I shall not go into these matters.

Dr. REDWOOD: I may say in the first place that I have listened with very considerable interest to the discussion which has taken place here to-day, and that the effect of what has been stated by some of the gentlemen who have appeared here has rendered unnecessary my saying much upon the subject. At first the observations made by Dr. Muter I must entirely and completely agree with, and I may say also with reference to the very spirited and talented remarks which have been made by Mr. Barham, that I feel quite sure you will all have been greatly delighted in having had the opportunity of hearing the very able defence on behalf of the dairymen. Now, there are just two points I intended to refer to—two points which have not been so thoroughly disposed of, which I wish to make a few remarks upon; the first, with reference to the statement which was made yesterday to the effect that the Adulteration Act has not accomplished all that was anticipated from it, or even much that could be satisfactorily referred to it, especially because it is found on reference to statistics that the proportion of adulterated articles still continues to be so much what they were in the first instance. Now, that is an argument which will have, I conceive, weight with many persons, unless some mutual explanation is given as to the cause of that persistency in the percentage of adulterated articles appearing on the annual reports. It appears to me that that has arisen mostly from the circumstance that a very considerable change has taken place in the nature of the substances collected by inspectors for analysis recently, as compared with what was the case some years ago. I have been a public analyst almost from the commencement of these operations, and I have had a very considerable experience, being the analyst for the metropolitan county and for many of the large districts, and I can say from my experience that when we began this work the inspectors were in the habit of collecting a very large number of samples of different kinds and of different materials, which were submitted to analysis, and that in the process of time it was ascertained by these inspectors and others that a large number of the substances which they had been in the habit of collecting never practically were found to be adulterated. Latterly the inspectors have confined themselves within my experience to a very limited number of articles, and those are the kind of articles which are most liable to adulteration, as, for instance, milk and butter, coffee and mustard, and a few more articles of that description; in point of fact, the very articles which are referred to by Dr. Bell in his paper are those which alone are now found to be to any general extent subjected to adulteration: and seeing that these articles are of the special nature of those liable to adulteration, it would naturally follow that the proportion of adulterated specimens among them should be in relation to what occurred when a much larger class, a much larger number of different classes of articles were collected, all of which were submitted to analysis, but $\frac{9}{10}$ of which were never found to be adulterated. It appears to me this is the principal cause of the continuance of the percentage of adulterations which is almost identical with what it was years ago. There are some other causes certainly, but not as influential as that I have mentioned. Many of the causes also of the increased high percentage of adulteration is the imperfect manner in which the Act is carried out. I can speak from my own experience within those districts where the Act has been most regularly, systematically, and consistently carried out, that there has been a very considerable reduction in the amount of adulteration. There are one or two of the metropolitan districts of which I am analyst where there has been a very marked indication of improvement in this respect, whereas in some others of which I also have experience the case has been quite otherwise. In districts, for instance, in which the inspectors only now and then bring samples by impulse, or when they have been accidentally prompted to bring samples, in those cases where they often remain for many months without collecting any samples at all, and the result of that is that certain traders get into a habit of supplying articles which when analysed are found to be adulterated. Now, that is one point which I wish specially to call your attention to, and another point is that referred to by Dr. Bell at the end of his paper; and I shall be glad to hear what he has to say in his reply on this point, namely, whether he considers that the addition of flour or starch to mustard is an adulteration, or sugar and starch to cocoa—an opinion which I myself have entertained and acted upon. I certainly consider that the substance sold to the public under the name of cocoa is well understood in this country to be mixed with starch and sugar; but nevertheless, if I were to find an undue proportion of these materials, then I should look upon it as an adulteration, and so likewise with reference to mustard. I consider that a little flour added to the mustard contributes to its value, but if I found more than five or ten per cent., I should look upon it as an adulteration. Of course I should make an exception of mustard for medicinal purposes, as this ought to be pure; but the conclusion I have arrived at is that in the general run of mustard not much flour is added.

Mr. CHESHIRE: I had made a few notes yesterday on some points on which I wanted to speak, but the greater part have been dealt with, so I will only allude to a few of them. I will begin my remarks by saying how glad I am I came up from Hastings to attend this conference. The first point is the question of the percentage as mentioned in Dr. Bell's paper. It is stated that the percentage of adulteration is probably very much higher than the Reports give, on account of the traders often knowing the inspector, especially in uniform. There is, however, the other side, as, for instance, at Hastings. The inspector only comes where he expects to find bad specimens, and yet we only get 15 per cent., and the common way is for the public to go and tell him where the bad specimens are to be found. He employs every means for preventing anybody knowing him. I had a small number of

samples from the public, but, curiously enough, in the samples from the public I never had one that was adulterated.

Then as regards the small fines, there is just one reason why the fines are is some cases small, and that is, that they do not fall on the really guilty party. The retail dealer often pleads that he has sold the articles just as he bought them from the wholesale man. Then as regards understating the results, I have always made a practice only to certify to so much as I could be certain about; but there is this, if you state the amount low, the magistrates say it is very small in quantity, and perhaps there might have been a mistake. They argue that it would not have been worth the tradesman's while to adulterate in such small quantities. I do not believe in saying anything as to the quantity, when I do I always put "about"—as in a case last week of a sample of strawberry jam, when I certified that there was *about* 50 per cent. of apple. With regard to improvement in samples, I heard of a curious circumstance at Rye. It is one of those places where they never take any samples for a long time, and then go in with a rush. I had a letter from the Town Clerk saying some samples were to be brought especially of milk. One-half of the specimens were adulterated, and when I met the inspector who had been to take samples of butter, he said, "Sir, I cannot find any butter; it is all butterine." Then as to beer, as there is no definition, one must be very careful. I take it, beer must be a liquid which must be fermented with some form of starch, with the addition of a bitter. As far as the use of chemical reagents is concerned, where preservative reagents are used with a good effect, and are innocent in themselves, I pass them; but I think there is need for a general agreement among public analysts on this head.

Then as regards milk and its standards. The majority of these low standards are those realised by Dr. Voelcker, and it is clear he adopts some peculiar plan of his own. In my own case I have always dried for three hours, and in every case where it has gone below nine I have reported it, and I have never had an appeal to Somerset House. It is not very often I get a milk which runs below nine, and it is very difficult to understand why a series of analyses by Dr. Voelcker should all come below nine, seeing that his fat is very high.

Mr. LLOYD: There are very few points for me to speak upon, and I shall only point out that I think the great object of the Food and Drugs Act is to ensure health, and that the public analyst is required more to protect the public from any ill-effects than really that the food should come up to any definite standard. That is the great difficulty I find in coming to any conclusion as to standards, especially with regard to milk, because we all know that milk has proved of all articles of food the one which has brought most disease. That reminds me of a point which I think is of importance, and I have not heard it remarked upon, that there is a large amount of condensed milk being sold as milk having had water added to it. Now, if there be one practice more than another that is likely to prove detrimental, it is that the liability to disease from the addition of water is very great, even in ordinary milk, but what will happen if condensed milk is to be made up to the strength of milk and sold as such? If the condensed milk has been condensed with sugar this could be detected in the solution, but if unsweetened condensed milk be employed, I do not know any way of ascertaining the fact, nor do I know that any action could be taken on such grounds, even if proved. One of the greatest difficulties that the public have to contend against is that their food shall be pure, although the Acts exist, because every one must know who has had any experience of the matter that under the present system it is very largely a failure—namely, that the inspectors are not able to obtain adulterated samples when those adulterated samples exist. The public are open to have analyses made, but they have to pay ten shillings, and no one will pay ten shillings to ascertain whether one shillingsworth of food which he has purchased is genuine or not. It is the State which should protect the public. How that can best be done I am not altogether prepared to say, but the method of people writing to the inspector and telling him he has reason to suspect such and such a material obtained at such and such a place is the most possible one that I can suggest, but the public require to be educated before they will understand the desirability of pure food. We cannot expect the poor man to pay one shilling and sixpence a pound for coffee without chicory in preference to one shilling a pound with chicory, and until we can teach them this the Act will never get that public support which after all is what it mostly needs. One remark more as regards the application of the Act to agricultural substances. I believe that that is totally unnecessary; the reason why the public are able to obtain analyses of food at the expense of the State is that the food costs comparatively little, compared with the cost of the analysis; but this does not hold good with respect to the agricultural substances, where the purchases are made in large quantities, and, besides, every farmer belongs to a society, attached to which there is an analyst who will analyse his specimens for him at a small cost. I say the farmer is able to protect himself, which the individual cannot.

Dr. VIETH: Almost every speaker who has addressed this meeting has taken up one question as relating to an article of food upon which the young part of the population almost entirely subsists. As I have devoted eight years to the analysis of milk in the laboratory under my charge, where fifty or sixty mixed samples are analysed every day, I may be allowed to speak on the subject. That there are some difficulties in connection with milk analysis and milk adulteration is, I think, sufficiently proved by the animated debates which occur whenever the subject is made a matter of discussion. The variations in the natural composition, and the alterations caused by the tendency of the fat in milk to separate out in the form of cream make it difficult to ensure the supply of an article in no way tampered with to the general public, and at the same time not to do wrong to the honest dealer and the liability to speedy decomposition very often forms a difficulty to prove and confirm an alleged adulteration.

In the case where a sample of milk is found or suspected to be adulterated, it will be very rarely possible to compare it with a sample as it was originally. This being so, and keeping in mind that milk naturally varies to a great extent, a prosecution for adulterated milk would be at most impossible, unless some standard or better limit be found; where to fix it is another difficult question, which, in my opinion, cannot be solved satisfactorily, so long as milk of individual cows and dairy milk is treated in the same manner. Milk of individual cows sometimes comes down very low as far as composition is concerned, and I can see no difficulty why dealers should not be compelled to sell a milk labelled accordingly. If the public choose to buy a milk which might be very rich or might be very poor, they may do so. With dairy milk, which is the mixed milk of a number of cows, the difficulty is diminished to a great extent. Such a milk is much more uniform, although it still may vary a good deal. In the first place the specific gravity, which is so easily ascertained by the lactometer, falls always between 1029 and 1034, and if only every small milk dealer who has no other means of protecting himself, and every householder who likes to have pure milk for himself or his offspring, would use this instrument freely, a great deal of watered milk would be banished from the streets of London in a very short time. As it is impossible to detect adulteration in every case in this way, there will be still a great deal of the work left to the analyst. I have said already that in my opinion it is necessary to fix a limit; where to fix it is, in the first place, a question of analytical method. The total solids given, fat and solids not fat, compensate one another. If, by our method, the fat is exhausted to the last trace, the solids not fat will be proportionately low; if, on the other hand, a particular method leaves about half one per cent. of fat in the non-fatty solids, the latter will be so much increased. How much fat or solids not fat may be expected must be found out by statistical investigation, and I think there exists plenty of material now-a-days to settle the question at once. If, say among 100 farmers, ninty-nine are able to produce a milk of a certain standard, the remaining one should be able to do the same; and if, through bad feeding or watering, the milk should be excluded from the market, I do not think any reasonable man could find fault with this. In my opinion, the standard applied by the Society of Public Analysts at present is quite fair and just to both parties as far as fat solids are concerned; but with the analytical methods the limits for fat and solids not fat should be altered. The tendency of the fat to rise as cream must not be lost sight of, and I would think that it is only right that in the letter of the law milk falling below the fixed limit should not be returned as watered or skimmed, but as not of the nature, quality, and substance of the article demanded, and the public analyst should not be obliged to make a statement which he cannot prove, viz., that the addition or deprivation extends to so much per cent. As to the decision in case of disputed analyses, I think it is utterly impossible to put an analysis of an old and decomposed sample of milk against one made of the milk as long as it was sweet. As soon as decomposition has proceeded to a certain point, it is, in my opinion, almost waste of time to analyse it. There does not exist a general rule according to which one could calculate the progress by extent of decomposition of milk from day to day.

Dr. BELL: My reply will be very short, for very few criticisms have been made upon the paper, or upon the statements made in it. First, I think, Dr. Dupré rather questioned the potency of fusel oil in whisky. I still adhere to the statement, and experience fully bears me out. I dare say we are all aware of the frequency that one hears said in Scotland, "You will not find a headache in a hogshead of that whisky," because it is a pure and mature whisky; the fusel oil has been changed into harmless ethers. Distillers might also entirely dispense with the trouble and expense of maturing spirits in bond if it were not for the deleterious character of the fusel oil. Then the next gentleman has asked a question with reference to cocoa, for example. The only substances which are now found in cocoa are sugar and starch, and these are not considered as adulterations so long as the articles are not sold as pure. I have mentioned that they must be sold as mixed articles. Then with regard to the quantity, it is not the presence of a quantity of sugar or starch in cocoa or mustard which will constitute adulteration. This is a question for the justices. If it comes to us, we merely say how much it contains, and leave it to them to adjudicate upon the case. I think the only question really started, and upon which I should like to make a few remarks, is the question of milk. It seems to be a great bone of contention; and our position in reference to the questions seems to be largely misunderstood, and I am pleased to have this opportunity of explaining my position in reference to it and to other articles. There was a paper read from Mr. Bannister, which gave a paragraph from the Report of the Committee met in 1874. Now that is the starting-point. They said that cows yield milk of different qualities. They clearly indicated that proper allowance is sufficiently made for variations in the quality of milk. Parliament is aware of this; they laid down no limits of quality nor any standard. They leave it to the public analyst. Now Mr. Hehner said last evening that he sent two specimens of milk to Somerset House. They say that they cannot affirm that water has been added, but they cannot affirm that water has not been added, and we say neither can they! Now if there is one thing which we value more than another, it is the principle that everybody is presumed innocent until he is proved guilty, and if there be a doubt whatsoever, the defendant has the benefit of that doubt. I am not opposed at all to the fixing of limits of quality or standards: it is not a matter at all for me; it is a matter between the analysts and the trade. I am simply placed to do justice between the two parties, and I have no objection, provided it has been laid down legally; but I cannot lay it down, nor can the public analyst lay it down. We can only give an opinion, unless we come down to a very low limit; so that, as I say, we have no desire at all that limits of quality should not be laid down. We are quite prepared to accept any limit which may be laid down. It is pretty well admitted that milk does vary very considerably in quality. I was very pleased to hear Dr. Muter state so

honestly and fairly his views upon the subject, and I hope that every public analyst will follow him in the same line. It is, I believe, the first time that a public analyst has appeared in public, and stated so clearly and honestly the case, as Dr. Muter has done to-day. I do not say that we are not prepared to say that milk with eight per cent. was adulterated if we obtained evidence from other data which would lead us to that conclusion, but if we have not sufficient evidence from the data which we have obtained, then we cannot conscientiously pronounce it adulteration, and we give the benefit of the doubt to the defendant. I am not prepared to come down either to a low limit. I think I agree largely with a statement of Dr. Wallace, that when it comes low down, the defendant should be called upon for an explanation, and if he cannot furnish an explanation, he should be called upon to satisfy the justices that his milk is genuine; and that is the fair and proper way in which an Act of this kind should be applied to an article which varies so much in composition. The desire of the analysts should be to avoid the infliction of an injury to a tradesman. As Mr. Barham pointed out, it is a most serious thing for him to be convicted for his milk when he is innocent. I thank you very much for your reception of my paper, and for your kindness altogether; and now I will propose a vote of thanks to our worthy President for the able, liberal, and fair way in which he has conducted this meeting. The success of any meeting depends upon the management of it by the chairman, and I think that on this occasion our President has managed the meeting most successfully, and contributed largely to the success of the discussion.

The motion was seconded by Dr. Muter, and carried unanimously.

"OLD PROCESSES OF FOOD ANALYSIS."

By A. W. Blyth, M.R.C.S.

In contributing a short paper on behalf of the Society of Public Analysts, with the title of "*Old Processes of Food Analysis*," I will anticipate the question *cui bono?* by answering, that he is a poor student of science, who takes no heed of the road hewn out by his predecessor. While we extend knowledge by new departures, while we pioneer our path through the untravelled forest, cutting away the undergrowth of error, the settlers who preceded us must neither be forgotten nor lightly held :—

It must, however, be confessed that as the older methods of sophistication were primitive, coarse, and evident, so were the methods of detection; bread mixed with lumps of iron, or made of rotten materials within, good without, needed not the exposition of its quality by recondite or refined processes.

A full history of the older methods of assaying foods, beverages and drugs would be neither more nor less than a history of the evolution of the chemical, physical and natural sciences, for all these aids are used by the modern analyst; the less ambitious aim I adopt of giving a brief sketch of what may be considered the more important labours of the earlier workers of this particular field. To do this with profit, I must at once pass over both the writers before the Christian era, and some 16 centuries after that era; the quaint conceits and theories of the herbalists, and of the alchemists, the questions so hotly debated, as to the division of substances into *hot cold* or *moist;* the *sulphur*, the *mercury* and the *salt* believed at one time to be the basis of all composition, must not detain us. So far as they suggested or stimulated to experiment, they advanced knowledge, so far as they were accepted as true, they retarded knowledge.

One of the earlier pioneers of analysis was the Hon. Robert Boyle; in a way he may be said to have written the first scientific treatis, the sole object of which was to make known a method of detecting adulteration. This work is entitled "*Medicina Hydrostatica; or, Hydrostatics applied to Materia Medica*, showing how by the weight that divers bodies used in physic have in water, we may discover

whether they be genuine or adulterated," 800 London1690. His method is of course the one so long known termed "*Specific Gravity.*" He showed that impure mercury sublimate, that Roman vitriol contaminated with alum and other substances could by the method of weighing them first in air, then in water be detected.

The invention of the microscope opened the doors of a previously invisible universe, and by revealing the intimate structure of animal and vegetable tissues, and the regular and mathematical forms of crystals, gave an impetus to all sciences, and among these to the analytical.

Anthony Van Leuwenhock and his contemporaries, Doctors Hooke and Henry Powers, were certainly the first who occupied themselves in a systematic way with the microscopical studies. I am never wearied of insisting on the claims of Leuwenhock, the more so for he has been much neglected, and few people have even a superficial acquaintance with the works of this acute and great observer. Theine, the active principle of both tea and coffee, is said to have been discovered by a German chemist in 1820, but Leuwenhock had separated it 120 years previously, both by crystallisation from coffee infusion and by sublimation of tea leaves; his description is not quite exact, but he has given a fair drawing of what he calls the "minute saline particles;" all of them he says "were of the same shape, and long and pointed at the ends." He, however, was not aware that the crystalline principle of tea and coffee were identical. "I afterwards endeavoured," he goes on to say, "to discover, if possible, how many saline particles could be produced from a single leaf of tea, but having reckoned up only a part of the volatile salts contained in one leaf I forbore any further observations because the number I had already reckoned up was so great that I dared not publish it, as I had proposed to do; and, indeed, many persons could not believe that the leaf itself could be divided into so many parts, visible by the microscope, as I saw volatile saline particles produced from one single leaf."

Leuwenhock also discovered piperine, the crystalline principle in pepper, he distilled pepper and considered that the difference between white and black was that the one was decorticated, the other not, and proved that he was right by direct experiment. He noticed that vinegar could be neutralised by chalk, and described the vinegar eel.

The miscroscopical characters of milk did not escape him, he said that it was a fluid containing many globules, some of these were of a buttery nature, and rise to the top, others sunk to the bottom and were of a different composition.

In England Dr. Henry Power and Dr. Hooke were working in the same direction; they both investigated the minute structure of a number of plants, and Dr. Power published observations, directly bearing on the detection of adulteration by the microscope, as for example when he states how easy it is to observe the mercurial and other substances in compound powders.

Food analysis is now seldom performed qualitatively only, but also quantitatively, and the first attempt at the quantitative analysis of the more important foods was made in the 18th century.

The general process by the school of Boerhave in use was distillation, and all things possible of distillation were submitted to that process.

If an 18th century chemist were by some undiscovered art resuscitated, placed in his old primitive laboratory, and asked to analyse a sample of milk, he would act as follows:—Some large quantity, many pounds, would be weighed in what we should call a common coarse balance; he would next take from its special stand with loving care a thick large fantastically-shaped retort, and place the milk therein; he then would set it over a furnace, lit by a fire either of charcoal or ordinary materials, he would sit down and watch it, keeping the heat as low, and the distillation as slow as possible; it would take a long time; was not Voltelenus thirteen days distilling one sample of milk, when the retort cracked and spoilt his labours? day by day, with incredible patience, our resuscitated chemist would sit by his retort and watch "the spirit," as most volatile condensable matters were called, and when no more moisture could be detected- he would urge the fire, carbonise the residue, even unto a *caput mortuum*, and lixiviate any salts it might contain with water. Lastly this solution would be concentrated and allowed to crystallise.

Geoffrey, in 1737, made what I believe is the first quantitative analysis of milk, he took 12 lbs., or about 190 times as much as a modern analyst would use, the milk was coagulated by gentle heating, the coagulum was separated and weighed, and found to be 20 per cent of the original quantity, the serum was evaporated down, and its weight equalled 5·2 per cent.; he carbonised this residue, obtained a caput mortuum and lixiviated certain salts, of these quantitative determinations the solid residue from the serum representing milk sugar, and soluble ash, was what might be expected and is fairly correct; the caseine and milk-fat making up the coagulum, are, of course, much too high.

Hoffmann and Casper Neumann made analysis of milk, and estimated the total solids with accuracy—so that, despite of the clumsy processes, it is clear that had they only forsaken their wearisome distillations, and essayed the use of solvents, the 18th century chemists would have made a very fair quantitative analysis of milk.

The great chemists Stahl Merggraf, Brandt. Bergmann, Schiele Berthollet Priefley and Lavoisier also belong to the 18th century, and laid the foundations of modern chemistry, which were so extended and developed by Liebig and the German school.

Modern analysis is so very modern, that several living chemists have pretty well seen its entire growth, sound views as to the constitution of organic bodies, aud accurate methods for the quantitative determination of alcohol, sugar, starch, gum, fat, wax, resines glucosides and alkaloids, all of which, the very root of our operations, are, so to speak, the birth of yesterday.

The food analysts since 1874, united in a society, have aimed at the co-ordination and the specialisation of existing knowledge, so as to bring it to bear upon the subjects which it is their duty to deal with, and they have done so, with such success, that their nine years of corporate existence can be looked at with pride and satisfaction.

There is a great gap between the appliances in the laboratory of Voltelenus; between the painful tedious watching for thirteen days of a distillation, and the rapid yet accurate methods now in use, but there still remains a great deal of work to be done in order to distinguish the true from the false. We must settle the composition definitely of all genuine substances, a task requiring many hands and minds and these not working alone, but in co-operation.

AN EXAMINATION OF MUSTARDS MANUFACTURED AND SOLD IN NEW YORK CITY.

By E. Waller and E. W. Martin.

We have had occasion recently to make an examination of samples of mustard manufactured in New York City, and have presumed to believe that a statement of our results may not be without interest to the members of the Society of Public Analysts.

Many interesting points have been suggested by the results of the examination, but we are at present too closely occupied with other matters to follow up the lines of inquiry so attractively suggested.

The samples of dry mustard (Table I) represent the *lowest grades* of mustard put upon the market by eleven different manufacturers, while the samples of mustard pastes

Table I.—(Dry) Mustard Manufactured and Sold in New York City.

No.	Moisture.	Fixed oil.	Ash.			Colouring matter.	Remarks, &c.
			Soluble.	Insoluble.	Total.		
197	6·15	21·17	0·30	5·54	5·84	Martins Y.	Cout's starch
204	8·03	12·79	1·39	5·39	6·78	Turmeric	$CaSO_4$ present ,,
206	7·35	12·54	0·23	4·69	4·92	,,	Ash fused ,,
207	8·23	8·42	0·15	1·90	2·05	Martins Y.	,,
208	8·50	10·92	2·90	13·15	16·05	Turmeric	$CaSO_4$ present ,,
209	7·24	6·81	0·10	3·55	3·65		,,
213	7·65	13·32	0·64	5·17	5·81	Martins Y.	Ah fused ,,
214	7·60	7·74	1·53	1·69	3·22	Turmeric	,,
215	7·15	9·09	0·20	2·91	3·11	,,	,,
216	5·45	20·57	0·15	5·12	5·27	,,	,,
217	6·50	8·59	1·52	5·65	8·17	,,	$CaSO_4$ present ,,
218	8·45	14·59	2·15	6·65	8·80	,,	$CaSO_4$ present ,,
219	6·62	22·56	1·62	4·86	6·48		No starch
294	9·86	6·21	1·16	3·54	4·70	Martins Y.	$CaSO_4$ present

"German mustards," (Table II) as they are termed here in the trade, represent four different manufacturers, Nos. 221 and 242 being from the same.

Table II.—Mustard Paste, "German Mustard," manufactured in N.Y. City.

No.	Moisture.	Acetic Acid.	Oil.	Other Organic Constituents	Ash.			Common Salt.	Oil on dried Mustard.	Metallic Copper (per cent.)
					Soluble.	Insoluble.	Total.			
221	77·02	2·76	2·55	14·18	2·51	0·93	3·49	2·11	24·98	0·001
222	81·52	1·98	3·50	10·67	1·77	0·56	2·33	1·63	21·24	trace
237	77·62	2·43	3·90	12·60	2·52	0·97	3·49	..	19·51	0·009
242	76·54	3·69	4·57	11·53	2·69	0·98	3·67	1·86	23·14	0·003
244	81·45	2·94	3·73	9·09	2·14	0·65	2·79	1·77	22·44	trace

The method of analysis for the dry mustards was :—

Moisture.—Drying in air bath at 100° to constant weight.

Ash.—Ignition of the dried residue from the above at as low a temperature as possible, after weighing, boiling with water, filtering and weighing the undissolved residue to get soluble and insoluble ash.

Fixed oil.—Extraction in a modified form of Soxhlet apparatus with ether. The modification was only of such a nature as to render the apparatus more durable, and had no effect on the principle or method of extraction of the Soxhlet apparatus.

For the German mustards the method followed had only those modifications which the pasty condition of the material required. In extracting the oil some 15 or 20 gms. were dried in the air bath until the material ceased to lose weight, when it was ground up in a mortar, a portion weighed out and extracted with ether in the Soxhlet apparatus. The results so obtained are given in the column headed "Oil on dried mustard," and by calculation the figures in the third column (Table II) were determined.

The *acetic acid* was determined by washing a weighed quantity of the paste on a filter with cold water, until the filtrate was neutral, adding coralline and titrating with half normal sulphuric acid. The acetic acid so calculated was deducted from the loss by drying, which was assumed to represent moisture and acetic acid together.

Copper was determined by destroying the organic matter so far as possible by heating with fuming nitric acid, finally fusing with potassium nitrate, and subjecting the solution (converted into sulphates) to the action of a battery. In heating for this purpose, burners constructed of glass and cork were used.

As a guide in these examinations samples of mustard purporting to be pure wer obtained from manufacturers in the City, and specimens of mustard seed were also obtained, which after repeatedly grinding in a coffee mill were submitted to the same tests.

Through the kindness of Mr. Wigner we received also samples of mustard flour and seed from the London market, the results on which are also given in Tables III and IV.

TABLE III.—(BOLTED) MUSTARD FLOUR PURPORTING TO BE PURE.

From New York Manufacturers.

No.	H_2O	Oil.	Ash.			Remarks.
			Soluble.	Insoluble.	Total.	
201	6·10	26·42	0·21	5·92	6·21	
220	5·50	25·70	0·86	4·80	5·66	Trieste and Bombay Seed, mixed.
			English Samples.			
273	4·85	36·67	0·175	3·725	3·900	White Seed.
274	4·75	41·70	0·125	4·425	4·550	Brown Seed. Ash fused.

TABLE IV.—GROUND MUSTARD SEEDS.

No.	Kind of Seed.	H_2O.	Oil.	Ash.		
				Soluble.	Insoluble.	Total.
	AMERICAN MARKET.					
231	Bombay	7·52	36·96	1·25	4·37	5·62
232	Trieste	6·35	36·45	0·70	3·70	4·40
233	California Yellow ..	4·95	34·00	0·50	4·40	4·90
234	English Yellow ..	6·10	35·46	0·25	4·55	4·80
	ENGLISH MARKET.					
271	White	7·10	34·45	0·7	3·9	4·60
272	Brown	7·30	34·71	0·85	3·9	4·75

The results obtained for oil on Nos. 201 and 220 led to inquiry, the result of which was the discovery that it is the regular practice of the mustard manufacturers here to express a portion of the oil from the ground mustard seed, before working it up into the condiment sold as mustard. In these samples, as well as in No. 219, which was sold under guarantee of being pure mustard without admixture, no starch, colouring material, or other material known to be foreign to the mustard seed, was found.

If we calculate, then, that these mustards had been made up from mustard flour containing 25 per cent of oil, by multiplying the percentages of oil given in Table I by four, we would get approximately the proportions of mustard flour present in percentages. In justice to the manufacturer of No. 214, it may be stated that the package was labelled as consisting of a mixture of mustard and starch. On none of the other samples, however, did there appear any such intimation.

We were told that a man who formerly worked under one of the well-known English manufacturers of mustard had asserted that the practice of extracting a portion of the oil before making the condiment was used in England, and that in order to evade the vigilance of the Public Analysts, that starch or flour, saturated with some inferior fat or oil, was mixed in with the mustard flour. An assertion coming in so roundabout a manner would have received no attention, had it not been that samples bearing the name of that manufacturer, were submitted to examination at the same time with those above enumerated. Notwithstanding a high percentage of oil, the samples contained starch when examined by the microscope, and by the iodine test, and the oil extracted was decidedly more fluid than that extracted from any of the other samples.

These points gave some colour to the statement quoted.

As yet, however, we have been unable to verify the actual presence of any oil foreign to mustard in the extracts. Mr. Wigner also kindly sent us a sample of mustard from the same manufacturer. The oil extracted from that did not have so marked a fluidity.

The results were as follows:—

			Ash			
No.	H_2O	Oil.	Soluble.	Insoluble.	Total	Remarks.
199		35·15	0·34	3·64	3·98	Ash fused in all cases.
230	4·92	35·13	0·25	3·80	4·05	All contained Turmeric and Starch.
275	5·175	32·07	0·25	3·62	3·87	

Nos. 199 and 230 were of the same brand, though purchased at different times and in different places. No. 275 was the sample sent by Mr. Wigner.

So far as the results of the tests on genuine mustards (flour and seed) go, some modification seems necessary for Dr. Blyth's statement (Foods, p. 491) that 30 per cent. of the ash of mustard is soluble in water.

The fusibility of the ash of some of the specimens was an unlooked-for phenomenon, and what tests we have made have been insufficient to decide the point. It is apparently not due to presence of an excess of carbonates of the alkalies, as the reaction of the solution of the ash was only very faintly alkaline. Moreover, even after boiling with water the fusible portion was not removed.

On a few of the samples the experiment of removing the oil by the use of CS_2 in the Soxhlet apparatus was tried ; the results were found to be lower in every case than when ether was used. As witness :

Sample No.	Oil by ether.	Oil by CS_2.
197	21·17	19·73
207	8·42	6·36
213	13·32	10·90
220	25·70	25·08

We have not yet decided as to the significance of this fact.

Nos. 197, 207, 213, and 294, were found to be coloured with Martins yellow (dinitronaphthol), a specimen of which was handed us at the same time with the samples of mustard. The sample had apparently been made from the sulpho compound, as it gave reactions with barium salts, after fusion with potassium nitrate. After purification by solution in alcohol, filtering and recrystallising the product failed to give this reaction. The sample was the calcium compound, and was found to contain :—

	Found.	Theory for $Ca(C_{10}H_5N_2O_3)_2 6H_2O$.
CaO	9·38	9·12
H_2O	17·00 per cent.	17·59

The calcium, sodium, and ammonium salts are moderately soluble in hot water. In these solutions, potassium chloride produced precipitates of red tufted crystals, not very soluble in water or alcohol. In the solution of the ammonium salt, concentrated solution of ammonium chloride produced a precipitate. In any of the aqueous solutions precipitates soluble in alcohol were produced by soluble barium, lead, and silver salts ; the colours of these precipitates ranged from orange to almost a vermillion shade. The addition of acids (HCl, H_4SO_4) to the aqueous solutions gave lemon yellow precipitates of the acid fusing at 135°.7 C. (Recorded fusion point of pure acid 138° C.) By prolonged heating with strong nitric acid, phthalic acid was obtained, proved by obtaining from it fluorescein by heating with resorcin. The acid was readily soluble in chloroform.

All of the compounds deflagrated violently on ignition. The calcium salt, when crystallised rapidly from its solution, gave crystalline plates ; when allowed to separate more slowly, it formed needles. By drying in the air bath its colour was deepened to red.

It was found that qualitative tests for the presence of this colour in the mustard could be made by pouring alcohol of 93 to 95 per cent. upon the mustard, allowing it to act for a few minutes (cold), stirring occasionally, and filtering. Most of the colour, with some of the oil, was thus extracted. By evaporating off the alcohol and treating the residue with water, a solution was obtained in which wool could be readily dyed a brilliant yellow. The water solution, nevertheless, contained some gummy or oily substance, which presented some difficulties in the way of obtaining crystals of the colouring matter, for examination by the microscope, and the more thorough the extraction with alcohol, and subsequent treatment with water, the greater this difficulty. We have as yet been unable to effect a satisfactory quantatitive separation of the colour in consequence, but still hope to perfect some plan for that purpose.

Statements regarding the physiological effects of this colouring matter when swallowed, are few and far between. Eulenberg, in his Handbuck de Gewerbliche Hygiene, states, that the dinitronaphthol is non-poisonous. Experiments made upon dogs by Dr. C Edson, of the Health Department, in connection with this investigation, went to show that it was a strongly irritant poison. Four dogs, each weighing about 50 lbs., were killed by doses of 15 to 40 grains of this colour. The autopsy showed acute gastero-enteritis as the cause of death.

DETERMINATION OF FREE ACID IN OILS.

By L. Archbutt, F.C.S.

In the Analyst for September, 1883, and again in the number for June, 1884, there appeared papers translated from foreign journals, descriptive of certain methods for estimating Free Fatty Acid in Oils. As neither of the methods is so simple or satisfactory as it might be, a description of the process which I have constantly used for some years past may be of service to some readers of this journal.

I use two tall, narrow-mouthed, colourless glass bottles, of about 400 c.c. capacity. One bottle is divided, by file marks on the side, into four parts of about 100 c.c. capacity each. An ordinary normal soda solution (40 grammes NaHO per litre) is used for the titration.

The divided bottle is filled with re-distilled methylated spirit, a few drops of phenol-phthalein solution added, and normal soda run in, drop by drop, until the liquid is coloured a faint pink. This quantity of neutralised alcohol serves for four titrations.

The other bottle is counterpoised on a large balance, and 50 grammes of the oil are weighed into it. 100 c.c. of the neutral spirit is added, and a few drops more phenol-phthalein, and then normal soda is run in until the mixture, after being violently shaken, is permanently coloured just pink. One drop of soda (=·03 per cent. of oleic acid) in excess, will produce this result. The number of c.c.'s employed ×·562 gives the percentage of free fatty acid, stated as oleic acid. The determination can thus be accurately made in a few minutes, with very little trouble. The bottle containing the oil and alcohol, when emptied and allowed to drain for a few seconds, is ready for the next sample.

In the case of palm oil (which is often coloured red), and other solid fats, the process requires to be slightly modified. If the sample be very red, it will not be possible to work on a much larger quantity than five grammes, and as a rule it will be found most convenient to take from 5 to 10 grammes of any solid fat. The result will not be quite so accurate as by using a larger quantity, but it will be sufficiently so for most purposes. My plan is to melt some of the fat in a beaker, and weigh 10 grammes into a short wide-necked flask, of about 150 c.c. capacity. 20 c.c. of neutralised spirit are added, and some phenol-phthalein, and then normal soda, as before, until the pink colour is permanent after vigorous shaking. During the titration, the fat is kept in a melted condition by warming the mixture occasionally. Even when palm oil is very red, with

a little care it is quite easy to detect the change. I have proved by experiment upon neutral palm oil that no saponification of the fat takes place. The number of c.c.'s of soda required ×·255 gives the corresponding weight of free palmitic acid in the quantity of oil taken.

Some oils are liable to contain a small quantity of *Free Mineral Acid* which has not been washed out after refining. It is obvious that the process described above makes no distinction between mineral and fatty acid, but simply estimates the total acidity. Free mineral acid may, however, be readily detected and estimated by shaking the oil with water and methyl orange, instead of spirit and phenol-phthalein, the former indicator being unaffected by fatty acids. In this case it is better to separate the oil from the water before titrating. In the case of dark coloured mineral oils this precaution is essential.

The following factors will be useful :—

1 c.c. of Normal Alkali is equivalent to

* { ·281 gramme Oleic Acid.
  ·283 ,, Stearic Acid.
  ·255 ,, Palmitic Acid.

*O = 15·96

ON THE PROPORTION OF FREE FATTY ACID IN CERTAIN OILS OF COMMERCE.

By L. Archbutt, F.C.S.

1. *Olive Oil.*—During the past few years I have frequently examined samples taken from large bulks of olive oil intended for lubricating. The proportion of free fatty acid (calculated as oleic acid) in 89 samples which proved to be genuine, is given in the following table :—

Free Oleic Acid per cent.

Origin of oil.	No. of Samples.	Highest.	Lowest.	Average.
Malaga ..	12 ..	25·1 ..	2·3 ..	8·1
Seville ..	7 ..	10·0 ..	2·5 ..	5·3
Gallipoli ..	3 ..	15·0 ..	8·2 ..	12·2
Gioja ..	2 ..	10·4 ..	10·0 ..	10·2
Messina ..	5 ..	11·3 ..	8·2 ..	9·0
Unknown ..	60 ..	24·5 ..	2·2 ..	8·0

These results show that olive oil is liable to contain very considerable proportions of free fatty acid, which very much detracts from its value as a lubricant. I have also found it, on this account, very unsuitable for burning in lamps, the free acid (if exceeding about 3 to 5 per cent.) having a very serious charring action upon the wick.

2. *Rape or Colza Oil.*—This oil always contains a certain proportion of free fatty acid, but a far smaller and less variable proportion than olive oil. 44 samples of genuine refined rape oil for lubricating and burning, contained the following proportions of free acid, calculated as oleic :—

Highest .. .. 5·5 per cent.
Lowest .. .. 1·7 ,,
Average .. .. .. 3·0 ,,

3. *Palm Oil.*—This oil is liable to contain very large proportions of free fatty acid, as the following nine samples show:—

Brand.	Free Fatty Acid, calculated as Palmitic.
1. Salt-pond	78·9 per cent.
2. Unknown	72·0 ,,
3. Brass	53·2 ,,
4. New Calabar	52·2 ,,
5. Unknown	35·3 ,,
6. Half Jack	24·4 ,,
7. Bonny	21·5 ,,
8. Unknown	13·3 ,,
9. Lagos	11·9 ,,

Free palmitic acid has a very corrosive action upon steel. A strip of bright steel immersed in palm oil containing free acid, will soon become discoloured, and will frequently be found to be deeply pitted in places, if left some time in the oil. The action is very irregular, and I have not always found the most acid oil give the worst results.

PHOSPHO-CITRIC ACID.

A Preparation to Supersede Citric and Tartaric Acids in Mineral Waters.

By J. Napier, F.C.S.

Citric and tartaric acids have long been used for acidulating or giving to mineral waters their acid flavouring, but these acids have certain disadvantages, inasmuch as their solutions cannot be kept for any great length of time without the formation of a fungoid growth, and also the extreme difficulty of obtaining them free from lead.

A solution has recently been offered to the trade called phospho-citric acid, intended to supersede citric and tartaric acids in mineral waters, a sample of which I have lately received, the composition of which, I have no doubt, will interest analysts. It contains—

Free Phosphoric Acid	34·34 per cent.
Phosphate of Magnesia	1·86 ,,
Sulphate of Magnesia	1·93 ,,
Sulphate of Lime	·55 ,,
Iron and Alumina	traces ,,
Citric Acid	6·50 ,,
Water	54·82 ,,
	100·00

Poisonous metals were entirely absent, and so also were free sulphuric, hydrochloric, nitric, and acetic acids. The solution was comparatively clear, and almost colourless. According to the proportions instructed to be used, the quantity of phosphoric acid in a small bottle (half-pint) will amount to ·95 grains, which I found to be the case in a sample of lemonade made with the above. The flavour and appearance were quite as good as that made with the organic acids.

Seeing that phosphoric acid has been largely used, and appears to be highly valued for raising bread and pastry, and that it is recognised as an important medicinal constituent to the system, there is no reason why this article should not be used in this highly diluted form as the acid flavouring of lemonade and other mineral waters.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Pharmaceutical Journal; The Sanitary Record; The Miller; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; Cowkeeper and Dairyman's Journal; Sugar Cane; Country Brewers' Gazette; The Medical Record; The Grocers' Gazette; London Water Supply, by Crookes, Odling and Tidy; Chemical Review; Independent Oil and Drug Journal and Paint Review; Science Monthly; Journal of the Society of Chemical Industry.

THE ANALYST.

OCTOBER, 1884.

SALVAGE PEPPER.

During the past month a letter appeared in the *Times* from a firm in Upper Thames Street, calling attention to a sale of salvage pepper. In this communication they state that two thousand bags, equal to about 240,000lb., of pepper, being the salvage recovered from the fire at New Crane Wharf about six or seven weeks since, were sold at Wapping by public auction, and realised prices in some cases within 20 to 25 per cent. of the market value. The pepper, however, was saturated with Thames water, the sewage or impurities in which had so impregnated the article as to have destroyed its essential properties and rendered it utterly unfit for human food, and in this belief the writers of the letter, Messrs. Harvest, directed the auctioneer's attention to the fact, and suggested that the sale should be postponed until an analysis could be obtained. This, however, was objected to, and the sale was continued, with the above results.

It is exactly in such a case as this that the present Sale of Food and Drugs Act fails to protect the public, because when this damaged stuff gets distributed to the retailers, mixed doubtless with some good pepper, it will still be pepper, and, therefore, its sale will not be interfered with. It seems, however, somewhat strange that, if the case be really so bad as represented, the Sanitary Authorities did not step in and ask for the destruction of the whole. We constantly hear of the seizure of decayed meat and fish, but the importers of all other articles of food seem to be able to do very much as they like so far as any interference of the Sanitary Inspector goes. Chemically it would be very interesting to get hold of a sample of this article and see really what effect the water damage had upon its strength and nature as a condiment.

INTERNATIONAL HEALTH EXHIBITION—ABSTRACT OF A LECTURE ON PURE MILK.

Delivered on July 30th, 1884, by G. W. WIGNER, F.I.C., F.C.S.

PURE milk is the natural food of infants, and in many cases the most appropriate food for invalids, and it may fairly be said to be essential to the growth of a healthy race of men and women. But it is even more than this, Milk may be regarded as a model food, and as a complete food. It is a model food because it is nature's own food, designed for the sustenance of the young of animals, and, as such, it contains and furnishes all the nutritive properties in due proportion required by a growing animal.

Milk of course differs slightly, according to the animal from which it is derived; and this point we shall have again to consider at greater length, but at present we must simply view it as a typically perfect food.

It would be hard to give any food a higher recommendation than this, and yet it is not too much to say that two-thirds of the inhabitants of London, or indeed of England, have any practical knowledge of what pure milk is, and that at least one-half of the remainder only consume it occasionally rather as a luxury than as an article of food.

Now milk is not only a perfect food, but it is the most extensively used food. Some might think that this post of honour belongs to bread, but really I think it would be the food that, including children with the population, is used more extensively than even bread.

From pretty careful enquiry, it appears that the consumption of milk among the middle classes of London, is something like 10 gallons per head per year; but there are a large proportion of the poor to whom the cost of milk is serious, and there are a large proportion of the rich to whom, I am afraid, milk is less palatable than it should be; and therefore it would be a very moderate estimate to say that, on the average, 3½ gallons per head per year is consumed by the entire population, or say, 1½ ounces per head per day.

Now London has been rendered somewhat notorious by the outcry about the amount of the Water Rates; it will perhaps surprise some to hear that the amount of the Milk Bill of London is within about 10 per cent. of the amount of the Water Bill of London, and while the water rates amount to about £1,562,000, the milk rates, if so I may call them, amount to £1,400,000 per year, or about 5s. 10d. per head per annum.

There is a good deal of difference, however, in the actual incidence of the milk rate as distinct from the water rate; because the poor, who have but little money to spare, are practically untouched by the water rate, their proportion of the landlord's tax being almost too small for consideration, while, on the other hand, they are among the largest consumers of milk, and, unfortunately, from the very necessity of their purchases being small, say ¼d. worths, or ½d. worths, they buy from the worst vendors, and, without doubt, succeed in procuring the most heavily adulterated milk.

Milk consumers have, however, become so habituated to use the poor watered and skimmed milk which is supplied by these tradesmen, that the loss which they incur from

day to day is not appreciated; and although their infants are deprived of the food which they require, the result shows rather an increase in the bills of mortality than an improvement in the character of the milk supply.

Of course milk has been a source of an immense number of cases of prosecution and litigation—persecution the milk dealers call it—but anyhow, whether it is persecution or prosecution, for close upon twenty-four years—that is ever since the passing of the Act of 1860 for the suppression of adulteration—milk dealers have appeared in police courts, quarter sessions, and every other court having power to deal with such matters, not only from week to week and day by day, but many times a day, and yet milk adulteration goes on as fast as ever.

Pure milk ought to be such a simple and straightforward term that it should not need definition, but legal sophistry has been exerted to such an extent upon the milk subject, and discussions of every sort have taken place in reference to milk, that even those two words differ in meaning according to the views of the persons by whom they are used. I define pure milk to be the milk produced by a properly fed cow in a state of health. I do not by this mean to imply for a moment that a cow should be fed to the highest pitch which modern science can devise, or that a veterinary surgeon should be kept in constant attendance upon it; but I do imply, that a man who puts forward his herd of cows as milk-producing machines, and sells the milk which these cows produce to the public as genuine milk, is bound to take reasonable precautions to keep them in health, and such proper precautions as any man who values his stock would take, to see that they are sufficiently fed with proper food to prevent their deterioration in health and milk-giving power.

There are certain persons in the milk trade who distinctly challenge this view, and I shall not be putting the matter fairly before you if I do not state their arguments from their point of view, even though I state them merely to show their fallacy. The view which these representatives of a certain section of the milk trade take is, that any liquid which comes from the udder of a cow—no matter how much that cow may have been wrongly fed—is pure milk, and has a right to be classed as such, and to be exempt of the penalties of the Adulteration Act. The leading argument which they put forward in favour of this view is, that the prize beasts of the Agricultural shows have frequently given milk below the usually accepted standard of quality both as regards cream and solids not fat. I admit this fact without hesitation; it is well known, but the reason is not far to seek; animals at these shows are fed in such a way as to force the quantity of milk which they yield to the maximum, while at the same time the animals themselves are kept as far as possible in the highest external condition, and calculated to attract the eyes of those who judge of animals by external appearance.

When these very same cows are taken back to their homesteads, regularly and properly fed, kept from the impure air of the show-shed or show-yard, and milked in a proper way, no such abnormal results are obtained, but the milk assumes the ordinary typical character, even when the quantity yielded is somewhat less.

Pure milk, therefore, should not merely be the produce of the cow, but should be the produce of the cow in a healthy condition and reasonably well fed. Granting, then,

that this definition be accepted, in the first instance, we have to consider whether it is capable of being formulated in a more distinct way, so that, for instance, it would be possible for the milkman or analyst, by examining the milk, to say whether the liquid fulfils the conditions I have laid down; and here I am compelled at once to say, No, it would not be possible; but the utmost that could be done by science and practical knowledge combined is that a certain limit may be laid down below which pure milk will not fall unless under circumstances of most exceptional character. This limit is in practical use, and is adopted by a very large number of public analysts throughout the kingdom.

I pass now to consider the different constituents of milk, that is the various different parts into which it can be approximately divided, and into some of which, as a matter of fact, it is divided in the various processes of cream, butter, curd, and cheese making. These different constituents are Water, Fat, Caseine, Albumen, Sugar, and Salts, &c.; and for convenience of demonstrating the fact clearly, I have arranged on the table before me a series of bottles (which Messrs. Welford and Sons, who have the large Dairy in the Southern Gallery, have kindly placed at my disposal), that you may see the proportions of each of these ingredients contained in one gallon of milk. Here, for instance, we have the Water contained in one gallon of milk, which amounts to 8lbs. 7oz., and each of the other constituents in its proper relative proportion. I ought at once to disabuse your minds of the idea that milk is absolutely constant in composition; it varies to some considerable extent, but in talking of it to-day, for popular purposes, I shall assume a fair average composition, and explain the extent to which the variations occur afterwards.

Commercially we get fat in a state of what may be called "*semi purity*," as Cream. Good cream contains from 50 to 60 or 65 per cent. of butter fat, the remainder consisting of water and a small proportion of the other constituents of milk. When cream is churned into butter the envelopes of the fat globules are broken, and a large number of these tiny little spheres of fat, originally of microscopic size, adhere together, while a large proportion of the water and the soluble constituents are washed away with the butter milk. We thus get butter fat in a still higher state of purity.

Good butter, well made and well worked, should contain somewhere about 88 per cent. of pure butter fat, and the highest class of butters will contain rather more than this. To get the butter fat, however, in a state of purity, the butter must be melted with the water, soluble matters and curd separated; the clear limpid oil, of beautiful amber colour, floats on the top. This, when poured off and allowed to chill, forms pure butter fat.

Fat in some form or other is an absolute essential to the dietary. If children are brought up without the use of butter, or a butter substitute, they rapidly lose health and condition, and even in many savage races, we find that the fat of animals is consumed in large quantities, taking the place of the butter of more civilised countries. Following out this argument, I see no reason why, with proper precautions in its manufacture, butterine should not be used to a considerable extent, to replace the deficiency of butter, from which we at the present time suffer. Butterine, when properly made,

is nothing but the best and purest dripping, flavoured with milk, so as to make it resemble butter as much as possible.

The next constituent of milk that we have to notice is Caseine. This is the flesh-forming constituent of milk, and is called curd. It is classed as one of the most valuable constituents, and is a highly nitrogenous matter. Indeed, with the exception of a small amount of albumen and Lacto Protein, all the nitrogen of milk exists in the form of caseine. Caseine forms the basis of our cheeses of every kind, except the real cream cheese. It will therefore scarcely surprise you to hear that it is highly nutritious. We all know how hard-working men live, to a very great extent, upon cheese with a quantity of bread, and not only do they thrive on the food, but perform an amount of physical work which most of us in this room would be quite incapable of undertaking. It is therefore fair to look upon caseine as being the work-sustaining portion of milk, and to say that if a sample of milk is deficient in caseine, it is deficient in a constituent most necessary for securing health.

Albumen constitutes nearly the whole of the remainder of the nitrogenous matter in milk. It is difficult to define the exact position which this albumen holds in the dietetic value of milk. It forms a small proportion, only about one quarter of the nitrogenous matter present, but owing to its more soluble form, and the greater difficulty with which it is coagulated, it appears to me extremely probable that its real food value may be higher than the other nitrogenous constituents. There is some amount of evidence, although not yet a certainty, that this form of albumen is peculiar to milk, and that it differs from the albumen present in eggs, but it seems probable, that like the volatile acids present in the fat of milk, this substance has a special nutritive value of its own, and that without this albumen milk would not be a perfect or complete food.

Of course in the case of whey, which is not unfrequently used as a diet, the albumen forms a very important part, because the caseine, containing some three-fourths of the nitrogenous matter, has already been separated, and the albumen, with a trace of Lacto Protein, form the only nitrogenous matter available.

Sugar of milk is a very peculiar sugar, differing from most other sugars. Nearly all its properties, both chemical and physical, differ from cane sugar, in not being so sweetening in its properties, and yet it has a pleasant taste, perhaps more agreeable in flavour than most of the glucoses and other uncrystallizable sugars. Sugar of milk itself, however, is crystallizable, but with a different form of crystallization to cane sugar or beet sugar, and its solution in water behaves differently during concentration, a large proportion of the milk sugar present being deposited at a certain stage of the boiling, in an imperfect crystalline form, while the other part remains in solution. The polarization differs considerably from the polarization of any other known sugar. All these different points mark it out as a peculiar sugar. There is a good deal yet to be done in investigating the chemistry of sugar of milk, and it appears very probable that at some future time, further investigation may show that in reality what we look upon as a simple sugar, consists of different substances mixed together in proportions which are at present unknown. Sugar of milk is important in another way, as it forms the great point of difference between human milk and cow's milk.

Human milk contains a larger proportion of sugar than cow's milk, and fat, less caseine, albumen, and ash. It is from this that the formula generally adopted in the manufacture of artificial human milk is obtained; cow's milk is diluted with water, and then milk sugar added; by this means we obtain a liquid which assimilates somewhat closely in chemical composition to true human milk.

MINERAL MATTER.

This term includes a variety of salts which, physiologically considered, are of very great importance in the composition of milk. It is absolutely essential for the formation of bone and muscle that a growing child, or for the matter of that an adult, should be supplied with certain phosphatic substances, lime, salts, etc. Milk contains these ingredients in the right proportions to form the bone and muscle of a child.

We now come to the water, the last and largest constituent.

Water, of course, strictly speaking, has no real dietetic value, and yet without water milk itself would be useless as food, because it is essential that the valuable food ingredients of which we have already been speaking should be dissolved or emulsified, so as to be in a suitable form capable of easy digestion, in fact so that the stomach can easily assimilate them. This water is the bone of contention between public analysts and milkmen, and nothing was more common three or four years ago than to hear a long cross-examination directed solely to the elucidation of the very knotty point—as to whether there was any difference between the water natural to milk, which in fact the cow put into it, and the water which the milkman added.

I should like to consider next, by the aid of a set of samples which have been lent me by the Aylesbury Dairy Company, the mode in which the milk is divided by the dairymen into the different articles of commerce which are most frequently made from it. The samples to some extent speak for themselves, and certainly as regards the first series, that of old milk, I need not detain you any longer except to say that here we have fat, caseine, and sugar, all shown in the same form as in the larger bottles on the table. Our next two series of samples here show us the division of the whole milk into cream and skim milk. Cream, as I took occasion to tell you some time ago, does not consist entirely of butter fat, but contains fifty to sixty-five per cent. more or less according to its quality. And in this series of samples we have the cream divided into the constituents present in a good ordinary commercial sample, and you will see that some thirty per cent. of water is still present, and that this water carries with it caseine, albumen, and salts. We may in fact put it another way, and say that separate any particular constituent of the milk as carefully as possible by mechanical means, and we always find that some small proportion of the other constituents are present, thus, referring to skim milk: in the first separation we find that it still contains some fat; the amount in skim milk is extremely variable, according to the mode of manufacture. The Centrifugal machine, which you can see at work in the south gallery, is by far the most efficient and most successful for separating the cream from the milk.

The principle of the centrifugal separator is practically identical with the principle of skimming, although the two processes appear so dissimilar. The milk revolving in the

separator at great speed acquires immensely increased centrifugal force, which corresponds to the force of gravity. This centrifugal force acts more strongly on the heavy non-fatty portion of the milk and less strongly on the cream, and consequently the non-fatty part of the skim milk gravitates by the centrifugal force to the outside of the revolving circle, leaving the cream to flow away in the inside in an almost pure condition.

A few weeks ago I tried experiments with each of the separators at work in these dairies, and in some cases found the proportion of fat present in the skim milk reduced to even less than ·1 per cent.

These separators at the time produced cream of high quality, and the skim that they produced is more palatable than skim milk obtained by the old process. I have known this statement to raise a smile on the faces of those who thought they knew all about milk and have wondered how it was possible that one skim milk could be more palatable than another, but the reason is not far to seek; mechanical action in the separator thoroughly aerates the skim milk while it is fresh and has lost none of the aroma peculiar to new milk. Milk exposed to the action of air for twelve or eighteen hours in open vessels loses its aroma, and is apt to become contaminated by an impure atmosphere.

Here we have the other constituents of skim milk separated, by which you will see that we have a very small increase in the proportions of sugar, caseine, and salts, due to the proportion of fat that has been removed.

Our next array of samples show us a further sub-division. Here we have the cream divided into its two constituents of butter and butter milk. Still the same rule holds good of the constituents of the original milk passing through, though in diminished proportions, into the finished product. Thus butter always contains milk, sugar, and caseine or curd, and even soluble albumen is not entirely washed away with the butter milk. Still the butter milk, as we see by the central bottle, retains fat—true butter fat, which of course represents so much waste in the process of butter making.

Taking the other side of our case, where the skim milk heads the columns, we have skim milk divided up into cheese and whey. The cheese is represented here by the proportions shown. One of these types is skim milk cheese with its very small proportion of fat. These cheeses are common enough, and are usually consumed in this country, but there are many cases in which the use of whole milk cheese, containing a large proportion of fat, is desirable rather than cheeses containing so little fat.

The proportion of fat contained in these cheeses vary, from skim milk cheeses occasionally to be met with containing as little as three per cent. of fat, up to cream cheeses in which the proportion of fat is largely in excess of the proportion of caseine.

Now every one of these constituents we derive from pure milk is capable of being adulterated. There are one or two of these adulterations to which it is necessary I should refer. The most serious portion of adulteration unquestionably is the admixture of butter with foreign fats, and the substitution of inferior fats for the true butter present in cheese.

We will take the latter first. A large number of cheese consumers desire a cheese containing a considerable proportion of fatty matter. This fatty matter, of course, ought to be the butter natural to milk, but butter is far more valuable than oleomargarine, and therefore extensive manufactories have been established for the production of oleomargarine cheese. This cheese is made of skim milk, skimmed by separators, so that the butter is practically all abstracted, the deficiency of fat being replaced by the addition of oleomargarine or lard, in sufficient quantity to make the cheese a tolerably fat one. I look upon this as an exceedingly flagrant adulteration; the more so because it is one which is hardly likely to be detected by the consumer. There is no difficulty in detecting the fraud by an analytical process. The very worst adulteration in the products is of course the use of oleomargarine to mix with, or as a substitute for, pure butter. I have nothing to say personally against the use of good carefully made oleomargarine as a substitute for butter, if only it is sold under its own name and at a fair price, but I have the greatest objection to its substitution for butter, which is more valuable and a more digestible diet, and unquestionably more suitable for domestic use. Good oleomargarine is nothing but the very best of beef fat carefully refined and carefully churned with milk, and as such no one can dispute its suitability for use as a food; bad oleomargarine, on the other hand, is a compound of vile refuse fats, clarified and refined in any way that will chemically fulfil the object in view; but, to say the least, such a mode of preparing refuse materials for food use is objectionable, and the sale of the inferior sample should be in every way discountenanced.

The only reliable and trustworthy method of ascertaining the quality of milk, is by means of a full chemical analysis. To carry this out the water contained in the milk is evaporated. The whole of the solid matters of which I have shown you specimens are left behind in a state in which they can be weighed, the fat contained in these solid matters is then extracted by means of either petroleum or some other suitable liquid, and the solids not fat, which are left behind, are dried again and weighed; these solids, not fat, form the real standard by which the question of watering is determined, while the fat which has been extracted when weighed forms the real guide as to whether the milk has been skimmed. If either of these two figures were perfectly constant, one problem of milk analysis would be solved, but unfortunately there is a considerable variation in different samples of milk.

To get over this difficulty a low or minimum figure has been adopted as the standard, so as to allow an ample margin for the natural irregularity of composition. Milk dealers are aware of this difficulty in fixing a standard, and are constantly endeavouring to prove that adulterated milk is really pure milk. There is practically no milk adulteration case ever brought into court in which any other defence is raised. The allowance is always said to be insufficient, and the unfortunate milkman has cows worse in quality than those which have been tested by the analysts, and, consequently, he obtains milk poorer in quality and worse in character than any which they have seen. This argument, however, has pretty nearly spent itself; it is only occasionally that there is any magistrate who is found to listen to it.

In conclusion, it will be interesting to notice the extent to which pure milk is sold in London. The returns which are made under the Adulteration Acts specify the per-

centage of adulteration found in each sample, while the tabulated reports issued in the blue books state only the number of adulterated samples, and taking the case of milk do not give the percentage of skimming or watering. This, of course, seriously diminishes the value of the returns. It is, therefore, surprising to find that only on one occasion during the last seven years has the percentage of adulterated samples of milk fallen below 20. Out of every 100 samples of milk purchased by the inspectors 20·35 were adulterated, even on the lenient limit of calculation used.

Now this is a very unsatisfactory state of affairs, and it will surprise no one if I say that I think further legislation is needed to enforce the adoption of a somewhat more rigid standard, and also to increase the efficiency of the supervision at present exercised over the milk supply. A very much larger number of samples should be examined, so that purchasers may procure something like a genuine article instead of an adulterated one.

I am not at all prepared to say that this will not be attended with an increased price in milk; but that I look upon as a matter of trifling moment only, if the steps that are taken are such as to ensure an uniform and genuine article.

ABSTRACT OF A LECTURE ON THE ADULTERATION OF HONEY, BY OTTO HEHNER, F.I.C., AT THE CONFERENCE OF THE BEE-KEEPERS' ASSOCIATIONS.

After fully entering into the chemical composition of honey, all of which is perfectly familiar to our readers, the Lecturer said:—

Thus water, dextroglucose and levoglucose, constitute by far the greater bulk and weight of honey. But the bee carries away from the flower other constituents, less in quantity but by no means in importance, and incorporates them in the honey. Accidentally, perhaps, but none the less invariably, a great number of pollen granules find their way into the comb, and these in their turn carry with it the odour and aroma peculiar to each flower. Minute amounts of colouring matters are dissolved from the pollen and give honeys from different flowers the innumerable shades of yellow, green, and brown with which every bee-keeper is familiar. Thus honey from white clover is practically devoid of colour; that from sainfoin is yellow; from limes, more or less green; from beans, brown; from marshy heaths, almost black. Far greater still is the variety of flavours and odours. Every conceivable aroma, lovely and delicate as that of the flowers themselves—sometimes, I must acknowledge, also repulsive and unpleasant—is met with, and the practised observer can, without much difficulty, conclude from this from what kind of blossom the bulk of any given sample of honey is derived.

More characteristic still is the size and shape of the pollen. Infinite varieties, each characteristic of a particular genus or class of plant, can be seen in honey, and a glance through the microscope is frequently sufficient to ascertain with a great amount of accuracy the name of the plant from which the honey is derived.

From the very variable amount of pollen granules met with in different honeys—some samples which I have examined containing enormous numbers, others but very

few—there appears to be a considerable difference in the degree of cleanliness with which bees store the honey. Some flowers yield an infinitely larger number of pollen granules than others, but the importation of the latter to a greater or less extent into the honey itself appears to me to depend mainly upon the bee itself.

There are three classes of manufactured honey: first, honey made from ordinary sugar, and essentially consisting of cane-sugar syrup; second, that obtained by the action of an acid upon cane sugar, and consisting, as does genuine honey, of water, dextro and levoglucose; and third, the product of the action of acid upon starch, called corn syrup. I have never met with any samples of the first of these three classes, and I doubt whether any such article can now-a-days be found, although in older works on adulteration their occurrence is asserted. The second kind is also very rare, but yet it exists; but the third, starch syrup, is the main substitute and adulterant used at the present time.

The characteristics of these articles compared with those of pure, natural honey, are as follows:—A solution of pure honey in water, when boiled with one of a salt of copper which has been rendered caustic by the addition of potash, deposits a precipitate of red suboxide of copper, 100 parts of honey thus yielding about 137 parts of precipitate. Neither by the addition of alcohol, nor of lead acetate, nor of barium chloride, should a solution of honey be rendered perceptibly turbid. Subjected to fermentation by the addition of yeast, practically the whole of the saccharine material should be decomposed, and transformed into alcohol and carbonic acid. And lastly, a ten-per-cent. solution of pure honey, when examined in an instrument called a polariscope, should have no perceptible action upon polarised light. If anything, it may turn the polarised ray very slightly to the left.

Cane-sugar syrup agrees in its chemical behaviour with real honey, inasmuch as it does not yield precipitates with alcohol, salts of lead, or barium, and is also completely fermentable. It differs essentially from it, inasmuch as it does not give with the alkaline copper of solution alluded to a deposit of red suboxide at all, or only a much smaller proportion than that holding good with honey. Its ten-per-cent. solution turns the polarised ray of light powerfully to the right.

Cane sugar which has, by treatment with an acid—sulphuric or tartaric—been made into dextro and levoglucose, is practically identical with honey sugar, and as such exhibits precisely the same characters as does genuine honey. Its origin, however, betrays itself by the traces of acid which always remain mixed with it, and which cause precipitates either with lead or barium solutions, or with both.

Corn or starch-syrup, lastly, differs in almost every respect from the genuine product. It throws down abundant precipitates with lead or barium solutions, often with alcohol; it does not ferment completely, but leaves about one-fifth or one-sixth of its weight as unfermentable, gummy residue, and examined by the polariscope, turns the ray of light powerfully to the right.

These few simple tests readily enable us to distinguish these products from each other, and from honey. Examined with the microscope they all are found to be devoid

of pollen; and, in consequence, are without the delicate aroma, the bouquet, which is inseparable from the product of the flower and the bee.

By far the most common of these kinds of adulterations is starch sugar, and this for several reasons. The price of starch is lower than that of any other available carbohydrate, and this kind of sugar is, for other and more legitimate purposes, manufactured on a very large scale. Since all restrictions on the preparation of ale or other so-called malt beverages have been done away with, and the tax is levied only on the strength or gravity of the liquor before it is fermented, it is found to be more economical to convert starch of rice or maize into fermentable sugar by means of acid, than by the aid of malt diastase, and the trade in brewing sugar has correspondingly increased. But the main reason is the very close resemblance to genuine honey of syrups made from starch sugar. They do not readily crystallise, and are devoid of the overpowering sweetness of cane sugar. In America, especially, the production of starch sugar has been developed to perfection, and even as substitute and adulterant of cane sugar the article is used to a large extent, although the very low price of cane sugar must militate not a little against adulteration of any kind. As was to be expected, corn syrup is actually most frequently found in honeys imported from America, although Switzerland is striving hard to carry off the "honour" attached to the production of artificial honey.

Of forty-two samples of honey obtained by purchase from retail dealers, partly by myself, partly by Mr. J. M. Hooker, of the Bee-keepers' Association, twenty-six were avowedly English, nine American, four Swiss, two French, and one Transylvanian. Twenty-four of the English samples were undoubtedly genuine, and two (which I have very good reason to believe of American origin, although vended as English) were adulterated with corn syrup. Of the nine American and Californian samples, seven were adulterated —namely, six with corn syrup, and one with inverted cane sugar; whilst of the four Swiss samples not one was genuine. The two French and the Transylvanian samples were pure.

The most satisfactory part of these results is the freedom of English honeys from adulteration. As far as my experience goes, there exists no regular English factory of spurious honey; only where the American element asserts itself corn syrup may be suspected. As to Swiss honey, I have seen it stated, in corroboration of my results, that every exporter—otherwise manufacturer—of Swiss honey adds to the natural product a more or less considerable quantity of starch syrup, the alleged philanthropical object being to obey the desire of the public for clear and uncrystallisable honey, purchasers being credited with the belief that pure and genuine honey is always clear and fluid. In mitigation it is urged, that honey from Switzerland is not sold as "genuine honey," but as "Swiss honey!"

I find that the price is no indication whatever of the genuineness of the article. Some of the "Swiss table honeys" cost, retail, 1s. 3d. per 1lb. jar; English honey of perfect purity is to be met with at 5d. and 6d. per lb.

Of course, perfectly pure and genuine American and Swiss honeys do exist. Bees all over the world appear to secrete similar honey, just as I have ascertained, as the

result of an extended investigation into the nature and composition of wax, that that product is of perfectly uniform composition, no matter by what kind of bees or in what part of the world it may have been produced. But seeing that the chances of obtaining pure honey are much greater in the case of English than in some of the foreign supplies which I have named, I cannot but think that lovers of honey would do well to eschew the foreign product until a decided change for the better has taken place in the commercial morality of the vendors, and be content with that gathered from British fields and pastures.

The adoption of anything but the plain name of honey carries to me, after the experience above detailed, the suspicion that the article designated by a name more or less qualified or fanciful is not genuine. Thus I have acquired, and hope to impart it to you, a suspicion against "honey-dew," "table honey," " prepared for table use," or "finest prepared table honey," because I have found, that just as good wine needs no bush, so good honey needs no fancy name. These names and qualifications do not convey to the purchaser the simple plain fact that the article is adulterated. They may ease the manufacturers' elastic conscience, as disguised declarations that the honeys so designated are not in the same state as they left the hive. But I think they would not for a minute be held to be valid declarations, required by law, of the mixed nature of these compounds.

Chemistry during the last fifty—or shall I say thirty?—years has made enormous strides. It has enabled us to obtain a fairly clear insight into the working of life processes, both vegetable and animal, to understand the composition of organic matters, and to trace their thousand-fold changes in living organisms. It has broken down the barriers which not so long ago were considered insurmountable, dividing the living from the dead creation. It has enabled us to make artificially, from the very elements, substances formerly intimately associated with life-action, and almost every day new organic substances are added to the already long list of those which are the result of laboratory work. But so far only chemical compounds of comparative simplicity have been the result, and in not a single case has any complex product, such as is used for food by man or beast, been obtained. Indeed, with all the enormous amount of research and experiment we only stand on the threshold of real knowledge of organic life; we only see the rough outlines of the composition of living things. We know what the bulk of their components is made of, but in the case of food substances it happens that their value, and above all their price, generally stands in no direct relation to their composition. A cargo of manure, or of some metallic ore, possesses a value which bears a direct relation to the percentage of phosphoric acid or of metal which by analysis can be ascertained to be contained in it. A load of oil cake or other cattle food generally has both a feeding and a money value, directly proportioned to the amount of oil and of albuminous compounds which can be extracted from them. A water supply depends on quality strictly upon its composition. But the case is vastly different in that of most food materials used by man. Composition, as ascertainable by chemical analysis, goes for very little; *quality*, which is dependent upon circumstances beyond the present ken of the chemist, goes for a great deal. Wine, for instance, con-

sists essentially of dilute alcohol, slightly acid, and more or less coloured. But whilst a good bottle of wine may fetch—and be *worth*—say five, or ten, or more shillings, I have yet to taste the first sample of artificially coloured and dilute alcohol, slightly acid, which should be worth even a shilling per bottle. A pound of tea has no more food value than a pound of sloe or withered leaves, but who would pay for the latter, say, three shillings, which the tea is readily worth? And so on with almost every article of food or of luxury. The value is not a question of the composition of the bulk of the article, but is regulated by the presence or absence of exceedingly minute amounts of flavouring matters, of which we know little or nothing at all. The difference between good and bad wine, or tea, or meat, is so small that the most subtle analysis generally fails to detect it. And as in the case of these articles, so it is with honey. We prize honey, not because it consists of some sugar or other and water, but because it possesses a delicate flavour and aroma which is absent from, and cannot by any means at present known be given to, any artificially made syrup. Were the taste of the public educated for honey in anything like the same degree as it is in for tea, wine, or other articles of every-day consumption, no one would venture to palm off artificial syrups for real honey. As well might a butcher offer his customers leather instead of meat, the composition of both being nearly identical.

It is possible that, as far as mere food value is concerned, the substitute is as good as the original article. Sugar, whether taken in the shape of cane sugar, starch sugar, or honey, produces the same proportion of heat and muscular energy. Butterine or oleomargarine, when burnt or digested, produces no less, if not more heat, than does butter. Yet butter holds its own against its substitutes, partly on account of its delicacy of flavour, and its much more ready digestibility. Some experiments recently made with starch sugar syrup point towards the similar difference between it and honey, in favour of the natural product. Bees refuse, as long as they are able, to feed upon corn syrup; when driven by sheer necessity to take it, they soon die of diarrhœa. This fact should make us at least pause in giving a definite opinion as to the relative food values of the two products.

There can be no question that the Sale of Food and Drugs Act, at present in force, is as perfectly capable to operate against spurious honey as it is against other articles which are "not of the substance, nature, and quality demanded." But yet, as far as I am aware, it has never been put into motion against manufacturers of "honey." About 180,000 samples have been analysed by public analysts since the Act is in force, but I have not heard of a single prosecution in the case of spurious honey. It is not the fault of the analysts, who have absolutely nothing to do with the collection and purchase of samples. The growing evil of substituting a manufactured article for the genuine product presses especially heavy against the English producers, because the public seem to prefer honey derived nominally from fragrant Alpine herbs, but practically from potatoes and sulphuric acid, or from some mythical Californian bee-farms, to that collected from English hedgerows and meadows. But this evil is not yet recognised by the general public; the taste for honey is not educated; any syrup is eaten as honey, provided it looks transparent and is contained in a neat bottle and boasts of a fine label. As soon

as there is a demand for really good, delicately flavoured honey, and the Sale of Food Act is put into operation at the initiative of the public, corn syrup will be a thing of the past.

In order to aid in this desirable education of the public taste, I would recommend that whenever practicable, bee-keepers should state on the labels of the honey they sell from what kind of flower the bulk of the product is derived. Clover honey, lime honey, or heather honey, for instance, are quite as distinct in their characters as are Burgundy, Rhenish, or Moselle wines; but yet, while no one would purchase any wine without distinctly stating the specific variety which he desires, all kinds and sorts of honey are sold without any explanatory designation. Of course, from the nature of the article and its collection it is impossible, in many instances, to state its precise derivation, but whenever practicable this should be done. The British Bee-keepers' Association, which either directly or by means of its country branches has done so much to raise and encourage scientific bee-culture, could readily induce its members in this manner to aid in educating the consumers of honey.

NOTES ON MILK ANALYSIS.

By M. Dechan and T. Maben, Analytical Chemists, Hawick.

In undertaking the series of milk analyses, the results of which are appended to this paper, we had two objects in view, viz.: to demonstrate the practical utility of the system of fat extraction which we have for some time past employed in preference to the methods in common use, and also to ascertain whether the limit adopted by the Society of Public Analysts was or was not too high. The experience of the working of the Adulteration Act has proved how difficult it is to obtain convictions, even in very glaring cases, owing to the different results obtained by different analysts, as well as the lack of a uniform standard. It would be absurd to expect the occupants of the judicial bench to be acquainted with all the intricacies of the various *methods* of working, and hence we must not think them unreasonable if they look solely to *results;* accordingly, when these fail to agree, a judge has little difficulty in dismissing a case. It is of the utmost importance, therefore, that a uniform method of analysis should be adopted, no less than a uniform standard. On both of these particulars, the report of the "Milk Committee" of the Society is eagerly awaited, and it is to be hoped it will be the means of settling this vexed question. Pending its appearance, we submit for consideration our method of working and the results we have obtained.

Before proceeding further, however, we may briefly indicate our objections to the methods in more general use. Regarding the Somerset House process as described by Dr. Bell, one of its most objectionable features, in our opinion, is the filtration necessary to remove the fat from the solids not fat, as there is always a difficulty in being certain that the last trace of fat has been removed from the filter. We have also found the method approved by the Society to be unsatisfactory in so far that the residue obtained after evaporation is covered by a thin glossy film, and is thus in the best possible condition to resist complete fat extraction; indeed, it is admitted that perfect separation is not obtained, and we are inclined to believe that this part of the process is to blame for

certain incongruities in the results obtained from the same milk. The limitation of time for drying is also objectionable unless the size and the shape of the vessel be distinctly specified. We have obtained very different results from the same milk on weighing at the end of three hours, by simply substituting a round-bottom for a flat-bottom vessel; with the latter a lighter weighing is invariably obtained.

After a series of test experiments which led us to conclusions similar to those arrived at by Mr. Hehner with regard to the insolubility of milk sugar in ether, we adopted the following process with very satisfactory results.

The total solids are determined separately in a shallow vessel with a flat bottom, the quantity of milk taken being 5 grms. The vessel is large enough to allow the residue to form in a thin film, and there is no difficulty in obtaining weighings which correspond with the weight of the fat and non-fat solids. This, therefore, forms a good check, being for all practical purposes a duplicate analysis.

For the fat, and solids not fat, ten grams are weighed into a capsule capable of holding double that quantity. This is placed on an open water-bath and the milk stirred repeatedly during evaporation. By this means a granular residue is obtained, which, when reduced to powder, is in the best possible condition for the extraction of the fat. This we accomplish with ether by means of one of the many forms of extraction apparatus modelled on the principle of Soxhlet's tube. The fat and solids not fat are determined separately, both being dried till they lose not more than 0·001 gram in an hour.

We have been in the habit of using two extraction tubes, both of which are peculiarly well suited for the purpose in hand. The first is that devised by Messrs. Dunstan and Short, of the Pharmaceutical Society's Laboratory, and figured in the *Pharmaceutical Journal* (vol. xiii, p. 664), and the other, that of Mr. West-Knights, as described by him in the ANALYST (vol. viii, p. 65). On the whole, we prefer Mr. West-Knights' apparatus, which is less complicated than the other, more easily managed, and not so liable to accident. In actual practice, however, we find that rather better results are obtained by tapering the lower end of the tube and inserting a small plug of cotton wool in the neck thus formed. Those who have already used this apparatus for other purposes can readily imagine its great value for the extraction of milk fat, and we now bring it forward with the view of inducing its more extended use in this direction. We find that from one and a-half to two hours is quite sufficient for the perfect separation of the fat, and when ether is used as the solvent there is no risk of any of the solids not fat being dissolved. The advantages claimed for this process over those which consist in maceration and filtration are very considerable. The solvent is kept at the boiling point, which cannot be obtained by any other method, the form of the tube gives the maximum of extracting power with the minimum of loss of ether; the apparatus is simplicity itself, and is so little liable to accident that when once set in working order it needs no further attention till the extraction is complete. Any number of extractions can thus be carried on simultaneously, and this of itself is a very great advantage.

The second object of our experiments was to ascertain for our own guidance, whether the limit adopted by the Society is or is not too high. For this purpose, we selected a small dairy of ten cows, and took samples from each of these morning and evening. These on analysis gave us the results as expressed in the following table, the average of which very nearly corresponds with two analyses made of the mixed milk obtained from the same dairy in the regular course, which are also appended. It is a well-known fact that the first portions of milk drawn from a cow, at any given milking, contain much less fat than the last portions. It is easy to understand why this should be so. The fat naturally floats more or less on the surface of the milk, and it is only when the udder becomes partially emptied that milk rich in fat begins to flow. We had samples drawn to illustrate this fact, and the analyses of these are also given. From the very low figures which are sometimes given as a standard by certain well-known analysts, as well as by the authorities at Somerset House, it is perfectly possible to conceive that samples from only one portion of the milking had in some cases been analysed as representative milks. If, for instance, the sample were obtained at the beginning of the milking, it would be poor in fat, and if at the end, it would be poor in solids not fat. Granted, therefore, that the lowest of a number of fats, irrespective of its complementary non-fat solids, and similarly, that the lowest solids not fat irrespective of its fat, be taken as the limit, we might easily have a standard, which for poverty could never even be approached by a natural milk; but, obviously, this would be altogether unfair.

It is unnecessary to refer further to the tables than to point out that alike in fat and non-fat, the average is far above the limit adopted by the Society. Taking the single cows, we find that in only three cases are the non-fat solids under the limit, but these are more than made up by the fat. On calculating their value by the factors suggested by Mr. Estcourt in the ANALYST (vol. viii, p. 245), they are found to be all above the limit. Cows No. 1 and 5 were said to be poor milkers, but even their milk is higher than what would pass for genuine. In no case is the percentage of fat lower than 2·7, while in mixed milk it is as high as 3·25. It is quite true that the first portion of the milk of No. 10 cow—an exceptionally rich milker—gives as low as 2·05, but it would be utterly wrong, as we have already pointed out, to assume that this represented the true amount of fat in the milk.

In a recent number of the ANALYST (vol. viii, p. 248), Dr. Dupré submitted a table for ascertaining the relative proportions of milk sugar and proteids in the solids not fat, by calculation from the specific gravity. We have compared the results so obtained with the actual analysis, and we find that while in some cases the figures come very near, in others they are somewhat wide of the mark. For example, No. 5 morning milk gives by calculation 5·54 of milk sugar and 2·54 of proteids, whereas the actual analysis gave 4·18 and 3·9 respectively. On calculating the specific gravity from the factors suggested by Dr. Dupré, we get the following result:

Constituents.		Influence on Gravity.
+ Sugar ..	4·18 × 3·7	15·466
+ Proteids	3·9 × 2·55..	9·945
+ Ash	0·72 × 7·5	5·4
— Fat	3·0 × 0·725	2·175
	Calculated specific gravity	1028·636

but in reality the specific gravity was found to be 1030·2.

From this it is evident that the factors are not quite correct, or that the gravity is not so wholly dependent on the principal constituents of the milk as it is supposed to be.

Of course, it must be remembered that Dr. Dupré makes no claim for perfect accuracy for the figures suggested by him. If carefully followed up, this line of inquiry is certain to have valuable results, as it is possible that the composition of the proteids themselves and also of the ash, may yet be ascertained by calculation.

In concluding this paper we would submit for the consideration of the "Milk Committee" the following suggestions:—

1. That the total solids be determined separately; and if time be specified, that the quantity in weight of milk, and the shape and size of the evaporating vessel, be stated.

2. That the solids for fat extraction be obtained in a fine granular condition by repeated stirring during evaparation. Using ten grams of milk the time necessary for this need not exceed 1½, or at the very utmost, 2 hours.

3. That the fat be extracted in some such apparatus as we have recommended; time allowed for extraction to be from 1½ to 2 hours.

4. That all the constituents be weighed, viz.: Total solids, fat, solids not fat, and ash. This gives practically duplicate analyses and forms a valuable check on the accuracy of the results.

5. That the fat and solids not fat, be both considered by the analyst in estimating the genuineness or otherwise of the milk.

6. That in the case of mixed dairy milks the limit should not be lower than that at present adopted by the Society, viz. fat 2·5 per cent., and solids not fat, 9·0 per cent., or their equivalent, as calculated by some such method as suggested by Mr. Estcourt.

7. That in the case of single cows the limit might be lowered to fat 2·5, and solids not fat, 8·5, or their equivalent. The fixing of two limits would of course require it to be stated when the milk is sent for analysis, whether it is from a single cow or from the mixed milk of a dairy.

No.	Cows, stall fed.	Total Solids.	Fat.	Solids not fat.	Ash	Specific Gravity.
	Morning.					
1	Ayrshire	11·8	2·7	9·1	0·7	1030·7
2	Crossbred	12·25	2·75	9·5	0·75	1032·5
3	Do.	12·75	4·4	8·35	0·72	1028·0
4	Do.	12·17	3·17	9·0	0·74	1031·4
5	Ayrshire	11·8	3·0	8·8	0·72	1030·2
6	Do.	12·3	3·0	9·3	0·73	1032·8
7	Shorthorn	13·0	3·2	9·8	0·75	1032·0
8	Do.	13·94	4·3	9·64	0·7	1032·5
9	Ayrshire	12·7	3·5	9·2	0·75	1031·9
10	Shorthorn	14·61	3·99	10·62	0·7	1036·0
	Evening.					
1	Ayrshire	11·66	2·85	8·81	0·71	1030·2
2	Crossbred	12·29	2·89	9·4	0·7	1032·5
3	Do.	12·17	3·07	9·1	0·7	1030·0
4	Do.	13·35	4·15	9·2	0·75	1031·5
5	Ayrshire	11·88	3·0	8·88	0·72	1030·2
6	Do.	12·9	3·7	9·2	0·71	1031·5
7	Shorthorn	12·9	3·4	9·5	0·74	1033·2
8	Do.	14·05	4·35	9·7	0·74	1032·5
9	Ayrshire	12·82	3·7	9·12	0·7	1032·0
10	Shorthorn	14·35	3·9	10·45	0·7	1035·2
	Average ..	12·784	3·451	9·334	0·721	1031·84
	Mixed milks from same dairy	12·7	3·3	9·4	0·715	1032·5
	Do. do.	12·63	3·25	9·38	0·71	1032·5
	First portions of milking, No. 10 Cow	12·5	2·0	10·45	0·7	1036·0
	Last do. do. ..	15·73	6·2	9·53	0·75	1031·0

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

To the Editors of "The Analyst."

Gentlemen,—I am requested by the Committee of the Manchester and Salford Milk Dealers' Society to enclose you printed copies of the proposed New Clauses, that we are most anxious to have inserted in any amendment of the Sale of Food and Drugs Act. We shall be very glad if you will kindly hand them over to your Committee, who is now considering this Act of Parliament.

It will give us much pleasure if you can see your way clear to adopt them and attach them to any improvement you may suggest in the present law.

These clauses have been very carefully prepared, and are the result of practical experience and a perfect knowledge of the wants of the trade, and are quite impartial, making no difference between milk dealers and farmers.

I may also inform you that every portion of these suggestions are more or less practically carried out both in this city and Salford, and nothing could work better or give more satisfaction.

It is absolutely necessary, for the protection of both milk dealers and farmers, that nothing shall be left to chance or favour, and that the duty of every officer under this Act shall be imperative to carry out the law both in the spirit and letter.

We offer you these suggestions with every confidence, honestly believing that if they were made law they would so improve the Sale of Food and Drugs Act as to make it as near perfect as possible, so far as the milk trade is concerned. We shall be happy to forward you any further information, or would send a deputation to meet your Committee, so that we could give you our reasons for each clause.

Waiting your reply, I remain, yours very faithfully,

ROBERT EDGE.

15, Upper Medlock Street, Pigot St., Greenhays, Manchester.
June, 1884.

SPECIAL PROVISION AS TO MILK.

An Act to amend the Sale of Food and Drugs Act, 1875, *and the Sale of Food and Drugs Act Amendment Act*, 1879, *as to Milk.*

This Act may be cited as the Sale of Food and Drugs Act Amendment Milk Act, 188 , and shall be construed as one with the Sale of Food and Drugs Act, 1875, in this Act called the Principal Act, and with the Sale of Food and Drugs Act Amendment Act, 1879.

If at any time any Medical Officer of Health, Inspector of Nuisances, or Inspector of Weights and Measures, or any Inspector of a Market, or any Police Constable under the direction and at the cost of the local authority appointing such officer, inspector, or constable, charged with the execution of the Principal Act, should procure any sample of milk from a milk dealer, and notify to such milk dealer or his agent selling the sample his intention to have the same analysed by the public analyst pursuant to the provisions of the 14th section of the Principal Act, such dealer or his agent may thereupon, or within a reasonable time afterwards, inform the said officer, inspector, or constable that the said sample is an unaltered part of a quantity of milk sold to him in the performance of a then continuing contract, and by a person whose name and address he shall then give to such officer, inspector, or constable, together with the place of delivery, by such person, of the milk to the dealer, such officer, inspector, or constable shall thereupon and as speedily as may be procure a sample of the milk delivered by the consignor to such dealer at the place of delivery, notwithstanding that the place of delivery may not be within the jurisdiction of the local authority appointing such officer, inspector, or constable.

The officer, inspector, or constable procuring such sample shall then and there divide it into three parts, each part to be marked and sealed up, and shall forthwith notify such consignor that he has procured a sample of the milk that day consigned to the dealer for the purpose of having it analysed by the public analyst, and that a part of the said sample may be had by the consignor from the office of the said officer, inspector, or onstable, upon the application for the same being made by such consignor or his agent.

The officer, inspector, or constable shall retain one of the said parts for future comparison, and shall submit the third part to the analyst.

When the analyst, having analysed the two samples of milk shall have given his certificate of the results, from which it shall appear that the two samples are substantially alike, though an offence against some provision of the Principal Act has been committed, yet the milk dealer shall be discharged from prosecution, and shall not be liable to any costs, because he had no reason to believe at the time when he sold the milk that it was otherwise than as demanded of him by the prosecutor, and that he sold it in the state in which he received it from the vendor. The person causing the analysis to be made may take such proceedings against the consignor for the recovery of the penalties imposed for such offence as are authorised by section 3 of the Sale of Food and Drugs Act Amendment Act, 1879.

If the person so proceeded against should dispute the analysis and declare that the said sample was the same in all respects as that which his cows had given, and states that he intends to rely upon this for his defence, and should request such officer, inspector, or constable to visit his farm and see his cows milked, such officer, inspector or constable shall thereupon and as speedily as may be, visit, with one or more persons possessing competent knowledge, skill and experience in the milking of cows, the defendant's farm, notwithstanding that the defendant's farm and cow sheds may not be within the jurisdiction of the local authority appointing such officer, inspector, or constable, and shall take all and every precaution to see that the cows are properly milked, when the analyst, having analysed the two samples shall give his certificate of the result from which it may appear that the two samples are substantially alike, the defendant shall be discharged from prosecution.

LAW REPORTS.

RAID ON HULL MILK-SELLERS.—SKY-BLUE MILK ON SUNDAY MORNINGS.—On Tuesday, Aug. 26, before Mr. Twiss, stipendiary magistrate, a number of milk-sellers were summoned for selling milk adulterated with water, all the samples having been purchased from them on Sunday morning, the 10th inst. The first case was that of Thos. Nicks, milkseller, residing at 3, Adam's Place, Pease Street, who was summoned for selling milk adulterated with 30 per cent. of water. Mr. A. P. Wilson, from the Town Clerk's department of the Hull Corporation, appeared in support of the summons, and evidence in proof was given by Mr. James Thackray, acting-inspector of the Urban Sanitary Authority, who stated that he purchased the milk in question on Sunday morning, 10th inst. When he asked for a pint of new milk, defendant told him that he was selling only old milk. Defendant's wife was present, and the inspector purchased a pint from her, and divided it in the usual way. The Borough Analyst's certificate was to the effect that the milk was new milk, and was adulterated with 30 per cent. of added water. Mr. Wilson said there appeared to be an impression among milk-sellers that by putting water to milk and calling it old milk they would get over the consequences of selling adulterated milk. Defendant said his wife purchased the milk, and he did not know whether it was adulterated or not. Mr. Twiss: Have you anything more to say? Defendant: What is there to pay? Mr. Twiss: The milk was nearly one-third water. It is a very bad case, and I must find you 40s. and costs. Defendant: How much in prison? Mr. Twiss: A distress warrant, or 30 days.——The next case was that of Edward Burrows, milk seller, 19, Kirby Street, Hull. Mr. Thackray purchased a sample from defendant's son, and the certificate of the borough analyst showed 30 per cent. of added water. Defendant was not present, and Mr. Wilson stated that a former summons against him for a similar offence was withdrawn, as he stated that he had purchased the milk from another person. He was, however, informed that in future he must get a certificate from the seller to clear himself. Mrs. Burrows said her husband was from home, and she supported an aged mother by means of the milk from one cow. Mr. Twiss fined defendant 40s. and costs.——Richard Kirby, 33, Lincoln Street, was summoned for having milk adulterated, according to the certificate of the borough analyst, with 19 per cent. of added water. Defendant said he fetched the milk twice a day from Sutton, and obtained it from first-class farmers. Mr. Twiss: Then you should obtain a written guarantee. Mr. Wilson observed that in consequence of a belief that the inspector would not go round on Sunday it was thought that some milk-sellers took the opportunity to water their milk. The authority had made a number of complaints respecting the quality of the milk on Sunday mornings. Mr. Twiss: Then the public appear to suffer on those days. Mr. Wilson: Yes, Sir. Defendant was fined 30s. and costs.——James Baker, a youth, living at 27, Bowes Terrace, Waterloo Street, was summoned for selling milk adulterated with 20 per cent. of added water. Defendant said he bought the milk believing it to be pure. He had been in business for himself four years, and he

had not had a previous complaint against him. Mr. Wilson said he must press this case. Mr. Twiss imposed a penalty of 20s. and costs. ——Alfred Fenton, 6, Green Lane, milk seller, was also summoned for refusing to sell a pint of milk to Acting Inspector Thackray, when required. Mr. Thackray stated that on Sunday morning, the 10th instant, he was in Francis Street, when he saw the defendant selling milk. Witness asked him to sell him a pint for analysis, but defendant, who knew who he was, declined. Witness thereupon followed him to one of his customers' houses, and after defendant had handed in a pint at the door witness obtained it from the servant. Fenton then rushed at him, took the basin from him, and threw the milk on the flags. Fenton now stated, in explanation, that the milk he supplied to the house in question was milk which the inspector had no business with; and, further, that he had no milk to spare that morning. Fined 50s. and costs.

Important Condensed Milk Cases.—At Worship Street the adjourned hearing of the summonses taken out by the sanitary authority of Bethnal Green against six tradesmen of the district for having sold condensed milk, "From which one-third of the cream had been abstracted," was resumed before Mr. Hannay. Mr. Goodrich, barrister, appeared for the parish authorities; Mr. Nasmyth, barrister, for some of the defendants, and Mr. Chapman, solicitor, for others. The cases were before the Court on the 18th of June, when it appeared that the summonses were taken out under the 9th Section of the Adulteration Act, which enacted that no person should sell any article that had undergone alteration without making disclosure of the alteration. The milk in question being, however, sold in tins, it was submitted in some of the cases heard that the sellers, who were retailers for the importers of the articles from Switzerland, could have no knowledge of the purity or impurity of the milk. The analyst's certificate put in showed that the milk was deprived in several cases of a large proportion of the natural cream, and the defendants, it was contended, could have had no knowledge of this alteration. Mr. Hannay, in giving judgment, said he thought the summonses must be dismissed. Purchasers of condensed milk could not, he thought, expect that they were to get an article of equal richness with English new milk. On broad grounds the case must fail, because the character of the article sold was such that the defendants could have no knowledge of any alteration in it. The whole of the summonses were ordered to be dismissed. Mr. Chapman wished it to be known that he had a certificate of Dr. Corfield and other authorities, describing some of the brands of Swiss milk as thoroughly pure and rich.

Alleged Adulteration.—A Grocer Fined.—At the Worship Street Police Court, on Tuesday last, before Mr. Bushby, Mr. H. M. Lewis, tea dealer, of 311, Mare Street, Hackney, appeared to an adjourned summons, for having sold as coffee an article adulterated with chicory "and other roots" to an extent of 10 per cent. The case, when first before the Court, was proved by the sanitary officer of the parish, Lawrence, and the certificate of Dr. Tripe, medical officer of Hackney, showed that the "coffee" purchased by the officer was adulterated as stated. The defendant contested the correctness of the analysis, and elected to have the matter referred to the Government analysts at Somerset House. The certificate of those gentlemen was now read, and bore out the correctness of Dr. Tripe's analysis.—Mr. Bushby thereupon fined the defendant 40s., and further condemned him in the costs of the later analysis, £1 1s.—It will be remembered that a fortnight previous, on the first hearing, the defendant disputed Dr. Tripe's certificate, and said he had sent a sample to Somerset House, but the analyst there refused to certify until the case had formally come before the Court.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Pharmaceutical Journal; The Sanitary Record; The Miller; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; Cowkeeper and Dairyman's Journal; Sugar Cane; Country Brewers' Gazette; The Medical Record; The Grocers' Gazette; London Water Supply, by Crookes, Odling and Tidy; Chemical Review; Independent Oil and Drug Journal and Paint Review; Science Monthly; Journal of the Society of Chemical Industry.

Errata.—Owing to being late for press last month the Editors regret that several printer's errors were overlooked in Mr. W. Blyth's paper on "Old Processes of Food Analysis," especially in the names of the scientists referred to by the Author. These errors are, however, so self evident that all our readers will have by this time corrected them for themselves.

THE ANALYST.

NOVEMBER, 1884.

In Memoriam.

"*In very loving remembrance of* GEORGE WILLIAM WIGNER, F.I.C., F.C.S. (*eldest son of the Rev. J. T. Wigner*), *of Wickham Road, Brockley, S.E., who, just nine months after his loved Wife's decease, and after weeks of severe suffering, peacefully passed away, October* 17, 1884, *aged* 42 *years.*"

SUCH were the words of the card announcing to the public analysts of Great Britain the sad news of the decease of the first President of our Society who has died during the term of office. When an old connection is thus rudely severed and a literary and official union of years is terminated, it is a sad and difficult task to sit down and announce the bare fact without attempting to make our readers familiar with the sincere private relations and many virtues of the departed one as a husband, a father, a chemist, and a friend, but such matters must be suppressed when performing a public duty, and we will, therefore, only speak of the deceased in his official capacity. To the business talents and organising power of George William Wigner the Society of Public Analysts owes its existence, for it was his devoted zeal and personal labour that carried the young babe safely through the perils of infancy and the temptations of adolescence; and when, having safely brought it to years of discretion, he resigned the Secretaryship and accepted the Presidency, all hoped that he would remain with us to see the fruits of his work in bringing together the public analysts in permanent bonds of unity, and of encouraging and fostering through this Journal a new branch of science even now in its infancy. But it very often happens that the cup of happiness is dashed unexpectedly from our lips, and just at the moment when many of the leading spirits of our Society were ventilating among themselves the idea of marking his untiring zeal by offering him the exceptional honour of an additional year of Presidency, he is gone, and we are left to bow to the decision, and to reflect that he is, after all, perhaps, in a happier state than those still remaining amidst the trials and sorrows of life! The funeral took place at Brockley Cemetery on the 22nd inst. where a number of public analysts reverently assisted the relatives in laying their respected friend to rest, surrounded by one of the largest assemblies that we have ever seen at a private interment.

As we took our last lingering look on that solemn occasion, the words of the poet Gray came before our minds, and in shadowing forth our present painful task we felt that we should:—

> "No farther seek his merits to disclose,
> Or draw his frailties from their dread abode.
> Where they alike in trembling hopes repose
> The bosom of his Father and his God."

PROCEEDINGS OF THE SOCIETY OF PUBLIC ANALYSTS.

NOTICE TO MEMBERS.

THE first meeting for the Session 1884-5 will take place at the rooms of the Chemical Society, Burlington House, Piccadilly, on Wednesday, November 19th, at eight o'clock p.m., when papers will be read and discussed. The report of the Milk Committee will probably be presented.

It is earnestly hoped that members possessing any useful notes concerning analytical matters in general or food analysis in particular, will communicate the same to the Society, and will give early notice of their intention to do so to the undersigned.

BERNARD DYER,
OTTO HENHER, } HON. SECS.

(CONCLUSION OF THE PROCEEDINGS OF THE SOCIETY OF PUBLIC ANALYSTS.)

NOTES ON THE ESTIMATION OF LEAD IN ÆRATED WATERS.

BY ALFRED H. ALLEN.

I RECENTLY received from an inspector under the Sale of Food and Drugs Act, a sample of lemonade, which I certified to contain 1¼ grain of lead per gallon. The estimation was made colorimetrically with sulphuretted hydrogen, and the presence of lead was confirmed by chromate of potassium, which gave an immediate turbidity in the unconcentrated sample. In consequence of my certificate, the vendor was summoned before the magistrates at Otley Petty Sessions, when his solicitor produced a certificate from Mr. F. Rimmington, of Bradford, stating that the sample contained ·05 grain of lead per gallon. In consequence of the discrepancy between our certificates, the remaining portion of the sample was referred to Somerset House, whence, in due course, a certificate was received stating that the sample contained $^1/_{55}$ grain of lead in 10 oz., and that this proportion was within the limits of accidental impurity. Calculated on the gallon, the amount of lead found by Somerset House is 0·30 grain per gallon, but, of course, the Bench did not understand this,—and the defence took care not to tell them—while I, the unfortunate analyst, had not even been informed that my certificate was in dispute. The result was that the case was dismissed, together with another in which the facts were similar, but the magistrates decided to reserve the question of costs till they learned whether any explanation was forthcoming. Thus, at length, I have heard of the case, and have had an opportunity of calling attention in writing to the following facts:—

The samples were never divided at all. Three closed bottles of each were purchased, sealed by the inspector, and duly distributed between the vendor, the analyst, and himself. It is evident that the contents of the three bottles should have been mixed (in a jug), and then divided, if so required by the defendant. Seeing that a re-examination of the remaining portions of my samples has proved the substantial accuracy of my certificates, it is clear that there was no accidental mistake or transposition, and, as the estimation of lead in water is too simple a matter for an error of chemistry to occur, I presume that the amounts of lead found by Mr. Rimmington, the Somerset House chemists, and myself, really represented the proportions of metal present in the various

bottles examined by us. If this be the case, it is certainly rather startling to find that bottles of ærated water, from the same manufactory, and of presumably nearly contemporaneous manufacture, should be apt to contain amounts of lead varying so much as the figures of Mr. Rimmington and myself show, but the probable cause of the variation in the amount of lead will be evident to the readers of the ANALYST. If we assume the 0·3 grain of lead per gallon found by the Somerset House chemists in their portion of one of the samples to represent the general extent of the contamination by lead, it is clear that the case was not one to be pooh-poohed or dismissed, for, although 0·3 grain per gallon may be within the limits of accidental impurity, people will generally object to be poisoned, even accidentally.

Another point worthy of notice in the examination of ærated waters for lead is the tendency of the contents of a bottle to become contaminated from contact with the leaden alloy which forms part of the stopper arrangement in a certain description of patent bottle. In a recent instance I found 0·17 grn. of lead in a sample of lemonade analysed a few days after it was received, but after standing some three weeks, with the leaden portion of the stopper immersed, the proportion of lead had increased to 3·36 grains of lead per gallon.

In all cases in which I test for lead in ærated waters I am in the habit of confirming the result by the chromate test. When carefully managed, chromate of potassium will indicate any proportion of lead greater than one-third of a grain per gallon, without it being necessary to concentrate the water. The sample should be placed in a Nessler cylinder and a drop of potassium chromate solution added, in such a manner that the yellow solution gradually sinks through the clear and colourless liquid. The faintest cloud of lead chromate can thus be recognised. Addition of acetic acid seriously mars the delicacy of the test.

In testing ærated waters for lead with sulphuretted hydrogen, the possible presence of tin and copper must not be lost sight of. Copper, if present, may at once be recognised by the ferrocyanide reaction, but traces of tin are not readily identified. The plan I have found best is to precipitate 200 c.c. of the water with sulphuretted hydrogen and dissolve the precipitate in strong hydrochloric acid. When the sulphuretted hydrogen is expelled, the solution is diluted somewhat, and boiled with metallic iron to insure that the tin exists in a stannous condition. The liquid is then decanted from the undissolved iron and tested with mercuric chloride, when any formation of a silky-looking cloud of mercurous chloride will be readily recognised.

Although not closely connected with the detection of metals in ærated drinks, I may take this opportunity of calling attention to the fact that the ordinary test for zinc, with an alkaline sulphide, is far from delicate. A much more satisfactory test is one which I described many years ago in the *Chemical News*, Vol. XXIII., page 290, but it has never found its way into the text books. The solution to be tested for zinc is rendered ammoniacal, heated to boiling, and potassium ferrocyanide added, when a white precipitate will be produced if the merest trace of zinc be present.

MONTHLY RECORD OF ANALYTICAL RESEARCHES INTO FOOD.

At the meeting of the American Association for the advancement of Science, Prof. A. R. Leeds reported that he found the composition of human milk, on using every precaution, to be; albuminoids varying from ·5 to 4·25 per cent., lactose from 4·1 to 7·8 per cent., and fat from 1·7 to 7·6 per cent. The appearance and specific gravity of human milk, according to the same authority, never give any real index of its composition.

At the same meeting Professor Atwater read a paper on the chemistry of fish. Flounder is the least nutritive of fishes; while the salmon, when fat, is the most nutritive. Oysters have least nutritive matter among the invertebrates; and northern oysters are more nutritive than those from the south. The flesh of fish contains less fat and more water than that of vertebrates. Digestive ferments act upon the flesh of fish in the same way as upon that of the vertebrates, about ninety-eight per cent of the albuminoids being digested in both cases. As ordinarily found, fish gives from five to twenty per cent. of edible matter.

In the last *Zeitschrift für Analytische Chemie*, J. Uffelman makes an advance upon Fuch's idea as to the presence of nitrates in milk, proving the addition of impure water, and he has further amplified the matter so as to take into consideration the presence of ammonia and nitrous acid. He adds diluted acetic acid to 350 c.c. of milk until the caseine is entirely thrown down; 100 c.c. of the filtrate are then mixed with three drops of hydrochloric acid, boiled up, allowed to cool, and filtered. Of this new filtrate 50 c.c. are rendered faintly alkaline with pure potassium hydrate, filtered, distilled, and the distillate is tested with Nessler's reagent. To the remaining 50 c.c. are added sodium hydrate and carbonate, the mixture is filtered, and tested with Nessler's reagent. The residue of the liquid filtered from the acetic acid precipitate is boiled and filtered. 30 c.c are tested with meta-phenylen-diamine, and another 30 c.c. with zinc-iodide-starch paste for nitrous acid. The remainder is utilised for detecting nitrates by means of diphenylamine. A little crystalline diphenylamine is dissolved in a white capsule in about 1·5 c. c. of pure sulphuric acid (full strength) and three to four drops of the milk filtrate are added. In presence of much nitric acid there is formed almost immediately a blue zone, which quickly extends. If there is little nitric acid the colour appears only after some time. If the blue colour does not appear, the experiment is successively repeated with portions of the milk-filtrate, concentrated respectively to one-third, one-seventh, and one-tenth of the original volume. Neither ammonia, nitric nor nitrous acid, is present in normal milk, but all three may be introduced by sophistication with impure well-water.

In the same volume M. Vitali points out that when fusel oil (amylic alcohol) has been separated from spirit by Betelli's method of shaking up with chloroform, its presence in the residue may be proved as follows:—If the residue suspected to be amylic alcohol

be poured upon sulphuric acid, and then cautiously stirred with a glass rod, a play of colours is produced, commencing with dirty red and passing through violet to azure blue, and lastly to green. The addition of a few drops of ether makes the colours more brilliant.

The following is a description of a water bath designed to keep the water at a constant level by Dr. E. Mascarenas y Hernandes, in *La Nature* :—

The reservoir for water is a bottle tightly stoppered and through the stopper of which two glass tubes pass bent twice at right angles, one terminating just below the stopper, and having its outer limb ending at the exact level at which the water in the bath is to be kept, while the other tube extends to the bottom of the reservoir with one limb, and with the other to some distance down the neck of the water-bath. As soon as the siphon has been started, the water will flow from the reservoir until the end of the shorter tube becomes closed by the water, when the flow will cease, to begin afresh as soon as the level sinks.

In April last an attempt was made by H. Rabourdin, to estimate the amount of adulteration in commercial peppers, by olive stones and husks, and other similar hard bodies. It was published in the French *Journal de Pharmacie*, and has been hitherto passed over without much notice, but we have found it very useful as an aid in the microscopic examination of pepper, and to a certain extent fairly quantitative for other hard adulterants besides those named. It is as follows :—

A gramme of the sample is boiled continuously for an hour in 100 grammes distilled water and 4 grammes sulphuric acid, adding more water from time to time to make up for the loss by evaporation. The flask must be supported by the neck or it will be fractured by bumping. After boiling for an hour the liquid is allowed to cool, and poured upon a plain double filter which has been previously well dried and tared. When the pepper contains olive-kernels they fall to the bottom of the flask, and when the liquid is poured upon the filter they are found upon the sides of the flask in reddish fragments, more or less plentiful. This character already is decisive, since pure pepper never gives these dense, reddish fragments. The flask is repeatedly rinsed out, and the filter with the residue is perfectly washed with boiling distilled water. It is then dried and weighed very carefully. The weight of this total residue forms the *coefficient* of the pepper. This value is variable for every kind of pepper, but for all pure kinds within very narrow limits, and is strikingly increased when the pepper is adulterated with kernels or shells. The average value for pure peppers of commerce, 0·35. On the other hand, that of the olive-kernels is on the average 0·745, and that of the husks or shells 0·70.

The Determination of the Albuminoids in Human Milk. E. Pfeiffer.

(Communicated by the Author to the Zeitschrift f. Physiol. Chemie, 8.259.)

The author's researches deal, firstly, with the precipitation of caseine by acids; and, secondly, with the determination of the total albuminoids, according to the methods hitherto proposed.

As regards the first point, the author shows that in the precipitation of caseine, according to his method (viz., that of digestion for 10-15 minutes at 50-55°R. with dilute hydrochloric acid), other acids, diluted to the requisite strength, may be substituted for the hydrochloric acid. Thus, lactic acid (1 c. c. pure acid of sp. g. 1,0065 to 40 c. c. H_2O), acetic acid (2 c. c. concentrated acid to 100 c. c. H_2O), and sulphuric acid (2 c. c. conc. acid to 100 c. c. H_2O) produce, when added in drops, a pronounced coagulation. Dilute phosphoric and nitric acids do not give such good results. With the right strength of acid the coagulation takes place at a temperature as low as 30-40°R., which proves that a high temperature is not essential to, but only hastens the coagulation. The precipitation is best when the acidulated milk is placed in water at a temperature of 25-30°R., and then slowly warmed to 45°R.

The author then proceeds to compare (as regards the results obtained) his "hydrochloric acid method" (Zeitsch für Anal. Chem. 22, 14) for the determination of the total albuminoids, with the method in which they are precipitated by tannin, and the one in which an equal volume of alcohol is used.

Following the directions given by Biedert for the tannin method, the author used a 10 per cent. aqueous solution of tannin, of which 2-4 c. c. were found necessary for 10 grms. of milk. Sufficient tannic acid having been used, the precipitate, containing the total albuminoids and fats, was easily filtered and washed without loss. It appears, however, that its weight, after the removal of the fats, cannot be used for the calculation of the total albuminoids, as it contains variable quantities of tannic acid. Besides this, the filter paper is liable to become very weak, especially when much tannin is used, and, on drying, to fall to pieces.

The author finds more serviceable the method depending upon the precipitation of the albuminoids by alcohol, more especially because it allows of an approximately separate determination of the caseine and of the albumen. The greater part of the albuminoids, which the author regards as essentially caseine, is precipitated by adding an equal volume of cold absolute alcohol. Care must be taken not to add it in too large a quantity, as the precipitate is not thereby rendered more complete, whereas, on the other hand, a larger quantity of butter-fat is dissolved, which necessitates afterwards a separate fat determination in the filtrate. For the same reason, the author recommends washing the precipitate with an alcoholic solution, containing equal volumes of absolute alcohol and water, the washings, however, should not exceed the volume of milk taken. The filtrate, together with the washings, is, after the addition of a little water, evaporated until no more alcohol remains; it is then boiled, and the precipitate, thus produced,

collected upon the filter, dried, and weighed. In one part of the filtrate, the sugar may be estimated by any of the ordinary methods, while the "albuminous residue" can be determined by precipitation with tannin.

Analyses of the same milk, carried on simultaneously, on the one hand by the alcohol, and on the other by hydrochloric acid method, did not, however, completely agree. The results are mostly higher for both the caseine and the albumen, with the hydrochloric acid method, *i.e.*, the sum of the caseine and the albumen is generally greater than in the alcohol method, so that a less quantity of the "albuminous residue" remains to be precipitated by tannin. For this reason the author prefers his method.

The author adds to his former communications, the observation that he has found the temperature 50-55°R. the best for the coagulation of the caseine.

F. H. H.

Bonn, 21st October, 1884.

Dr. Henry Leffmann has published a series of analyses of butter, which we summarise from his article in the *Chemical News*, chiefly because they are performed by a process not usually employed by British analysts. Dr. Leffmann uses the method of Koettstorfer in preference to any other, viz., ascertaining the quantity of real potassium hydrate required to saponify the fat, and he also takes advantage of the odour of butyric ether given off during limited saponification with alcoholic soda, to prove the existence of butter at all. His results are expressed in terms of the amount of standard acid to which one gramme of the fat is equivalent in action on alkali. Divesting his table of unimportant particulars, we have the facts that:—

Genuine butters took from 5·5 to 6·3 acid, and gave a powerful ethereal odour.
Doubtful ,, ,, ,, 5·0 to 5·1 ,, ,, feeble ,, ,,
"Bogus" ,, ,, ,, 4·3 to 4·9 ,, ,, no ,, ,,

Although there is nothing very novel in the above information, still we put it on record, as every fact tending to throw any light on food analysis, should be recorded in our columns.

MONTHLY RECORD OF ANALYTICAL RESEARCHES INTO DRUGS.

At the last meeting of the American Pharmaceutical Association, Professor Frederick B. Power gave a very interesting paper upon Hydrastine, the active principle of *Hydrastis canadensis*, of the analytical and descriptive portion of which the following is an abstract:—

The crystals of hydrastine, which apparently belong to the ortho-rhombic system, are anhydrous, and when pure, perfectly colourless and very brilliant. They fuse at 132° C. (Mahla states 135° C.) to a light amber-coloured liquid. When heated on platinum foil they decompose with the evolution of empyreumatic inflammable vapours, reminding, as Mahla had previously observed, somewhat of carbolic acid, and leaving a large amount of ash, which burns slowly away at a red heat.

Hydrastine is insoluble in water and in petroleum benzin, these liquids leaving, after prolonged contact with the alkaloid, no perceptible residue upon evaporation, and the aqueous liquid is not affected by potassio-mercuric iodide; it is soluble, however, in dilute acids and in chloroform (in 1·75 parts), benzol (15·70 parts), ether (83·46 p.), and alcohol (120·27 p.), and, of course, much more freely soluble in these liquids when hot.

Its specific rotary power is (a) D = — 170°.

The crystals of hydrastine are affected in the following manner by re-agents:—

Concentrated sulphuric acid produces a yellow colour, which, in contact with a crystal of potassium bi-chromate, becomes brown. Concentrated sulphuric acid, on warming, produces a bright-red colour. Concentrated nitric acid produces, in the cold, a yellow colour, changing to reddish-yellow. Concentrated hydrochloric acid gives no colouration, either in the cold or upon warming. Concentrated sulphuric acid and ammonium molybdate gives an olive-green colour, which appears to be its most characteristic test.

The solution of the hydrochlorate is affected as follows by re-agents:—

Ammonia water and the fixed alkalies give a white curdy precipitate, sparingly soluble in excess; potassium, iodide, potassio-mercuric iodide, potassium ferrocyanide, potassium sulpho-cyanide, mercuric chloride, and tannic acid produce white precipitates; iodine in potassium iodide, a light-brown precipitate; potassium bichromate, a yellow precipitate; picric acid, a bright yellow precipitate; platinic chloride, an orange-yellow precipitate; auric chloride, a deep yellowish-red precipitate.

At the same meeting, Mr. W. Bartlett contrasted and criticised the methods for the estimation of Morphia in Opium, official, in Great Britain, Germany, and America, much to the advantage of the last-named. This process, as some of our readers may not be aware, consists essentially in rubbing seven grammes of opium with three grammes of slaked lime and 20 c.c. of water, until uniformly mixed, then adding 50 c.c. more water, and stirring occasionally for half an hour, and then filtering off 50 c.c. into a stoppered bottle (= 5 grms. opium). This liquid is then mixed with 5 c.c. alcohol and 25 c.c. ether and shaken, and three grammes of powdered ammonium cloride having been added, the whole is again shaken and set aside for 12 hours. The ethereal layer is decanted upon a pair of counterbalanced filters, which are then rinsed with 15 c.c. of ether, and finally the crystals of morphine are collected upon the filters, air dried, washed with 10 c.c. of water, and dried between 55° and 60° C. Mr. Bartlett's experience of the practical working is as follows:—

In using the U. S. P. process, I found that certain details which could not be properly put into the Pharmacopœia, were quite useful in carrying out its requirements. Thus, the freshly-slaked lime should be in the powdered form. This can be done by using lime, three parts, and water one part. The quantity of slaked lime directed to be used is intended to be in excess, so that if a little more is used there will be no harm

done. Hence, it can be weighed in a larger balance, if it is more convenient to do so. Then the ammonium chloride is also in excess, and can also be weighed on a large balance, care being taken, however, to have at least the *full* quantity. The commercial ammonium chloride, in the form of crystal, was carefully powdered in a mortar each time, as the powdered ammonium chloride of the market should not be relied on for purity. Then the filter should be wet with ether before decanting the ethereal layer upon it, for it is the ether that we wish to pass through first, and thus hasten the process. A fine glass rod was used to decant upon the filter. In decanting the ethereal layer, there is no absolute necessity for being particular to decant only the ethereal layer, for at least one-half of the other liquid will be carried along with it in any event. I found it convenient in washing the crystals with ether, to do so with a two c.c. pipette. After the crystals have been washed with ether, they need to be dried in the air only long enough to get rid of the ether, perhaps an hour. This is necessary, in order that the rest of the liquid, when added, will filter readily.

I have spoken of these points rather more in detail than I otherwise should, for the benefit of those who may have met with these difficulties, and have not clearly seen their way out of them.

The results of the three samples assayed by the U. S. P. process are as follows:

No. 1, 12.50 per cent. of morphine.
,, 2, 12·48 ,, ,, ,, ,,
,, 3, 13·40 ,, ,, ,, ,,

The crystals were quite well defined, and quite light coloured. Sample of opium No. 1 was quite dark coloured; samples Nos. 2 and 3 were quite light coloured; which shows that the colour of the opium is no guide to its morphine strength; and, indeed, I have found that the physical appearances of powdered opium, as a rule, give no clue to its morphine value.

The result of the same three samples assayed by the process of the German Pharmacopœia are as follows:

No. 1, 8.50 per cent. of morphine.
,, 2, 10·50 ,, ,, ,, ,,
,, 3, 9·25 ,, ,, ,, ,,

The crystals were quite light coloured, and somewhat larger than those produced by the U. S. P. process. This process is somewhat tedious, the liquids all being required to be weighed. The crystals of morphine were dried at between 70° C. and 80° C. till they ceased to lose weight, rather than at 100° C., in order to make sure that none of the morphine be lost. This process claims ten per cent. of morphine.

The results of the same three samples assayed by the process of the British Pharmacopœia are as follows:

No. 1, 5·12 per cent. of morphine.
,, 2, 8·25 ,, ,, ,, ,,
,, 3, 3·42 ,, ,, ,, ,,

Doubtless the new revision of the British Pharmacopœia will supply a much better method of assay. The present one claims from 6 per cent. to 8 per cent. of morphine. The morphine obtained in each case was shaken with one hundred parts of lime-water, and in no case was it completely dissolved, but in each case very nearly so, and all to the same extent. The morphine of the U. S. P. and German Pharmacopœia was quite light in colour, the U. S. P. being quite as light as the German, and the British was quite dark. It will be seen that the U. S. P. process calls for at least 12 per cent. of morphine, that the German calls for 10 per cent. morphine, and that the British calls for at least 6 per cent. of morphine, and that by actual experiment the U. S. P. process gave the largest yield, the German a much smaller yield, and the British the least of all. That the morphine in each case dissolved to the same extent in lime-water, and that the morphine obtained by the U. S. P. process was much lighter coloured than the British, and quite as light-coloured as the German, and gave a far larger yield than either of the other processes. The only inference that can be drawn from these results is that the present U. S. P. process is by far the most definite as to detail, yields by far the most morphine, and hence exhausts the opium more thoroughly than any of the other processes.

MONTHLY RECORD OF GENERAL RESEARCHES IN ANALYTICAL CHEMISTRY.

THE past few weeks have been very productive of research-work in Analytical Chemistry; in German laboratories several new methods and interesting separations have been worked out; and of these Fresenius' laboratory at Wiesbaden takes, of course, the lead. Among other researches which have lately been brought to completion in this laboratory is a new method for the determination of arsenic.

THE DETERMINATION OF ARSENIC*—BY CARL HOLTHOF.

Difficulties have always attended the estimation of Arsenic, due partly to the volatility of arsenious chloride, in the presence of concentrated hydrochloric acid, and partly to the imperfect precipitation, by sulphuretted hydrogen, of solutions containing arsenic. Again, the only safe method for the separation of arsenic from antimony, is the one proposed by R. Bunsen,† in which the antimony is removed as pentasulphide in the presence of concentrated hydrochloric acid. According to the directions given by him, the arsenic, after the excess of sulphuretted hydrogen has been expelled by a current of air and the solution heated with chlorine water, is precipitated as As_2S_5. This does not give as good results for the arsenic as might be wished, and the author, therefore, proposes to determine it in the strongly acid solution, which remains after the precipitation of the antimony, by a volumetric method, which was suggested by Mohr, but has never been worked out by him. It consists, essentially, in reducing the arsenic acid, either before or after removing the hydrochloric acid, and then titrating with a standard

*Zeitschrift für Anal. Chemie., 23, 378.
†Liebig's Annalen A., Chemie. 192, 305.

iodine solution. The author assumes that the reduction is complete when sulphurous acid is used (this has been proved by Wöhler Ann. A. Chem. u. Pharm. 30, 224). A large quantity of the sulphurous acid is used, the excess of which is removed by a current of air, or by evaporating to ½; a platinum-spiral being placed in the solution to facilitate the escape of the gas. According to the author's observations, if the hydrochloric acid be neutralized before the reduction, the results obtained are rather high, due to the large quantity of alkaline chlorides which are thus produced. The best results are got by evaporating off the acid, and then reducing. This course is further warranted by the following facts: firstly, that arsenic chloride is not reduced, in the presence of chlorine, by boiling hydrochloric acid; and, secondly, that hydrochloric acid of Sp. G. 1·10, containing arsenic, distils, after the addition of potassium chlorate, free from arsenic. To test the method, the following experiment, among others, was made: 50 c.c. containing 0·1814 As_2O_3 were taken and evaporated, with 200 c.c. chlorine-water and 1 grm. $KClO_3$, to dryness. The residue was dissolved in 200 c.c. of sulphurous acid, and as much distilled water; the solution was heated for half an hour to near boiling, and then evaporated to ⅔, another 200 c.c. of SO_2 solution were added, and the whole was finally boiled, with the platinum-spiral to ½. On titrating, 38·9 c.c. iodine solution were required, this was equivalent to 0.1323 grm As_2O_3, whereas the theoretical amount was 0.1330; a result which leaves little to be desired. Further researches of the author show that it is not necessary that the solution should be boiled, or even kept long near boiling, to insure a complete reduction with sulphurous acid.

THE DETERMINATION OF MOLYBDENUM.—BY OTTO FREIHERR VON DER PFORDTEN.*

The author has been investigating the different gravimetric methods for the determination of molybdenum, and has improved upon the volumetric method, which consists in titrating with potassium permanganate.

The following is a short *résumé* of his researches.

I. *Gravimetric Methods.*

The author made use of the ordinary ammonium molybdate, $3(NH_4)_2O,7MoO_3 + 4H_2O$, in his experiments.

(*a*) By reduction of molybdic acid to the metallic state.

C. Rounnelsberg recommended heating molybdic acid in a platinum tube, through which a current of hydrogen was being passed, to reduce to the metallic state (Pogg. Annal., 127, 281); while Debray proposed to reduce first to a lower oxide in a platinum crucible, and then to complete the operation in the platinum tube. The author has simplified the method by doing away altogether with the platinum tube; his researches show that it is possible to complete the reduction in a current of hydrogen, using simply a platinum crucible. The latter is fitted with a perforated platinum cover (porcelain may be used), through which the hydrogen enters by means of a suitable tube. The heat is supplied by the blowpipe flame. The analysis of ammonium molybdate is conducted in

* Zeitschrift für Anal. Chemie., 23, 413.

the following way:—The crucible is first kept at a temperature of 170° C. for several hours in the air-bath; this prevents spitting during the ignition. It is then gently heated in a slow current of hydrogen, the heat being allowed to rise slowly. The reduction is completed by a strong ignition with the blow pipe, about half an hour being required for 0·2 grm. of metallic molybdenum. Care must be taken, after the operation, to well clean the crucible by ignition and successive treatments with nitric acid and ammonia. This method is applicable to neutral solutions containing molybdic acid, if they are first precipitated by mercurous nitrate according to Rose's method.

(*b*) By reduction of molybdenum trisulphide to disulphide.

This is suited for the analysis of acid solutions containing molybdic acid. It was first described by T. Paul Liechti and B. Kempe. The acid solution is made alkaline with ammonia, ammonium sulphide is added, and it is then allowed to stand for 12 hours. The molybdenum forms a molybdic trisulphide, which is soluble in excess of ammonium sulphide to a deep brown liquid. The solution thus obtained is decomposed by adding sulphuric acid in excess; and the precipitate of molybdic trisulphide and sulphur is collected upon a weighed filter, washed with sulphuretted hydrogen water, and dried at 100–105° C. till the weight remains constant. A weighed part of the dried precipitate is then converted by ignition, in an atmosphere of hydrogen, to molybdic disulphide; and from this the molybdenum is calculated. The author obtained good results with this method, but recommends heating with a simple Bunsen burner, as a too powerful ignition with the blow pipe causes a partial reduction to the metallic state.

II. *The Volumetric Method.*

The author reduces the molybdic acid completely in hydrochloric acid solution, and then titrates with potassium permanganate, without excluding the air. The suboxide, first formed, is subsequently transformed into sesquioxide. The analysis is conducted thus:—To the solution of the salt, containing about 0·3 grm. MoO_3, is added 50–60 c.c. of a 27 per cent. solution of hydrochloric acid, together with 8–10 grms. of zinc, in which the amount of iron has been previously determined by titration. As soon as the solution assumes a yellow colour the vessel is cooled, before all the zinc has been used; and its contents are washed into a porcelain dish, containing 40 c.c. of a dilute sulphurous acid solution and 20 c.c. of a solution of manganous sulphate. An equal quantity of water (about a litre) is now added, and a considerable amount of standard permanganate solution run in, the liquid being, meanwhile, well stirred. The titration is complete when the solution becomes faintly pink. Allowance must be made for the iron contained in the zinc, and the permangate required to colour the mass of liquid. The results are accurate. The mean of 14 analyses was 81·52 per cent., MoO_3 (the maximum being 81·78 per cent., the minimum 81·28 per cent.) while the calculated quantity was 81·55 per cent.

The Determination of Phosphoric Acid.

Otto Freiherr von der Pfordten, the author, by ingeniously combining the volumetric estimation of Molybdenum (as described above), with the precipitation of phosphoric acid by ammonium molybdate, has produced a useful titration method for the determination of phosphoric acid.

The phosphoric acid is first precipitated by ammonium molybdate, in the usual manner. (Note.—The ammonium molybdate solution must be clear, and filtered from any deposit before use). To cause the precipitate to separate out better, the beaker containing the solution should be warmed in the water bath; the precipitate is thus freed from molybdic acid. The ammonium phospho-molybdate thus obtained, is washed with the filter pump, by a nearly saturated solution of pure ammonium sulphate, till a drop, on the addition of ammonium sulphide and weak acid, gives no dark colour. The precipitate on the filter is then dissolved in a small quantity of ammonia, and diluted to a known volume, of which a measured portion, containing at the most 0·3 grains, but not more than 30 c.c. is used for the reduction. This takes place as described above. It is advisable to make several titrations, and to take the mean of these. From the permanganate required for the oxidation, first the molybdenum is calculated, and from this the amount of phosphoric acid is deduced.

A Ferric phosphate contained, according to gravimetric methods, 35·99 per cent. P_2O_5; the volumetric method gave from 35·85 to 35·97.

A Guano-phosphate gave

Gravimetrically - - -	21·79 per cent. P_2O_5
Volumetrically - - -	21·88

The method is always applicable when the phosphoric acid can be separated by ammonium molybdate. The author recommends it especially for cases where the presence of other bodies (Fe, Al, &c.) has hitherto prevented the use of a titration method.

THE DETERMINATION OF PHOSPHORIC ACID IN SOILS.—P. DE GASPARIN.

P. de Gasparin gives in the Comptes Rendus (96, 314) the following method for the estimation of phosphoric acid in soils:—20 grms. of the finely powdered and sifted earth are treated in a porcelain dish, with sulphuric acid (1 : 5) as long as any effervescence takes place; 80 c.c. of aqua regia ($1HNO_3 : 3HCl$) are then added, and the mixture heated on the water bath, till the liquid becomes syrupy, diluted with cold distilled water, and washed on to the filter with hot water. The filtrate is precipitated with ammonia, collected on the filter and dried. The dry precipitate is heated in a platinum crucible to redness, digested with cold dilute nitric acid (1 : 40) and filtered. The filtrate contains, according to the author, all the phosphoric acid. It is concentrated on the water bath, precipitated with molybdic acid, and the phosphoric acid finally determined in the ordinary way as magnesium pyrophosphate.

THE DETERMINATION OF THE TECHNICAL WORTH OF CALCIUM TARTRATE.—WEIGERT.†

The principle of this method depends upon the fact, that calcium tartrate is decomposed by boiling potassium carbonate (1 to 2 hours on the water bath) into neutral potassium tartrate and calcium carbonate. The filtered solution is evaporated; enough concentrated acetic acid is added to the warm liquid, to form wine-stone (bitartrate of

† Zeitschrift für Anal. Chem. 23, 358.

potash), and the whole allowed to stand for some hours. It is then treated with alcohol (90 per cent.), filtered, washed with alcohol, and finally titrated. The correctness of the results depends upon the following precautions:—(1) The potassium carbonate must be added only in slight excess; (2) Acetic acid must be added only in a corresponding excess; (3) The washing must be carried on sufficiently long; (4) The mixture of potassium carbonate and neutral calcium tartrate, to which the acetic acid has been added, must still contain water on the addition of alcohol. For titration a potash solution is used, which serves for estimating the acidity of wines. Its strength is such that 1 c.c. will neutralise 0·01 grm. tartaric acid or ·02508 bitartrate (wine-stone).

The following correction is given by the author for the bitartrate remaining in solution for every five grms. of calcium tartrate, 0·33 per cent. bitartrate of potash is to be added to the quantity which has been found by titration.

F. H. H.

Bonn, 21st Oct., 1884.

In the *British Medical Journal* for 11th October, are found the following:—

REMARKS ON TESTS FOR ALBUMEN IN THE URINE, NEW AND OLD.

BY GEORGE JOHNSON, M.D., F.R.S.

In a paper on the above subject in the recently published *Manchester Medical Chronicle*, Dr. William Roberts, referring to the fact that the urine in health contains various forms of albuminoid matter, expresses his belief that the new tests for albumen which have recently been brought into prominence, especially picric acid, tungstate of soda, potassio-mercuric iodide, and the acidulated brine-test, "produce frequently in the urines of perfectly healthy persons, a reaction which is undistinguishable from the reaction which indicates disease or abnormality." This point was put to the proof by the examination of the urine of thirty-one healthy persons—students, candidates for insurance, and others, who exhibited no signs of disordered health, and in whose urine heat and nitric acid gave no indication of albumen.

Dr. Roberts, of course, needs not to be reminded that albumen, in greater or less abundance, and for long periods of time, may be unquestionably present in the urine of persons who exhibit no signs of disordered health. If this were not so, albuminuria would not be so frequently unsuspected and overlooked as it is.

Dr. Roberts proceeds to state that "the acidulated brine-test gave a reaction in eleven cases, picric acid in fourteen, the tungstate test in twenty-eight, and the mercuric iodide in twenty-nine cases."

Deferring for the present what I have to say of picric acid, I should have expected, from observations which I have quite recently made, that the other three tests would give a slight but appreciable reaction in every specimen of normal urine. It is a fact that all normal urine contains a small but variable proportion of mucus.

Now, mucin is precipitated by dilute acetic acid and mineral acids. (See the article "Mucus," in Watts's Dictionary of Chemisty, vol. iii., p. 1059-60.) It is also precipitated, as Dr. Oliver has shown ('Bedside Urinary Testing,' p. 37), by citric acid. The addition of a small quantity of acetic or citric acid to normal urine gradually renders it

slightly but decidedly turbid, by coagulating the mucin; and Dr. Roberts mentions the fact that, when nitric acid is added to albuminous urine, "the albumen is thrown down just above the line of junction of the two liquids, while the mucin is brought into view towards the upper part of the column of urine, where it gradually forms a diffused haze quite distinct from the opalescent haze at the line of junction."

To this I may add that, when nitric acid is placed at the bottom of a column of normal urine, a diffused haze of coagulated mucin may commonly, after a time, be seen near the upper part of the column.

Seeing then that mucin is precipitated by both mineral and vegetable acids, we are at no loss to understand that any test containing one or other of these agents should give a reaction with normal urine. The acidulated brine contains hydrochloric acid, the tungstate of soda and potassio-mercuric iodide require the addition of either citric or acetic acid before they act as albumen-precipitants; and they one and all, by the reaction with mucin, slowly cause, in most, if not all, normal urines, a cloudiness more decided than that which results from the action of the acids alone. With picric acid, however, the case is entirely different. In the form of a saturated aqueous solution, and uncombined with any other agent, it is a most delicate albumen-precipitant, but it gives no precipitate in normal urine unless an acid, such as citric or acetic acid, be added to it. This can readily be proved by the following experiment. Take about a drachm of freshly passed normal urine, and add an equal bulk of picric acid solution. The yellow mixture will remain quite clear, unless, as sometimes though rarely happens, some turbidity results from a deposit of urates, which would be at once removed by heat. Now add a few drops of dilute acetic or citric acid, and the mixture will, in a minute or two, become hazy from precipitated mucin, the haziness occurring much more slowly than the immediate opalescence, which results from the presence of a slight trace of albumen, but, like that, being unchanged by heat.

Another experiment consists in adding acetic or citric acid to normal urine, then, after waiting a minute or two to complete the coagulation of the mucin, passing the urine through a filter and adding picric acid to the filtrate; when the mixture will remain quite free from turbidity. I have tested many hundred specimens of normal urine with picric acid, and I confidently assert that in such specimens, no precipitate or haziness occurs when unmixed picric acid is used as the test-agent; and it may be that the different results with this test obtained by Dr. Roberts are due to his having added acetic or citric acid to the picric acid in his experiments. The only precipitates other than albuminous which may result from picric acid, employed alone, are urates which rarely occur, except when the mixture is allowed to stand for some time; peptones which I have met with only twice in as many years; and vegetable alkaloids, such as quinine, when large doses are being taken. These all differ from an albuminous precipitate in the fact that they are readily and completely redissolved by heat, while they may be distinguished from each other by the microscope. (See the author's lectures on Albumen and Sugar Testing,' p. 11, Smith, Elder and Co.)

It appears, therefore, from very numerous and careful observations, that albumen is the only substance found in the urine which gives with picric acid a precipitate insoluble by heat.

The difference, then, between picric acid and the other new tests for albumen is this—that picric acid, unmixed with other reagents, while it is a most sensitive and trustworthy test for albumen, gives no reaction with mucin. On the other hand, the potassio-mercuric iodide, tungstate of soda, and brine do not precipitate albumen unless when combined with an acid; and this combination gives a reaction with mucin, which is not distinguishable from a minute trace of albumen.

I have been in the habit of using the potassio-mercuric iodide only as a check upon the picric acid test, when small quantities of albumen only were present, and, until lately, had not thought of applying it to normal urine. I now find, however, that the test-liquid, when acidulated—as it must be, to act at all—gives a distinct opalescence in most, if not all, normal urines. I find, too, that after the mucin has been removed from normal urine, by its coagulation with acetic or citric acid, and subsequent filtration, the addition of the potassio-mercuric iodide to the filtrate causes a decided opalescence, which is probably due to the precipitation of some substance other than mucin in the urine.

In testing urines which contain a mere trace of albumen, it is important to remove any turbidity that would interfere with the process. Urates would be removed by heat, suspended mucus and other particles by filtration. The addition of the picric acid solution to a turbid specimen might give a fallacious appearance of coagulated albumen, when, in fact, there is nothing more than some increased opacity, due to the yellow staining of the suspended particles.

Picric acid is itself sufficiently acid, when added in excess, to dissolve and clear a phosphatic turbidity. In the rare case of the urine being so highly alkaline as to prevent the coagulation of the albumen by an excess of picric acid, the plan is to add sufficient citric or acetic acid to neutralize the alkali, then to filter, and add the picric acid to the filtrate.

It appears, then, that picric acid as a test for albumen is more free from fallacy than any other, not even excepting heat and nitric acid, which Dr. Roberts expresses his determination to fall back upon. Of course, in a doubtful case, no one would neglect to apply more than one test. That picric acid is a more sensitive test than heat and nitric acid is easily proved by taking a highly albuminous specimen and gradually diluting it up to the point where—though these tests fail to detect it—picric acid still gives a distinct reaction.

The main advantages of picric acid as a test for albumen are the following:—It instantly detects a small amount of albumen which nitric acid would indicate only slowly or not at all; while, on the one hand, an insufficient addition of the test does not, as is the case with nitric acid, prevent the subsequent coagulation by heat; neither, on the other hand, does an excess of picric acid redissolve the precipitate, as does an excess of nitric acid. For bedside urinary testing, the portability of the innocuous powder is a great convenience. The fact that, with caustic potash, it is an infallible qualitative and quantitative test for sugar, may be said to be more than double its value as an urinary

test. For bedside use, Mr. Hawksley, 357, Oxford Street, makes a waistcoat-pocket test-case, consisting of a test-tube four inches long, in which are packed two smaller tubes, one containing picric acid powder, the other grain-lumps of caustic potash, and also a small spirit lamp. These are enclosed in a metal case, not much larger than a pencil-case.

Another small case contains a nipple-pipette, which, amongst other uses, is convenient for conveying urine from the vessel to the test-tube.

The picric acid which is used for sugar-testing should be purified by recrystallization. The commercial samples usually give a red colour when boiled with liquor potassæ and I lately saw an impure sample, which not only gave this red colour, but the liquid was rendered turbid by fine granules. The impurity was removed by solution and recrystallization.

REVIEWS.

THE JOURNAL OF MICROSCOPY AND NATURAL SCIENCE, BEING THE JOURNAL OF THE POSTAL MICROSCOPICAL SOCIETY. Edited by *Alfred Allen, Hon. Secretary.*

THIS journal, which will in future, we understand, be published quarterly by Messrs. Baillière, Tindall and Cox, is an exceedingly interesting one. The Society was, we are informed, founded in 1873 to aid in the study, discussion, and circulation of microscopic objects, and to advance the pursuit of natural science among its members. It is divided into thirteen circuits of about twelve members each, arranged geographically. A box of slides, accompanied by MS. book for the insertion of notes and memoranda, is sent by the hon. secretary, at fortnightly intervals, to the first member on one of the circuits; who, after keeping it for three days, must send it on by post to the next on the list, and he to the following one. When it has gone round the circuit, the last member returns it to the hon. secretary, who will then forward it to the first member of the next circuit, and so on, until the slides have been seen by the whole of the Society. Each member is expected to contribute six slides annually, which are returned to him after they have been round the circuits. Ladies, as well as gentlemen, may be elected members of the Society. As a rule, the journal, being conducted by the members, as it were, *con amore*, is very readable, and not only so, but exceedingly instructive and interesting to microscopists.

ON THE HEALTHY MANUFACTURE OF BREAD. By *Benjamin Ward Richardson, M.D., F.R.S.* London, Baillière, Tindall and Cox.

THIS is a well-written pamphlet, designed to advance the taste of the public for ærated bread manufactured upon Dr. Dauglish's system. There is nothing particularly novel or striking in its composition, but the name of its author will, doubtless, lend weight to it, and help to convince the public in favour of his views. It, of course, deals in a popular and easily comprehensible manner with the chemistry of fermentation.

DENTAL CARIES. By *Henry Sewill, M.R.C.S. and L.D.S.* Reprinted from the Journal of the British Dental Association. London, Baillière, Tindall and Cox.

ALTHOUGH not a strictly chemical work, this book is yet interesting to the chemist and microscopist, as the author takes the view that *caries* of the teeth has a distinctly

chemical origin, being started frequently by a generally acid state of the saliva. These acids, according to Mr. Sewill's views, are principally malic, butyric, and acetic, and are the products of chemical change and fermentation, set up in the fragments of organic matter—food, mucus, and epithelial scales—which are commonly present in the mouth, and lodged upon the teeth. Acid may be derived from several other sources. It may be secreted by the mucous membrane. The normal secretion of the membrane is small in quantity, and slightly acid. In health, the acid is at once neutralised by the alkaline saliva, with which it mingles; but when the membrane is congested or inflamed, the mucus increases in quantity, and becomes more strongly acid in character. Then again, many forms of organisms themselves produce acid. Acid is eructated in many gastric disorders; and an acid, instead of alkaline, reaction is shown by saliva in several diseases. The whole work, dealing as it does with the microscopical and chemical characters of sound and decayed teeth, is evidently the product of much thought and research, and the arguments contained in it, are, in many places, exceedingly striking. The treatment recommended is not within our province to discuss, but generally speaking it is alkaline (use being made of borax) and antiseptic. The author does not agree with the wholesale condemnation of the use of the tooth-pick we frequently see indulged in, but on the contrary recommends its employment every night before going to bed, followed by a good rinsing of the mouth with the alkaline and antiseptic lotion, for keeping the teeth in good condition. It is a book that will really enhance the author's fame, both with his fellow professional men, and with the public who happen to come across it.

LAW REPORTS.

DISPUTED MILK CASE, "ALLOWANCE FOR DECOMPOSITION" NOT HOLDING GOOD.—Thomas Eggleton, market gardener and milk vendor, of Leighton Buzzard, again appeared to adjourned summons, charged with having sold to Supt. Shepherd, on the 31st of July, milk which was alleged to have been adulterated with 12 per cent. of water and deficient in butter-fat to the extent of 20 per cent. This was the third time this case had been before the court. On the first occasion the defendant challenged the certificate of Dr. Stevenson, of Guy's Hospital, London, the county analyst; on the second he produced a certificate from Messrs. Wigner and Harland, of London, who, after analysis, stated that a portion of the sample of milk taken from defendant contained $^{9}/_{10}$ per cent. more of butter-fat than the limit laid down by the Society of Analysts, though they added that it was difficult to say whether or not the milk had been watered, owing to its decomposition when analysed. Under these circumstances the case was referred to Somerset House, and a portion of the sample forwarded thither for final analysis. A certificate from Somerset House was now produced by Supt. Shepherd, and read by the Chairman, as follows:—

"Laboratory,
"Somerset House, W.C.

"The sample of milk referred to in the annexed memorandum, and marked Bedfordshire, 11-9, was received here on the 17th inst. The bottle was securely sealed. We hereby certify that we have analysed the milk, and declare the results of our analysis to be as follows:—Non-fatty solids, 7·65 per cent.; fat, 2·59; water, 89·76; ash, ·73. From a consideration of these results, and after making addition for natural loss arising from the decomposition of the matter through a period of fifty days, we are unable to affirm that water has been added to or cream abstracted from the milk.

"As witness our hands this 27th day of September, 1884.

"R. BANNISTER.
"G. LEWIN."

Dr. Stevenson, now called to personally support his certificate, said he was public analyst for the county of Bedford. On July 31st last he received three samples of milk from Supt. Shepherd, numbered 11-8, 11-9, 11-10. The bottle mark 11-9 was now produced. After analysing the milk therein he gave the certificate before the court, which was a correct account of the analysis and his opinion thereon. He

made two analyses, and they agreed very closely. He was assisted in the analysis, but supervised the whole process. On September 18th the defendant came to his laboratory, and was shown the bottle marked 11-9, as it remained after the analysis. He said he had been summoned, and suggested that a mistake had been made. Witness said he would analyse the milk again. He made two new analyses from the milk left, and from the result he found that he could have made no mistake, and that his certificate was a correct one. The mean percentage of fat should be from 3¼ to 3½ per cent., but this sample was deficient to the extent of 20 per cent. On the 22nd of September defendant brought witness another sample of milk. He said it was from the same cows as the original milk had been taken, and that the cows were being fed in the same manner as in July, and that the sample was a fair one of the whole yield of the cows. Witness analysed that milk, and found it of very nearly the average quality. By adding 9½ per cent. of water to the last sample, and taking away 23½ per cent. of fat, the two samples would be brought together in quality. His conclusion was that the deficiency of fat in the original sample was not natural. Cross-examined by Mr. Grayson, witness said he was appointed analyst for the county of Bedford in 1872. He made 400 or 500 milk analyses in the course of a year. He was present and took part in the analysis. He employed assistants. He had paid a deal of attention to milk analysis. He was quite certain that his figures was correct, and had kept a record of them. Milk varied occasionally in quality according to the cows. It contained 87 to 88 per cent. of water naturally, and when it became decomposed it did not give such a good result. In a decomposed state the percentage would not increase more than about ½ per cent. It might get up to 90 per cent. if very much decomposed. Milk containing 10·60 of solids would not be consistent with genuine milk, with no water added, if a cow was milked under abnomal circumstances. Mr. Grayson here quoted from Dr. Tidy, who had, before a Select Committee of the House of Commons, drawn the line at 10 per cent. of total solids, and would not say that a sample of milk containing that quantity was adulterated; but Dr. Stevenson would not say that he agreed with Dr. Tidy—he would not rest his opinion upon such figures. He did not know that the standard was once higher, and that the analysts, finding out that they were doing an injustice to honest men, had to give up the standard of their own creation. Mr. Haslam inquired if 10 per cent. was the Government standard. Mr. Grayson said there was no standard, but the defendant's milk was $^{2}/_{10}$ per cent. in fat higher than the standard allowed by the Society of Public Analysts. Dr. Stevenson said he belonged to the society, and must correct a misapprehension. It was not $^{2}/_{10}$ per cent. above the standard, but above the limit allowed by the society. Further cross-examined, Dr. Stevenson added that defendant's was poor milk, and he thought no analyst would have difficulty in discovering that fact. His analysis had been made under more favourable circumstances than that of Messrs. Wigner and Harland. Had theirs been made earlier, it would have been more favourable to the defendant in some particulars. The Somerset House analysis convinced him that he had analysed the same milk. Witness had in his experience made mistakes—two, he believed. No analyst would be human if he was not sometimes in error, but in the two cases to which he referred he had made further inquiry, and, having satisfied himself, admitted the mistakes, which, however, were not in analysis, but in numbering. Good milk ought to contain twelve per cent. of solids, and he should be very suspicious of any below 11½ per cent. Mr. Grayson in defence, said he did not think there would be any difficulty in the Bench coming to the conclusion that this was genuine milk. There had been no complaint against it on the part of the public, and he thought it a very serious thing that the machinery of the Act should be put in motion against the defendant. In the absence of complaint there had been no reason to analyse this milk at all. The Superintendent of police, in the course he had taken, ought to be supposed to have some reason for suspicion. The chairman said that was not so. The Superintendent periodically submitted for analysis almost everybody's goods. Mr. Grayson said that two years ago defendant's milk had been tried and found genuine. Since that time he had been specially careful; he had not watered his milk, and no complaint had been made respecting it. On the last occasion that this case was before the court Messrs. Wigner and Harland's certificate left a doubt; and now the Somerset House certificate did not say the milk had been watered; and this latter certificate, he contended, entitled the Bench to give the defendant the benefit of the doubt. He rested his defence upon these two latter certificates. Had there been adulteration, it could have been easily ascertained. He believed he was defending an honest man, who had sold an honest article. They had now two certificates one way, to one the other, and he considered it a cruel hardship to summon this man without cause, beside which he did not think that Dr. Stevenson had given his evidence in a straightforward manner. The Chairman, who had during the cross-examination of Dr. Stevenson requested Mr. Grayson to allow the doctor to finish his sentences before putting further questions, here said the Bench did not agree with the remark that evidence had not been given straightforwardly. Mr. Grayson said he would give way, but he was puzzled to know

how the deficiency of fat and excess of water had been ascertained. The Magistrates now retired to consult together, and on returning into Court the Chairman said the Bench had given careful attention to this case, and they felt that it was not without its difficulties. In coming to a decision they had taken the most favourable view of the defendant's circumstances. At the same time, they had carefully prepared a table of the three analyses, and did not find the great discrepancies which the gentleman engaged for the defence endeavoured to draw attention to. Dr. Stevenson reported 10·60 per cent. of solids; Messrs. Wigner and Harland, 10·34 per cent.; and Somerset House, 10·24 per cent. It would be observed that the solids of Messrs. Wigner and Harland and of Somerset House were slightly less than those of their own analyst, but that might be accounted for by the deterioration in the milk. Again, in the two other things that went to make up the total, the analysts' reports were pretty well agreed. Dr. Stevenson said there were 2·46 of fatty and 8·14 of non-fatty matter; Messrs. Wigner and Harland put the fatty matter at 2·71 and the non-fatty at 7·63; and Somerset House gave the fatty at 2·59 and the non-fatty at 7·65. Then as to water. Dr. Stevenson said 89·40, Messrs. Wigner and Harland 89·66, and Somerset House 88·76. All the principal figures agreed, as did also the decimals to a very considerable extent, Somerset House giving rather more water and less solids than the other reports. With regard to Messrs. Wigner and Harland's concluding remarks, the Bench did not see much more than a negative opinion; and the analysts of Somerset House said that after the length of time that had elapsed, they were unable to affirm that water had been added or cream abstracted. They did not affirm that they had not. Under all these circumstances, and considering that the superintendent had only done his duty in the matter, and had not attempted to be hard or harsh, and taking into consideration the serious importance of the case to the defendant, they had decided to deal with the case lightly. A fine must be inflicted, but as small as possible. The expenses amounted to very nearly £1, and the defendant would have to pay £1, including costs.

Another Case Involving "Allowance for Decomposition."—Joseph Pickering, a milk dealer, of 68, Lockton Street, Bow, appeared to answer an adjourned summons taken out against him at the instance of William Talbot Harrison, one of the Sanitary Inspectors to the Poplar Board of Works, for selling as pure, milk which had been adulterated to the extent of thirteen per cent. with water. Mr. Farnfield appeared to prosecute. The case, which possessed some very remarkable features, has already been twice before the Court. On the first occasion the certificate of Mr. Young, the analyst to the Board, was put in, and that stated that the milk was adulterated with water to the extent named. The defendant, however, denied that there was any adulteration, and produced a certificate which he said he had received from Professor Redwood, setting forth that the milk was pure. The case was then adjourned for the attendance of the professor; but when it came up on the following week, the defendant said that he had not been able to secure the professor, as he was out of town, but that he (the defendant) should like the third sample of milk, which is generally retained in case such a demand is made, to be submitted to the Government analyst at Somerset House. This was accordingly done, the summons meanwhile being adjourned *sine die*. When the case now came on, Mr. Lushington said that since the last adjournment he had received a certificate from Somerset House, signed "Richard Bannister" and "G. Lewin," which stated that they had submitted the sample of milk sent them to analysis, and from a consideration of the results thereof—not losing sight of the time the milk had been kept before it was forwarded for analysis—they (the signatories) could not affirm that any water had been added. Under these circumstances, he (Mr. Lushington) should dismiss the summons. Each party would have to pay 5s. 3d. towards the expense of the Somerset House analysis. The defendant asked for his own expenses, but his worship declined to grant them.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Pharmaceutical Journal; The Sanitary Record; The Miller; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; Cowkeeper and Dairyman's Journal; Sugar Cane; Country Brewers' Gazette; The Medical Record; The Grocers' Gazette; London Water Supply, by Crookes, Odling and Tidy; Chemical Review; Independent Oil and Drug Journal and Paint Review; Science Monthly; Journal of the Society of Chemical Industry.

Notice to Our Readers and Contributors.—In future law reports will not be inserted in the Analyst, unless some really novel point of procedure, or reference under the Act is involved. Our *confreres* are earnestly requested to send us cuttings from local journals whenever such cases occur, but not otherwise.

THE ANALYST.

DECEMBER, 1884.

TO OUR READERS AND SUBSCRIBERS.

Owing to the change of editorship, we beg to inform our readers that the following alterations will, in future, be made in the arrangement of the contents of The Analyst.

First in each number will come the record of the work of that small, but admirable organisation, the Society we especially claim to represent. It will be headed "Proceedings of the Society of Public Analysts," and will, we hope, maintain in the future the high position with regard to the advancement of the Analysis of Food and Drugs, so markedly taken by British chemists since the passing of the Sale of Food and Drugs Act. At the end of such papers will come, as heretofore, the words "Conclusion of the Proceedings of the Society," and for all the rest of the contents of this paper, the Society, or its officers, are in no way responsible.

The remainder of the journal (for which the editor is alone responsible) will contain a record of all advances in analytical chemistry, whether British or foreign, which the editor can collect, and in this department he will be assisted by a staff of foreign correspondents. The usual system of not quoting from the other home chemical papers will not be followed, but anything interesting will be duly recorded, even if not contributed directly to our columns, as we consider that such petty jealousy is altogether unworthy of the scientific press. The matter will be arranged under the following heads:—

(*a*) Monthly record of Analytical Researches into Food.

(*b*) Monthly record of Analytical Researches into Drugs.

(*c*) Monthly record of General Researches in Analytical Chemistry.

Following the strictly chemical portion of the paper, will be found reviews of all such new works in Chemistry, or the allied sciences, as may be submitted by the authors or publishers. Particular attention will be paid to this department, a just opinion being earnestly sought after without fear or favour, and no undue delay will occur in the appearance of reviews. A new feature of the journal will then be introduced, which has been decided upon after much careful consideration, viz., an occasional record of advances or novelties in the preparation of food and drugs. Public analysts, and our readers generally, who are specially interested in the subject of food, require of all men to be placed *au courant* with what is going on in this respect, and special articles submitted by the proprietors will be referred to under this heading. Lastly, the journal will contain such legal reports as contain any novel point in the working of the Sale of Food and Drugs Act.

Original articles by gentlemen, not members of the Society, will be paid for at a liberal rate of remuneration, to be ascertained on application to the Editorial Department, and members of the Society contributing papers will have a certain number of Analysts *posted free* to such lists of friends as they may send in, according to the length of the article, and on this point information may also be had on application as above.

PROCEEDINGS OF THE SOCIETY OF PUBLIC ANALYSTS.

An ordinary meeting of this Society was held on Wednesday, the 19th November, at Burlington House, Piccadilly. The chair was taken by Mr. C. Heisch, who said:—

Gentlemen,—It is my painful duty to take the chair this evening. I say painful, for a reason which you all know. Since our last meeting we have lost, not only our president, but one who was, to a great extent, the backbone of our Society. My friend, Mr. Wigner, was, as you know, one of the first to begin the movements for the formation of this Society. He was, in conjunction with myself, one of the first secretaries, and we all know for how many years he conducted the business of this Society in an active manner, and in such a way as to put the Society in the position which it now holds. In every respect, whilst secretary, Mr. Wigner performed an amount of work which very few men would have undertaken, and I am quite sure that we must all deeply deplore the loss of such a man. His death will be a great loss, not only to this Society, but to chemistry in general. To those who, like myself, were intimately acquainted with him, it is a worse loss than this. Although there were occasionally little asperities in his manner, I fearlessly say that there was no man who would be a better friend than our late president when you once came to know him. It is with very deep regret that I find myself called upon to take the chair to-night, and I cannot refrain from making these few brief remarks upon our late president.

The minutes of the country meeting on 16th August were read and confirmed.

The following gentlemen were ballotted for and declared duly elected:—

Members:—Dr. C. W. Cresson, Chemist to the Board of Health, Philadelphia; F. Scudder, Analytical Chemist, Normanton.

Associate:—W. Beam, Assistant to Dr. Cresson, Philadelphia.

The following gentlemen were proposed for election, and will be balloted for at the next meeting:—

Members:—D. A. Sutherland, H. F. Cheshire, Sandford Moore, R. C. Woodcock.

Associate:—J. K. Colwell

The following papers were then read and discussed:—

"On some Analyses of Ginger," by W. C. Young, F.C.S., F.I.C.

"On recent legislation on Adulteration in the United States of America," and

"On the Analysis of Cheese," by Dr. Muter, F.C.S., F.I.C.

"On Artificial Fat Cheese," by Dr. P. Vieth, F.C.S., F.I.C.

Owing to the lateness of the hour the other two papers on the agenda were postponed until the next meeting.

The next meeting of the Society of Public Analysts will be held at Burlington House on Wednesday, the 17th December next.

SOME ANALYSES OF GINGER.

By W. C. Young, F.I.C., F.C.S.

Read before the Society at the meeting on 19th November, 1884.

These analyses were made in the hope that some data would be found which would enable Analysts to distinguish between genuine ground ginger and that to which

exhausted ginger had been added. As will be seen by the results my hope was not realised, the constitution of the various samples being so widely different.

The samples were all well authenticated, and with the exception of those from Malabar and Bengal, were decorticated and bleached.

The aqueous and alcoholic extractions were determined from a 2 per cent. and 5 per cent. decoction respectively, both being digested for an hour under a vertical condenser, allowed to cool and settle, the clear decoction then syphoned off and used without filtration.

The cellulose was obtained by digestion, under a vertical condenser, of 50 grains of the sample, first in 16 ounces of 5 per cent. sulphuric acid, then in 12 ounces of 10 per cent. potash, and finally in water. Each digestion occupied about twenty minutes, the residue being finally collected on a filter, and thoroughly washed, dried, and weighed, then burnt, and the ash extracted.

	African 1.	African 2.	Jamaican.	Cochin.	Japan.	Malabar.	Bengal.
Moisture (Loss at 100° C.) ..	15·8	14·5	15	15·2	15·2	10·2	20·50
Ash	3·4	4·3	5·4	5·8	8·0	3·4	4·75
Ash insoluble in H_2O ..	1·34	1·58	1·22	3·28	5·82	1·6	2·36
Ash soluble in H_2O	2·06	2·72	4·18	2·52	2·18	1·8	2·39
Aqueous extraction (from 2°/₀ decoction) ..	24·8	52·2	55·7	35·1	34·3	30·1	51·4
Mucilage	18·0	—	32·3	21·8	19·4	22·4	41·1
Alcoholic extraction (from 5°/₀ decoction)	8·5	15·7	6·5	12·5	8·3	4·1	4·3
Resin	2·2	—	0·25	4·5	2·8	1·7	0·84
Cellulose	5·1	—	3·1	9·0	4·6	1·7	4·9

DISCUSSION.

After a few remarks by the chairman thanking the author for his communication this paper passed without discussion.

NOTE ON THE ADULTERATION LAWS IN THE UNITED STATES OF AMERICA.

By John Muter, Ph.D., F.I.C.

(*Read before the Society at the Meeting on 19th November*, 1884.)

I have received a copy of the statutes that the legislature of the State of Massachusetts has just passed with reference to the adulteration of food and drugs, and I proceed to lay an abstract of the same before the Society, so that its members may contrast them with the law under which we are compelled to act in this country.

First, as to the Adulteration of Food.—The State Board of Health are empowered to expend, annually, an amount not exceeding ten thousand dollars, for the purpose of carrying out the provisions of this Act, provided that not less than three-fifths is expended for the enforcement of the laws against the adulteration of milk and milk products. Every person selling milk must be licensed, and his name, the number of his license, and his place of business, must be placed on each side of the conveyance used by him, or his servant, in the sale of milk. If any part of the cream has been removed, the words "skimmed milk" must be distinctly marked in letters not less than one inch in length on the outside of the vessel. Mixtures made in imitation or semblance of butter must be labelled "imitation butter," or "oleomargarine," and those made in imitation of cheese must be marked "imitation cheese," in bold Roman type, of not less than one half-inch in length.

Milk, shown by analysis to contain more than eighty-seven per cent. of watery fluid, or to contain less than thirteen per cent. of milk solids, is deemed to be adulterated. The terms "butter" and "cheese" mean the products usually known by those names, and are manufactured exclusively from milk or cream, with salt and rennet, and with or without colouring matter.

The general provisions for other articles of food run as follows:—(1.) If any substance or substances have been mixed with any article of food, so as to reduce, or lower, or injuriously affect its quality or strength; (2.) If any inferior substance or substances have been substituted wholly, or in part, for it; (3.) If it is in imitation of, or is sold under the name of, another article; (4.) If it consists wholly, or in part, of a diseased, decomposed, putrid, or rotten animal or vegetable substance, whether it is manufactured or not, or, in the case of milk, if it is the produce of a diseased animal; (5.) If any valuable constituent has been wholly, or in part, abstracted from it; (6.) If it is coloured, coated, polished, or powdered, whereby damage is concealed, or if it is made to appear more valuable than it really is; (7.) If it contains any added poisonous ingredient which may render it injurious to the health of a person consuming it; the article shall be deemed to be adulterated.

Both the manufacturer and seller of any beverage adulterated with Indian cockle, vitriol, grains of paradise, opium, alum, capsicum, coperas, laurel water, logwood, Brazil wood, cochineal, sugar of lead, or any other substance which is poisonous or injurious to health, are subjected to very heavy penalties.

Second, as to the Adulteration of Drugs.—The Act says:—(1) "If when sold under or by a name recognised in the United States Pharmacopœia, it differs from the standard

of strength, quality, or purity laid down therein, unless the order calls for an article inferior to such standard, or unless such difference is made known or so appears to the purchaser at the time of such sale; (2) If when sold under or by a name not recognised by the U.S.P., but which is found in some other Pharmacopœia, or other standard work on *materia medica*, it differs materially in strength, quality, or purity laid down in such work; (3). If its strength or purity falls below the professed standard under which it is sold; they shall be deemed to be adulterated."

The penalties for infringement of the provisions of the Act range from a fine of thirty dollars to an imprisonment for three years.

The expense of the analysis is not to exceed twenty dollars (say £4) in any one case, and may be included in the cost of the prosecution.

The analyst is to divide each article and retain one half sealed up, which he must deliver on application to the defendant or his attorney in case of prosecution.

All this reads very nicely on paper, but in each of the sections providing for penalties the word "knowingly" occurs, and unless the American attorneys are less "cute" than they are taken for, it should prove as fatal to successful prosecution as it did with us under the old Act of 1872. The chief point of interest to us as a Society is the milk standard, and it is a question whether the simple method of requiring so much total milk solids is after all not the simplest plan. American milk must, however, be much richer than that currently considered as a fair average in this country.

DISCUSSION.

Dr. Dupre said they were much obliged to Dr. Muter for bringing this before them; it was always well to learn what other countries were doing. He quite agreed with the proposal that if any standard was to be laid down for milk, it should be a total solid standard, irrespective of solids not fat. It was merely a matter of indifference to the man who bought the milk whether he got 3 per cent. of fat and 10 per cent. solids not fat, or 4 per cent. of fat and 9 per cent. of solids not fat, though the probability was that he might be better satisfied with the former. No doubt 13 per cent would be too high, but he thought about 12·5 might not be far wrong. He was quite convinced that if some standard, be it 12 or 12·5, were adopted, all difficulties would vanish, and there would then be practically no difference between analysts. With regard to drugs, he might perhaps lay claim to the definition as his own. He was the one who laid it down years ago, and it was almost exactly in the words in which he put it before the Committee of the Society, which was appointed many years ago to act in the matter of drugs. He should like to put in his strongest protest against the joke interpolated while reading the paper, about the American chemists being able to make a nicer analysis for four guineas than they could for 10s. 6d. (Laughter.) He must say he did not think it a laughing matter. He remembered some years ago a case of adulteration of bread, where a man had certified the bread to be pure, and when it was found by another analyst to contain alum, he said, "Of course, I only got 10s. for the analysis; and if I had had more I should have found out that there was alum in the bread." He (Dr.

Dupré) could not insist upon it too strongly, especially in the presence of the younger members of the profession, that if they took an analysis in hand at all, they should do it as well as they could, whether they received one guinea or ten guineas for it. If they could not do it for one guinea, let them decline it; but if they did it, then let them do it accurately.

Mr. Hehner said there was one clause he should like to see adopted in England—and that was, the division of samples by the Analysts. It was an exceedingly painful matter that the reputation of the Analysts should be placed at the mercy of the Inspectors. There were many cases of this sort. Quite lately they had a very striking case, where Mr. Allen found a very large quantity of lead in a sample of lemonade; whereas in the duplicate sample there was none. This duplicate sample had not been divided, but was a whole bottle; and the newspapers of course, spoke of the incompetence of the Analyst. There should not be any possibility of this occurring. Every sample should be divided in the presence of the Analyst, and if the Analyst were present he would say:—"I don't want another bottle or a a whole loaf. I want part of yours." He had often had a whole loaf brought to him, and he always felt that his reputation was more or less in the hands of the baker. He should be exceedingly sorry if Analysts were made judges of diseased or decomposed articles. If they did so they would usurp the function which at present belonged to the Medical Officer of Health, and Analysts were not competent to do that. He should also like to see a standard fixed for milk, but 13 per cent. solids would be quite out of the question, 11·5 or 12 would be about it.

Dr. Wynter Blyth said in criticising that Act one saw that there were some things very good and a distinct improvement upon our own Act, and other things distinctly retrograde. One improvement certainly was including the costs of the analysis in the fine. That would probably have a very good effect if introduced into our own law, because, at the present time, the fines were very inadequate indeed. Latterly certain London magistrates had commenced to raise the fines, but still they were seldom commensurate with the adulteration. That part of the Act as to milk was certainly good. Of course the standard solids was certainly high, a legal standard of 12 would be quite sufficient; but, if they had a legal limit fixed, it would be more simple, and would work very well, to place it simply on the total solids and not on any other constituent of the milk. It would be found that the total solids in duplicate analyses fairly agreed, the differences at present found, partly arising from the various processes still in existence, and partly from difference in the manipulation. Another retrograde movement was the adulteration of liquors; there were only five out of the ten substitutes mentioned which were called poisonous (excluding alum) which might be really so. Even laurel water was used as a harmless flavouring agent, and it depended upon the quantity, whether that was poisonous; cochineal was used in temperance drinks, and was not poisonous. He could not conceive how it was that, in this 19th century, these harmless substances could have crept into an Act of that kind. The Analyst was to return half the sample to the *Attorney;* this would act seriously in this country, and he did not suppose people were more honest in America.

About two years ago he had a sample of butter substituted for the one originally analysed, although the fraud was detected, and the man heavily fined; but that sort of thing often occurred, and the Analyst was blamed unjustly.

Mr. Heisch concurred on the point that it would be very much better for the Analyst to be present at the division of the sample. Analysts used to divide the samples, as they might, perhaps, remember. From the manner in which samples brought to him were frequently sealed, he had a very strong feeling that if a man knowingly sold an adulterated article, the probability was that the sample left with him would be altered. It was not at all an easy thing to seal up a sample so that it should not be tampered with, and inspectors are not cautious in their proceedings, especially when taking a milk sample in the open air—unless they get into a quiet place.

Mr. Hehner said that in the case of the butter referred to by Dr. Blyth, the sample was sealed up in such a way that there was no difficulty whatever in slipping a piece of genuine butter in.

Dr. Dupré recalled the fact that in the first sample ever referred to Somerset House the magistrate said he was bound by their decision. It was evidently a case of a substituted sample. Dr. Muter and Mr. Wigner had portions, and they all agreed that it was adulterated, and yet Somerset House found theirs to be genuine.

Dr. Vieth said that he knew very well that his Company had a great deal of milk with as much solids as 13 per cent., but not all the year. They had between 900 and 1,000 samples a month, and often averaged total solids of 13·8. The worst milk was 13·08; the March and April average was only 12·7 and 12·8, and sometimes it came down to 12.

Mr. Stewart said that he remembered a case, a good many years ago, where a milk, which they had certified to be adulterated, was forwarded to another Analyst. Their sample was 9·8 total solids, and the other was 13. They communicated with the other Analyst, who examined the bottle which had contained the milk submitted to him, and, holding it up to the light, he saw another figure on the label. He took off the label, and found another label under it. When they examined their sample with this other label, they found it closely agreed with the milk submitted to the other Analyst. They afterwards found that the vendor of their milk, who lived in the same street as another milkman whose milk had been sampled, had taken the label off his own sample and gummed it on the other milkman's. He did not have the gumption to take the old label off, but actually stuck the new one over it, and then sent that sample to the other Analyst. He (Mr. Stewart) also had a sample of coffee tied up in a bag and sealed, and, by a little manipulation, he slipped the tape off, took out the sample, and put in a new one, and fastened it up again without breaking the seal. With butters, if the Inspectors do not take the precaution when they put them in bottles to wipe the grease carefully off the neck, the cork will come out easily. In some cases Inspectors had a small crowd round them, and then it was not very easy to seal up samples carefully. With reference to divisions by the Analyst, or in the presence of the vendor, the old Act put everything in the hands of the Analyst. Now it has to be divided in the

presence of the vendor. It seemed to him that the vendor might object to the sample being divided out of his sight just as much as the Analyst. The more reasonable thing would be for the Analyst to follow the Inspector into every shop, or for the vendor to go to the laboratory and see the sample divided; and that was impossible. Inspectors were generally honest, and it was pretty safe to leave it to them. He did not think that any other plan would be possible, and they would have the trade complaining still more. As to the American style of the Analyst dividing the sample and sending it to the vendor, he thought the way would be for the Analyst to divide it and send it to another Analyst. With regard to what Dr. Dupré had said as to an Analyst doing as good an analysis for 10s. as for ten guineas, that was very pretty in theory, but not in practice. He did not think they could subscribe to that. Take a water analysis, for instance. Would Dr. Dupré care to make a complete mineral analysis, with combustion, albuminoid ammonia, and so on, for 10s.?

Dr. Dupré said he certainly gave the Analyst an alternative plan, and if anyone came and asked him to make a water analysis for 10s. he should show him the door.

Mr. Ashby said that sealing was not necessary. "Sealed, or otherwise secured," were the words of the Act. For years past he had induced Inspectors to do away with seals, they simply provided themselves with lined envelopes, generally inscribed with the borough arms, and the bottle of milk or butter or other sample was put inside, and the Inspector wrote his signature with an aniline pencil across the junction of the flap with the envelope. He always insisted on the use of these envelopes, and never had any difficulty with them; they even had envelopes large enough for loaves and samples of water.

Dr. Muter, in closing the discussion, said that nearly every analyst had met with instances of changed samples, but his had been by the vendors only. He had a milk case now pending, his sample containing under 10 per cent. solids, and the other sample nearly 13 per cent.

Conclusion of the Proceedings of the Society of Public Analysts.

MONTHLY RECORD OF ANALYTICAL RESEARCHES INTO FOOD.

We are indebted to the enterprise of the *American Grocer* Publishing Association for a very long series of analysis of Tea, by J. F. Geisler, of which the following is an abstract:—

Taking the average of 6 analyses of Indian tea we find:—

	Max.	Min.	Average.
Moisture	6·19	5·56	5·81
Half-hour Extract	39·66	37·80	38·77
Total Extract	45·64	41·32	42·94
Insoluble leaf	53·07	48·53	51·24
Tannin	18·86	13·04	14·87
Theine	3·30	1·80	2·70
Soluble ash	3·68	3·24	3·52
Insoluble ash	2·22	1·93	2·12
Ash insol. in HCl	·296	·137	·178

The average of thirteen varieties of Oolong tea yielded

	Max.	Min.	Average.
Moisture	6·88 ..	5·09 ..	5·89
Half-hour Extract	44·02 ..	34·10 ..	37·88
Total Extract	48·87 ..	40·60 ..	43·32
Insoluble leaf	53·15 ..	44·80 ..	50·70
Tannin	20·07 ..	11·93 ..	16·38
Theine	3·50 ..	1·15 ..	2·32
Soluble ash	3·71 ..	2·60 ..	3·20
Insoluble ash	3·17 ..	1·84 ..	2·68
Ash insol. in HCl	·838 ..	·266 ..	·507

The average of eleven samples of Congou showed:—

	Max.	Min.	Average.
Moisture	9·15 ..	7·65 ..	8·37
Half-hour Extract	32·14 ..	23·48 ..	28·40
Total Extract	37·06 ..	27·48 ..	34·35
Insoluble leaf	63·85 ..	54·50 ..	57·20
Tannin	13·89 ..	8·44 ..	11·54
Theine	2·87 ..	1·70 ..	2.37
Soluble ash	3·52 ..	2·28 ..	3·06
Insoluble ash	3·86 ..	1·90 ..	2·68
Ash insol. in HCl	1·31 ..	·32 ..	·425

The "half-hour extract" is the result of boiling the tea for half an hour in 100 parts of distilled water, and is, in the author's opinion, a better index of the quality of the tea than the ordinary total extract. The rest of the paper is devoted to the comparison of the results of chemical analysis with commercial value, and it is shown that, although no absolutely unimpeachable ratio exists between them, yet the nearest results are got by infusing the tea for ten minutes, under fixed conditions, with 100 parts of boiling distilled water. Tables of the results so obtained are given, but as they are too long for abstraction, the reader is referred to the original article in the *American Grocer*.

In the *Archiv. der Pharmacie* there is a long paper on the "Examination of Food, &c., containing Arsenic," by H. Beckurts.*

It is an exhaustive and critical study of the different methods for the detection and estimation of arsenic in food and other organic substances.

The author regards Fresenius and Babo's method for the separation of arsenic from accompanying organic matter, by destroying the latter with hydrochloric acid and potassium chlorate, as inconvenient, and to be avoided. Wöhler and Sieboldt's method is looked upon with more favour. In this method the substance is heated with an equal weight of nitric acid in a porcelain dish, neutralised with pure potash, and, after the addition of potassium nitrate, evaporated to dryness, and ignited. The arseniate thus formed, is dissolved out by water. Before testing the solution, however, in Marsh's apparatus, the nitrates and nitrites must be removed by evaporation with sulphuric acid.

* *Archiv der Pharmacie*, 3te Reihe, Bd. 22, Hft. 17, p. 653.

In criticising Schneider and Fyfe's method, in which the arsenic is distilled out as arsenious chloride, by slowly adding sulphuric acid to a mixture of the substance to be examined with common salt, the author remarks that, of all the arsenic compounds, only arsenious acid is easily converted into arsenious chloride.

The author then gives his and Herr Pehut's researches, on a method by which arsenic compounds in organic substances can easily be determined. The substance to be examined is stirred up with hydrochloric acid (20-25 per cent.), free from arsenic, mixed with about 20 grms. of a 4 per cent. solution of ferrous chloride, and the mixture distilled from a large tubulated retort, the neck of which is directed upwards, and connected with a Liebig's condensor. One-third is distilled at the rate of about 3 c.c. per minute. If the amount of arsenic present be not great, the whole of it will be in the first distillate. If larger quantities be present, the operation must, after the addition of another 100 c.c. of hydrochloric acid, be repeated. As ferrous chloride, according to Fischer, effectually prevents the volatilization of mercury, antimony, and tin in hydrochloric acid solution, there is no fear of antimony and tin chloride being found in the distillate. The latter, after dilution, can be tested directly with Marsh's apparatus. For quantitative determination the arsenic may be precipitated as sulphide by sulphuretted hydrogen, or, after oxydation, and the removal of the excess of hydrochloric acid, as ammonium-magnesium, arseniate, or, finally, volumetrically, by titration with a standard iodine solution ($^1/_{100}$ N.) In this method the arsenic present as arsenious and arsenic acids distils over. Arsenious sulphide, which is often formed in putrefying organic matter containing arsenic, is also decomposed by the distillation.

From the author's quantitative experiments, the following have been selected:—

1. *Arsenic Present as Arsenious Acid.*—75 grms. of meat were mixed with 250 grm. HCl, ·01 grm. As_2O_3 and 200 c.c. 4 per cent. solution of ferrous chloride and distilled. The arsenic was determined in the distillate as magnesium-ammonium arseniate: ·00968 grm. As_2O_3 was found.

2. *Arsenic as Arsenic Acid.*—300 grms. meat containing arsenic acid equal to ·01 grm. As_2O_3 were mixed with 20 grm. 4 per cent. $FeCl_2$ and HCl 100 c.c. distilled gave ·00985 grm. As_2O_3.

3. Arsenious sulphide was mixed with meat, and distilled as above. 42 per cent. As_2S_3 was recovered from the distillate.

4. Metallic arsenic can also be easily detected even when not at all *oxydized*.

MONTHLY RECORD OF ANALYTICAL RESEARCHES INTO DRUGS.

At a recent meeting of the Pharmaceutical Society, Dr. John C. Thresh made a communication, on the Proximate Constituents of Hedychium Spicatum, of which the following extract embraces the chief points of chemical interest. Preliminary trials showed that the best solvent of the active principle was petroleum ether, the extract from this menstruum yielding a crop of crystal which when purified were found to be tabular, colourless and odourless, soluble in petroleum ether, ether, alcohol, chloroform and benzol. Insoluble in diluted solutions of potash, soda or ammonia. Sulphuric acid dissolved it in the cold without production of colour, but if heated the

solution became purple red. The alcoholic solution was neutral in reaction, not coloured by ferric chloride or precipitated by basic lead acetate. It did not reduce silver salts. Melting point 49°C. Mean of two combustions gave C 69·73 per cent., H 5·88 per cent., agreeing with formula $C_{12}H_{14}O_3$.

By treatment with caustic potash, the crystals yielded ethyl alcohol, and an acid yielding upon combustion C 67·63 per cent., and H 5·69 per cent. The silver salt gave 37·55 per cent., metal. The acid therefore had formula $C_{10}H_{10}O_3$, and the crystalline principle $C_2H_3C_{10}H_9O_3$. Upon oxidation with dilute nitric acid, anisic acid was produced in abundance. The acid therefore is methyl paraoxyphenylacrylic, an acid obtained synthetically by Perkin, by the action of acetic anhydride on anisic aldehyde in presence of sodium acetate.

The Uncrystallizable Portion of the Petroleum Ether Residue.—This was found to consist of the odorous principle, a fixed oil and a very considerable proportion of ethylmethylparacoumarate, the latter doubtless prevented from crystallizing by the presence of the former. Upon saponification of the mixture with alcoholic potash, two crystalline acids were obtained, the methylparacoumaric and another, apparently a fatty acid. This latter was totally insoluble in boiling water, but crystallizable from alcohol. The quantity obtained did not enable me to identify it with certainty, and its further examination is reserved for the immediate future.

The odorous principle evidently exists in the rhizome in very minute proportion, and to isolate it in a state of purity will necessitate working on a much larger quantity of material.

A very minute quantity of the oily fluid above mentioned dropped upon the clothes renders them highly odorous for a considerable length of time, or if exposed causes a large room to be pervaded with its odour, which to me recalls that of hyacinths.

The proximate analysis of the rhizome gave the following results :—

Soluble in petroleum ether—		
Ethylmethylparacoumarate	3·0	5·9
Fixed oil and odorous body	2·9	
Soluble in alcohol—		
Indif. substance ppt. by tannin / Acid resin, &c.		2·7
Soluble in water—		
Glucoside or saccharine matter		1·0
Mucilage		2·8
Albuminoids, organic acid, &c.		1·9
Starch		52·3
Moisture		13·6
Ash		4·6
Cellulose, &c.		15·2
		100·0

The cod-liver oil supplied to the European markets is often spurious, being either a mixture of the genuine oil with seal or coalfish oil, or else simply the latter oils, alone or mixed. Japan also furnishes the market with so-called cod-liver oil.

In order to find, if possible, a test for pure cod-liver oil, A. Kremel has made extensive experiments with oils of known origin. He determined specific gravity,

amount of potash necessary for saponification, and amount of iodine solution necessary for iodizing the oil, but finally came to the conclusion that the best process for distinguishing the pure from the spurious oils may be based upon their behaviour with fuming nitric acid, spec. gr. 1·500, as follows:—

Ten to fifteen drops of the respective oils are poured on watch glasses, and two or three drops of fuming nitric acid are slowly run in from the side, when the several oils exhibit the following appearances: 1. Genuine cod-liver oil (from *Gadus Morrhua*) turns *red* at the point of contact; when afterwards stirred with a glass rod it becomes fiery rose-red, soon passing into pure lemon yellow. 2. Coalfish oil (from *Gadus Carbonarius*) turns intensely *blue* at the point of contact; when stirred it turns brown, and remains so for two or three hours, when it finally passes likewise into a more or less pure yellow. 3. Japanese cod-liver oil behaves like the preceding, except that red streaks are sometimes observed along with the blue ones, on the addition of nitric acid. All three varieties likewise yield the well-known colour reaction for biliary acids (with sulphuric acid). 4. Seal oil, treated as above stated, at first shows no change of colour, and becomes brown only after some time. As this oil is not a *liver* oil, it, of course, does not give the reaction for biliary acids.

According to the author, this reaction for the spurious oils with fuming nitric acid is so intense and characteristic, that admixtures of them (of not less than about twenty-five per cent. to genuine oil) may be readily detected. Some time ago, S. G. Bradford recommended solution of subacetate of lead as a test for cotton oil in both cod-liver oil and in olive oil, by producing a red colour when the former oil was present. Moreover, a mixture of solution of subacetate of lead with cod-liver oil causes saponification *at once* when shaken in the cold. When cotton-seed or any other oil is present, this saponification will not take place, no matter how long the mixture is allowed to stand, or how well it is shaken.

The strength of ether is almost universally judged by the test of specific gravity It is, consequently, of great importance that the density of absolute ether should be accurately determined. Authorities differ very much on this point. Various points ranging between ·690 and ·720 are stated, and though some of the discrepancies may be accounted for by the different temperatures at which the estimations were made, there still lacks uniformity. In an article in the *Ephemeris*, Dr. Squibb discusses the matter, and gives the result of a number of experiments made in order to determine the point. He acknowledges the difficulty in getting ether free from the last traces of alcohol, water, and air, and overcoming the extreme sensitiveness to heat of so volatile a fluid. His conclusions are not, so far, absolutely final, as he promises to continue his investigations when the cold weather shall have fairly set in, but for the present he gives the specific gravity at 4 C. as ·73128, and at 15° C. ·71888 or ·71890 at 60° F. According to a table of specific gravities of various mixtures of absolute ether and alcohol of Sp. G. ·820, the official ether of the B.P., which is of the Sp. G. ·720, would contain 1 per cent. alcohol, and that of the Sp. G. 735, about 13 per cent. Dr. Squibb does not find the general statement that one volume of ether will dissolve in 10 volumes

of water to be correct. His experiments give one in 11·1 even at a temperature of 25° C. The tests for alcohol in ether he does not find satisfactory. Admixture with an equal volume of copaiba or carbon bisulphide is not sensitive to ·1 per cent., while the test with fuchsine is really not a test for alcohol at all, and for water is too sensitive for practical use. Hager's modification of Lieben's test is considered the best, but for very accurate determinations requires great care, and even then the results are not absolutely certain. In reference to Dr. Squibb's experiments, it may be noted that absolute ether for anæsthetic purposes is commonly sold in England at a specific gravity of ·717 at 60°F.

MONTHLY RECORD OF GENERAL RESEARCHES IN ANALYTICAL CHEMISTRY.

On the Determination of Urea.—By J. F. Eykman.—Rec. trav. Chimie. 3, 125-136. The author acts upon 10 c.c. of the urea solution (containing about ½ per cent.) with 50 c.c. sodium hypobromite 5 c.c. Br and 150 grm. Na to the litre) and 10-15 c.c. sodium hydrate. The mixture is boiled until (5 c.c. have distilled over; and the evolved nitrogen is collected in a graduated tube over mercury and sodium hydrate containing a little pyrogallic acid; the apparatus is similar to the one used for the estimation of nitric acid by means of ferrous oxide. According to the author's experiments, a mixture of 50 c.c. alcoholic bromine, 10 c.c. sodium hydrate, and 20 c.c. water contain 0·5 c.c. dissolved air, and he therefore deducts this amount from the observed volume of nitrogen; the urea calculated from the difference is too low, and has to be corrected by multiplying by $^{100}/_{100-4.44}$. In analysing urine, the latter must be diluted to such a strength that 10 c.c. gives 15-30 c.c. nitrogen.

Determination of Silica in Iron and Steel.—By Herr von Juptner.—Oesterr. Zeitschr. f. Bergu. Hütteuw. 32-559.

In *communication* from the Chemical Laboratory in Neuberg, the author gives a number of analyses to compare the following different methods:—(1) Determination as raw silica (Rohkieselsaure). The iron filings were dissolved in strong hydrochloric acid, the solution evaporated to dryness, digested with hydrochloric acid, warmed, and after dilution, filtered, washed, dried, and weighed. (2) By fusing the raw silica with fusing mixture of carbonates of potash and soda, and determining in the ordinary way. (3) Purification of the raw silica by boiling with strong hydrochloric acid, diluting, filtering, and igniting. (4) By treating the weighed raw silica with hydrofluoric acid, evaporating, and weighing. The loss of weight gave the pure silica. (5) Determination by Brown and Shimer's method. The solution in nitric acid was heated, after adding an equal volume of sulphuric acid until sulphuric fumes were given off.

The mean results obtained by the author are the following:—

	Method 1	2	3	4	5
Raw Iron (*Habirtes Roh. Essen*)	1·68 ..	1·54 ..	1·565 ..	1·50 ..	1·51
Bessemer Plate	0·049 ..	0·0378 ..	0·0372 ..	0·0317 ..	0·0372

The differences among the first three methods are easily accounted for by the specialist. Regarding the 4th method, the reason of the results being low is that the

impurities of the raw silica were converted into fluorides, which are heavier than the corresponding oxides. The last method is especially to be recommended for cases where the manganese is also to be determined (by Volhard's method).

SEPARATION OF ARSENIC FROM TIN AND ANTIMONY.—By F. HUFSCHMIDT.—Berichte der Chem. Gesell. 14, p. 2245.—THE Author did not obtain favourable results with Fischer's method, (*Ann. Chem., Pharm.*, 208, 128), which consists in forming the volatile arsenic trichloride, by means of ferrous chloride, and distilling. His experiments show that much better results are obtained when the arsenic is distilled in a stream of hydrochloric acid, it being possible to separate all the arsenic in one distillation. The solution to be examined is made up to 250 c.c. with concentrated hydrochloric acid, and than distilled in a rapid current of the gas. The volatility of the arsenic is, however, so great that a receiver is not sufficient to retain it; and the author has, therefore, been obliged to use a modification of Fischer's apparatus. The receiver is connected with a Woulff's bottle capable of holding about 900 c.c.; this is filled with either 300 — 400 c.c. of water, or an equal quantity of potash (1·1 — 1·2 sp. gr.) To prevent overflowing, the delivery-tube, 28 cm. long and 11 mm. in diameter, which dips 10 — 15 cm. into the potash. The bottle must be cooled during the operation, as it easily becomes heated. It is not necessary to distil more than 100 c.c.; all the arsenic is then to be found in the Woulff's bottle, but not a trace of tin or antimony.

The results are equally good whether an arsenious or arsenic solution be used. The following are some of the author's experiments:—

ARSENIC AND ANTIMONY.

Pure metallic Antimony was oxidised with nitric acid, evaporated, and the residue, together with the arsenious acid, washed with hydrochloric acid into the distillation-flask; the latter was then filled up to a mark, indicating 250 c.c., saturated with hydrochloric acid and distilled.

Taken		Found		Difference.	
As_2O_3	Sb.	As_2O_3	Sb.	As_2O_3	Sb.
·4960	·0743	·4964	·0742	·0004	·0001
·0967	·3796	·0969	·3793	·0002	·003

ARSENIC AND TIN.

(*a*) Arsenic as Arsenious acid.

Taken		Found		Difference.	
As_2O_3	Sn.	As_2O_3	Sn.	As_2O_3	Sn.
·1482	·1530	·1481	·1522	·0001	·0008

(*b*) Arsenic as Arsenic acid.

As_2O_5	Sn.	As_2O_5	Sn.	As_2O_5	Sn.
·1040	·1050	·1043	·1048	·0003	·0002

A TEST FOR ARSENIC.—BY H. HAGER.—Pharm. Centralhalle, XXV. No. 45, p. 527.—IF a small quantity of a solution of sodium thiosulphate be added to a hydrochloric acid solution of arsenic, a yellow precipitate of As_2S_3 is obtained. In this way the

arsenic can be detached in a solution of $^1/_{1500}$ dilution. The formation of the arsenic sulphide is assured if to 3-5 c.c. of the arsenic solution 2-5 drops of the sodium thiosulphate be added. By warming (to 80°-90° C.) it may be obtained free from, or with very little, sulphur, so that its yellow colour is not hidden.

QUANTITATIVE ANALYSIS BY ELECTROLYSIS.—IN the latest number of the *Berichte der Berliner Chemischen Gesellschaft* is a long and interesting paper by Alex. Classen on Electrolytic Quantitative Analysis. The author first describes the process in general; and gives a number of methods for the separation and estimation of the different metals. A short abstract of the paper will doubtless be interesting to English readers; for the author maintains (B.B14. 2771) that the methods are simple and rapid, and allow of even greater accuracy than the ordinary gravimetric ones.

The batteries used are either galvanic cells (Meidinger, Leclanché, or Daniel's) or thermo-electric elements. The Meidinger, which supplies a constant current for a considerable time, can only be used in isolated cases, such as the precipitation of copper, bismuth, and cadmium, as the current is too weak for a quantitative separation of most metals from their double oxalates. The negative electrode, on which the precipitation takes place, is a thin platinum dish, weighing about 35-37 grms. 19 cm. in diameter, 4.2 cm. deep, and holding about 225 c.c. water. It is absolutely essential that the dish be perfectly clean and free from fat before use; or else the precipitated metal will not adhere to it. Dishes which have, in course of time, become rough and scratched cannot be used.

DETERMINATION OF COPPER AND CADMIUM.

These metals are separated out quantitatively from their double ammonium oxalate salts. To obtain a sufficiently weak current two Bunsen elements, in compound circuit (so as to act like one cell), are used. From 10-12 hours are required for the separation of about 0.15 grm. Cu or Cd. The end of the reaction may be detected by testing a drop of the copper solution with a fresh solution of potassium ferrocyanide.

SEPARATION OF COPPER FROM IRON.

The author used iron-alum and cupric sulphate in his experiments. To the solution of the two salts ammonium oxalate is added in excess; it is then electrolized as above. To determine the iron in the solution free from copper, a few grammes of ammonium oxalate are added, and the solution electrolized with two Bunsen cells.

Copper is separated from nickel, cobalt, magnesium, aluminium and phosphoric acid in the same way.

DETERMINATION OF ANTI MONY.

Antimony can be precipitated in the metallic state from a cold solution, containing ammonium sulphide in excess. Sundry slight precautions have, however, to be taken; the ammonic sulphide must contain neither free ammonia nor polysulphides; and the antimony must not exceed 0.2 grm. To ascertain whether the reaction be complete, the dish is tilted so that the liquid comes into contact with a fresh surface of platinum; if, after a quarter of an hour, the surface still remain clean the antimony is all precipitated.

Determination of Tin.

To the neutral solution, ammonium sulphide is added, it is then considerably diluted with water and electrolized with two Bunsen cells.

Determination of Platinum.

The platinum salt is slightly acidulated with sulphuric or hydrochloric acid (or ammonium oxalate is added), and electrolized while gently warming. It is best to use only one Bunsen cell, for the separation takes place too rapidly with two. The author adds that the inaccuracy of the determination of potassium as potassium platinic chloride is notorious; and therefore proposes for accurate determinations of potassium, ammonium and nitrogen the precipitation of platinum by electrolysis of the double salts, especially as its separation requires less time than that requisite for drying the platinum compounds.

Separation of Iron from Cobalt.

To determine both metals, the solution of the double oxalates is electrolized by Bunsen's elements. A few c.c of a potassium oxalate solution (1.3) are added, and, according to the quantity of the substance taken, 2-4 grms. ammonium oxalate; the whole is then warmed and electrolized. The operation requires from 3-5 hours. The iron and cobalt having been weighed together, they are dissolved in dilute sulphuric acid, and the iron titrated with permanganate solution. To compensate for the colour of the cobalt sulphate, nickel sulphate is added.

Iron and nickel are determined in the same way.

Separation of Iron from Zinc.

By electrolysis of the double oxalates. The results are only good when the zinc is less than one-third of the iron; for if more be present, it redissolves.

The author gives a large number of results which have been obtained, with the electrolytic methods, in his laboratory; to judge from these, the process certainly deserves all the praise he bestows upon it.

F. H. H.

Bonn, 21st November.

CURIOSITIES IN FOOD ANALYSIS.

An esteemed correspondent (F.R.S.) has forwarded to us a copy of the International Health Exhibition Handbook on "Public Health Laboratory Work." He specially calls our attention to the portion on, "The Work of the Hygienic Laboratory," by Dr. Corfield and Mr. Charles E. Cassal, F.I.C., F.C.S., and freely expresses his opinion thereon. We do not publish his letter or all the extracts he has suggested, because the latter are too lengthy and the former is somewhat strong. We, however, reprint from the work some annotated paragraphs for the delectation of our readers, who may not have advanced so far towards perfection in analytical chemistry as the authors of the work. In doing so we have taken the liberty of using italics to emphasize the lessons conveyed, and we trust that what is meant as instruction will not be made a matter of amusement, or carped at by wicked scientists like our correspondent:—

(1.) *Expense no object in analysis, and ability to easily lift from* 60 *to* 180 *lbs., a useful qualification.*—"The volume of a good-sized bottle of from *two to six litres* capacity, and provided with a well-fitting stopper, may be taken by carefully filling it with *mercury* and then measuring the volume of the mercury by pouring it into a glass measure." (*Page* 54.)

(2.) *Advances in the Chemistry of Arsenic.*—"If a *very large quantity* of air containing *arsenic* be drawn through a tube heated to redness by a gas flame, a 'metallic mirror,' or ring of *metallic* arsenic will be formed in the tube, which is recognizable by its peculiar crystalline structure and by other tests." (*Page* 60.)

(3.) *A really definite standard for water at last.*—"It should be clearly understood that in all these processes it is *necessary* to adopt certain standards for guidance. In the case of albuminoid or organic ammonia, for example, the limit 0·15 *parts per million*, meaning thereby 0·15 parts of ammonia (grammes, ounces, &c.), yielded on distillation by one million parts (grammes, ounces, &c.) of water, has been fixed upon as the result of experience. Pure water, known to be uncontaminated, not yielding more than this amount, and polluted waters *not yielding less.*" (*Page* 68.)

(4.) *An addition to our previously known Poisons.*—"The metals which may be present in drinking-water, and which have to be considered as regards their poisonous action are lead, copper and iron." (*Page* 69.)

(5.) *Interesting facts about Milk Analysis and striking instance of Organic Combustion in really competent hands.*—"For example, the chief *proximate* constituents of milk are: Water, fat, caseine, milk, sugar, mineral matter (including common salt and phosphate of lime); the principal *ultimate* constituents being the elements oxygen, hydrogen, carbon, nitrogen, calcium, phosphorus, sodium and chlorine. The isolation on the determination of the respective total quantities of the *ultimate* constituents of such a substance as milk is a *comparatively easy matter*, but we do not thereby obtain *very much* information as to its value as a food, or as to the purity or non-purity of a particular sample of it, such information being rather obtained by a study of its proximate constituents." (*Pages* 71 *and* 72.)

(6.) *A way of taking Fat in Milk.*—"A weighed quantity of the substance, which may previously require some preparation as in the case of milk, from which the *larger* part of the water must first be removed, is digested with ether at the boiling temperature of that liquid. (*Page* 74.)

(7.) *A really scientific way of estimating alcohol, to say nothing of its practical convenience, especially in summer.*—"The distillate having been received in a flask, fitted *air-tight* to the end of the condenser, is made up to the same volume as the volume of liquid experimented on (100 c.c. or more, as the case may be) with distilled water. The specific gravity of this distillate at 0° c. (32° *Fahrenheit*) is then accurately taken in a specific gravity flask." (*Page* 78.)

Here we will stop (the number seven being a strictly orthodox one), and we trust that this introduction of a little of the light literature of science may not be distasteful to our readers. As to the bearing of all this upon the proposal to constitute this "Hygienic Laboratory" in perpetuity, we shall have some words to say in an early issue.

REVIEWS.

A Course of Qualitative Chemical Alalysis. By the late *W. G. Valentin*, revised and corrected by *W. R. Hodgkinson, Ph.D., and H. M. Chapman*. London: J. and A. Churchill.

In the former Editions of Valentin's Qualitative Analysis the undoubted value of the book was obscured for general students, by the exceedingly copious use of constitutional formulæ. In the present edition this drawback has been modified to a great extent, and the formulæ and equations given are such as to be easily grasped by any ordinary student. There can be no doubt of the care with which Messrs. Hodgkinson and Chapman have done their work, and on careful perusal we have been struck by the freedom from *errata*, and from the unreliable reactions too often introduced in such works. The acid course is extremely good, and is a real one, worthy of the name of a course, and the preliminary examination with sulphuric acid, so important from a practical point of view, is fully entered into. We also find special instructions for the analysis of insoluble cyanogen compounds and silicates. The general portion of the book occupies 240 pages, and following that we have 43 pages devoted to the rare metals, and the whole concludes with a set of illustrations of spectra. To sum up the merits of the book in a single sentence, we say that it is one of the best works of English origin on the subject of *general* mineral Qualitative Analysis at present before the public, and does its present revisers the utmost credit. When the constitional formulæ (which are really out of place in a strictly practical book) are altogether removed, it will become all that can be desired.

Tablets of Chemical Analysis. By *Armand Semple, B.A.* London: Baillière's "Students' Aids Series."

It is a great pity that the compiling of these tablets was not left by the proprietors of the "Students' Aids Series" in the hands of a practical analytical chemist. We do not doubt that following the course laid down for bases, the student may eventually come to the right conclusion, but the same effect might be produced in an infinitely more simple manner. Take, for instance, the second group, and keeping in remembrance the fact that the book only deals with one base and one acid, we have a direction to distinguish Hg from Bi and Cu by the action of boiling hydrochloric acid on the group precipitate (if black), involving, of course, filtration and washing. Then, again, although PbS is specially mentioned as a possible constituent of the precipitate, we have no confirmation for lead given. Now, it appears to us, that any practical analyst getting a black with H_2S insoluble in NH_4HS would simply take a little of the original solution and settle at once whether it was Pb by adding a drop of dilute H_2SO_4 and then finish the affair by the action of KHO to distinguish between Hg, Bi and Cu in a manner which we advise the author to try. Again, in the third group, the examiners who want to catch a man crammed upon these tablets, have only to give him calcium phosphate and upset the whole affair. The acid course is wisely not called a course in "steps" but in "trials," and it would be there the candidate's "trials" would, in our opinion, begin. There are no directions for the proper preparation of the solution so necessary before acid testing, and the very first "trial" with $AgNO_3$ lands the unhappy student

in a maze of fifteen possible acids. It is astonishing that with so many real acid courses at his hand in other works, the author should not have adopted one of them where the absence of certain acids are properly assured, and all those capable of giving odours or appearances with H_2SO_4 are first of all put out of the question or readily detected and specially confirmed in the original solution. We are sorry to be unable to commend this portion of the Series.

AIDS TO PUBLIC HEALTH. By *J. L. W. Thudichum, M.D.* London: Baillière's "Students' Aids Series."

THIS is an addition to a set of cram books, very justly popular among medical students. That anything more than the merest sketch of the subject could be given within the compass of 50 short pages is of course absurd, but what is done is well and tersely expressed. In a word, the book is more an index to what to read than an actual work on the subject. As such it will doubtless sell and fulfil its mission.

THE ASSAY AND ANALYSIS OF IRON AND STEEL, IRON ORES AND FUEL. By *Thomas Bayley, Author of "A Pocket Book for Chemists."* London: Emmott and Co., and E. and F. N. Spon.

IT must at once be admitted that this is an exceedingly useful little book, as it gives the pure and simple processes well and shortly described, and divested of undue verbiage. The matter it contains was originally contributed by the author to the *Mechanical World*, but is now extended and improved. The system is to give in large type the process for each determination as tested and approved by the author, and then to add, in smaller characters, all those processes which have from time to time been published by other workers in the same line. That, although in small compass, the work is really an exhaustive monograph, will be at once apparent when we state that, commencing with the preparation of the specially pure reagents required for such work, it takes us through the estimation of manganese, phosphorus, silicon, sulphur, graphite, tungsten, carbon, chromium, titanium, slag, oxygen, nitrogen, &c., all in iron and steel. It then deals with iron ores, and finally, with the analysis of fuel. There are found a compendious set of recent analyses of such typical steels as those used by Krupp, by the Russians, the Swedes, and in our own Royal Gun Factories, not to mention the products of Landore and the British Iron Co. There are fifteen illustrations, and in a word, the subject is well exhausted. This book will be found a very useful one by all interested in the important industry with which it deals.

THE ALKALI-MAKERS' POCKET-BOOK. By *G. Lunge, Ph.D.*, and *F. Hurter, Ph.D.* London: George-Bell & Sons, York Street, Covent Garden.

THIS book is the outcome of Dr. Lunge's work, under the auspices of the Committee, formed some time ago, by the German Alkali-Makers' Society, to decide upon fixed processes, specific gravity tables, and standards generally, to be recommended for universal use by all the members in the analysis and valuation of the various chemicals with which they deal. It is, as it were, the first attempt at the establishment of a manufacturers' pharmacopœia, intended to hold good until officially revised at a future date. Only one definite process is selected in each case, and no question of choice or detail is left to the

judgment of individuals. Commencing with 70 pages of useful tables, the book devotes a similar space to the analysis of such articles as fuel, pyrites, salt cake, manganese ore, limestone, lime, bleaching powder, potassium chlorate, black ash, soda ash, nitrate of soda, chloride and sulphate of potash, gas liquor, ammonium sulphate, furnace gases, &c.; concluding with rules for sampling and for making standard solutions. It is a work which must of necessity find a place on the shelves of every chemist dealing with the subject.

CORRESPONDENCE.

[The Editor is not in any way responsible for opinions expressed by his Correspondents.]

To the Editor of "The Analyst."

Sir,—I can bear witness to the ferrocyanide test for zinc spoken of by Mr. Allen in this month's Analyst, having used it for some years. I believe it was shewn me by a friend, who had come across it in testing a water for iron. I am in the habit of applying it directly to the water in the presence of excess of hydrochloric acid, and I believe it is slightly more sensitive in this form than where chloride of ammonium is used in a neutral solution. A solution of zinc was prepared, containing one part in 200,000, with five per cent. of ammonium chloride; after half a minute or so a cloud appeared, the solution was then divided into two parts, and to one of them a little hydrochloric acid was added; after a further interval it was observed that the latter solution was distinctly the more turbid. On one occasion, having peroxydized iron with permanganate before using the ferrocyanide test for that metal, I observed, after a short time, a white cloud, which I afterwards found was due to manganese. Since the appearance of Mr. Allen's paper, I have further investigated this reaction, and find that in a five per cent solution of chloride of ammonium it is extraordinarily delicate, a strong and immediate turbidity appearing in solutions of manganese containing only one part per million. I do not find this test, which seems to be of much value as a negative one, in any of the text-books. Since making my experiments I have looked back through my file of the *Chemical News* to the original paper of Mr. Allen, and I find that there he mentions ferrocyanide as a test for manganese, but the precipitate in that case is a coloured one, and he gives no data as to delicacy. I think, therefore, that my observation is worth recording.

Yours, &c.,

Shrewsbury, November 8th, 1884. THOMAS P. BLUNT.

To the Editor of "The Analyst."

Sir,—In the extract on the "Determination of Arsenic," given in The Analyst for November, there is evidently a misprint.

In the example given the amount of As_2O_3, taken for the experiment, is stated to be 0.1814 grm., and the amount of iodine solution required for the final titration is given as 38·9 c.c.

If, as would appear, the iodine solution were decinormal, the corresponding amount of As_2O_3 would be 9·1925 grm., theory requiring 0·1814.

The 38·9 c.c. iodine solution is given as equal to 0·1323 grm., compared with 0.1330 required by theory.

Calculating the arsenic the quantities would be 0·1458 As. found and 0·1374 required by theory.

Southampton, November 10th, 1884. I am, yours, &c., J. BRIERLEY.

To the Editor of "The Analyst."

Sir,—Having in the practice of my profession observed that exhibitors of unpatented inventions, at International and Industrial Exhibitions, are not generally aware that their position is affected by certain provisions of the "Patents, Designs, and Trade Marks Act, 1883." I beg to point out through the medium of your paper that the six months' protection of Inventions so exhibited is no longer accorded unconditionally, such protection being now obtainable only by compliance with the requirements stated in Section 39 of the above mentioned Act, and Rule 17 of the Patents Rules.

Details of the mode of procedure may be obtained from the proper official sourcet of information, without charge, on application. I am, Sir, your obedient servant,

W. T. WHITEMAN, Fellow of the Institute of Patent Agents.

BOOKS, &c., RECEIVED.

Aids to Public Health, by J. L. W. Thudichum; The Assay and Analysis of Iron and Steel, by Thomas Bayley; Inorganic Chemistry, by Frankland and Japp; Report (forty-second) of the Legislature of Massachusetts relating to the Registry, edited by Frank Wells, M.D.; Statutes of Massachusetts, relative to the adulteration of Food and Drugs; Tablets of Chemical Analysis, by Armand Semple; American Druggist; The American Garden; American Grocer; The Brewers Guardian; British Amercan Journal; The Chemist and Druggist; The Cowkeeper and Dairyman's Journal; The Grocer; The Grocers' Gazette; Independent Journal; Invention and Inventors' Mart; The Lancet; The Medical Record; Medical Press and Circular; The Pharmaceutical Journal; San Francisco News Letter; Science Monthly; Scientific American.