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The Analyst,

INCLUDING THE PROCEEDINGS OF

THE "SOCIETY OF PUBLIC ANALYSTS."

A MONTHLY JOURNAL OF ANALYTICAL CHEMISTRY.

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THE ANALYST.

THE ANALYST appears, primarily, as the organ of the "Society of Public Analysts," and, secondly, as the representative of Analytical Chemists in general.

The Society of Public Analysts is still in its infancy, but at a very early period of its existence it became manifest that a literary organ of some kind was essential to its success.

Under these circumstances, and in the very early days of the existence of Public Analysts as a corporate body, an experiment (purely temporary) was made of utilising the columns of an established Chemical Journal, for the purpose of reporting the proceedings of the Society.

It was found, however, as the Society enlarged its borders, that as Public Analysts unfortunately could not entrench themselves within the quietude which ought to obtain in a Laboratory, but had occasionally to appear in Police Courts, a merely technical journal did not supply a sufficiently expansive vehicle for the communication of matter which, though not scientific, was of vital interest to Public Analysts as such.

Hence the object of THE ANALYST is not only to present to its readers the latest and best authenticated processes of analysis as they are perfected, but to publish all cases of prosecution for adulteration, and such parliamentary and other proceedings as may appear to touch the interests of Analysts in general.

This is, at all events, the task we propose to ourselves, relying upon the loyal co-operation of all Analysts.

THE SOCIETY OF PUBLIC ANALYSTS.

On the 15th inst. an Ordinary Meeting of the above Society was held at the Cannon Street Hotel.

Mr. Wanklyn, Vice-President, occupied the Chair.

There was a numerous attendance of members, and the interest of the Meeting was enhanced by the presence of an unusually large number of visitors.

After the ordinary routine business had been transacted the following resolution was put from the Chair:—

"That the name of Professor A. G. Anderson be removed from the roll of members of this Society, and that the Secretaries be directed to inform him of such removal and announce the fact in the Society's journal.

A ballot was taken and the Resolution was carried unanimously.

The Scrutineers appointed to examine the voting papers, announced that the following gentlemen had been elected.

Member—Mr. J. W. Thomas.

Associates—Messrs. S. T. Clothier, Francis Heron, L. de Koningh, E. Lapper, H. G. D'Arcy Power.

A Paper on the Determination of Quinine was read by Mr. Allen, and another on the Analysis of Butter was read by Dr. Muter.

Each Paper led to a lengthened discussion, and the Meeting did not terminate till a late hour, three other Papers being held over.

The announcement by Mr. Wigner of the early appearance of the first number of THE ANALYST was received with applause.

NOTE ON THE EXAMINATION OF WHISKY AND OTHER SPIRITS, FOR METHYLATED SPIRIT AND FOUSEL OIL.

BY A. DUPRE, Ph.D. F.R.S.,

Read at an Ordinary Meeting of "The Society of Public Analysts" held on Feb. 16th, 1876.

A.—EXAMINATION FOR METHYLATED SPIRIT.

Now and then we hear of a whisky supposed to be adulterated with methylated spirit. I myself have had several such suspected whiskies to examine, but failed to detect such an adulterant. My belief is that such adulteration is extremely rarely if ever practised, and that most, if not all, of the cases reported, are based on an error in analysis.

Under these circumstances, I have thought it might be of interest to other analysts to describe the method I have adopted for some time past, for testing spirits suspected of being adulterated with methylated spirit. Five fluid ounces of the suspected spirit are distilled twice, having been rendered alkaline the first time, and acid the second time, about two-thirds being distilled over each time. The distillate is now shaken up with dry potassium carbonate, and after standing over night, the upper layer is taken off by a syphon or pipette, and again twice distilled, about half-an-ounce being driven over this time. This last half-ounce will be found to contain any methylic alcohol present in the original five ounces.

All the distillations should be conducted in an apparatus having the receiver connected air-tight with the condenser, and furnished with a mercury valve, allowing of expansion and contraction of the air, but preventing loss by evaporation during the distillation. About one-third of this distillate is now diluted to a strength of from 10 to 15 per cent. by the addition of distilled water, or 70 fluid grains are made up to about 500. In this diluted spirit the alcohol is now determined. 1st, by specific gravity; 2nd, by means of Geissler's vaporimeter; and 3rd, by oxidation into acetic acid, and volumetric estimation of the latter.

With pure alcohol, all three methods give results which should agree to within at least one-tenth of a per cent. If, however, any appreciable amount of methylated spirit is present, the results will differ more or less widely.

The specific gravity will give the total amount of both alcohols present, the specific gravity of aqueous methylic and ethylic alcohols being almost identical. Geissler's vaporimeter will, however now give another result, the higher the more methylic alcohol is present, this alcohol having a lower boiling point than ethylic alcohol, or at the same temperature a higher vapour tension.

On the other hand the oxidation process will yield a lower result, since the methylic alcohol, when completely oxidised by sulphuric acid and potassium dichromate, yields only water and carbonic anhydride, which of course is not estimated volumetrically. This process will therefore indicate only the ethylic alcohol present in the mixture, and the difference between the strength thus found and that derived from the specific gravity, gives a rough indication of the proportion of methylic alcohol present.

When pure aqueous alcohol is oxidised in this manner in a closed flask, it will be found, on opening the flask after cooling, that if anything a slight vacuum has been produced in the flask. If, however, any appreciable amount of methylic alcohol is present, it will be found that on opening the flask a slight escape of gas takes place, owing to the carbonic anhydride produced.

For details of the method of oxidation, I must refer you to the work on wine by Dr. Thudichum and myself (page 207). Should the presence of methylic alcohol be indicated by this process, the remainder of the half-ounce may be employed for confirmation by other tests, such as production of methyl-aniline-violet, or oxalate of methyl. The method however, will I think be found valuable chiefly as yielding very strong negative evidence, and when once one gets accustomed to it it is very easily worked, much more so than might perhaps appear from my description of it.

In conclusion I will give two experiments showing the working of the process.

Firstly. A pure whisky, when treated as above, gave the following results for the diluted final distillate :—

Strength by specific gravity.....	9.83 per cent.
" " vaporimeter	9.75 "
" " oxidation	9.75 "

A portion of the same whisky was now adulterated with 10 per cent. of ordinary methylated spirit, and again tested. The final diluted distillate now gave :—

Strength by specific gravity.....	10.08 per cent.
" " vaporimeter	10.45 "
" " oxidation	9.50 "

The differences between the three estimations are, as will be seen, so great, that we are justified in concluding that as small an addition as 2 or 3 per cent. of methylated spirit would be distinctly recognisable, and that at all events, as much as 5 per cent. could not possibly be overlooked.

B.—TESTING FOR FOUSEL OIL.

From time to time, a certain amount of commotion is produced in the public mind, by alarming statements regarding the presence of fousel oil in spirits, and its alleged maddening effect on consumers of such spirits, and analysts have even been found certifying certain spirits to have been *adulterated* with fousel oil. Now in the first place I am not aware that any perfectly trustworthy evidence exists of the alleged injurious effects of fousel oil, and secondly I believe it is utterly absurd to suppose that any spirit is ever in any proper sense of the word, *adulterated* with fousel oil. Nevertheless the subject is an interesting one, and as I have not seen any process described for the detection and approximate estimation of small quantities of fousel oil, such as are usually found in spirits, I venture to bring the following method, which I have employed for years past for the purpose, before this society, without wishing to claim any special novelty for the process.

Fousel oil as is well known, consists of a mixture of various of the higher homologues of ethylic alcohol, all or most of which, when oxidised by means of sulphuric acid and potassium dichromate, yield their corresponding acids and these latter are much more readily separated than the alcohols.

Upon this fact the method is based. An amount of spirit containing from one to two grammes of alcohol, previously distilled if necessary, is oxidised in a closed flask by means of sulphuric acid and potassium dichromate, care being of course taken to have an excess of this mixture in the flask. I usually digest the mixture in the flask for two hours in a water bath.

When cool the flask is opened, the excess of dichromate present reduced by zinc, and the acids produced are distilled off (see the work previously quoted). The acid distillate is now neutralized with a standard solution of normal soda, the solution is

evaporated to a small bulk and transferred to a retort. An amount of normal sulphuric acid equal to one-twentieth of the normal alkali used is now added, and the contents of the retort are distilled to dryness in an oil bath; the temperature being allowed to rise to about 130° C. Water is now added and a further addition of one-twentieth proportion of normal acid is made, after which the contents are again distilled to dryness. These two distillates may be collected separately, but I prefer to collect them together. It is advisable to add some water to the dry residue in the retort, and again distil to dryness repeating this addition of water and distillation three times after the second addition of acid. The acid distillate which contains all the acids higher in the series than the acetic acid, together with a proportion of this latter, is now neutralised by means of pure carbonate of barium, the solution is boiled, filtered, evaporated to dryness, the residue dried at 130° C. and weighed.

The amount of barium contained in the salt is now estimated in the usual way by conversion into the sulphate. We now have the necessary data for calculating the amount of fousel oil contained in the spirit under examination, on the assumption that it consists either in amylic alcohol or of any other alcohol that may be supposed to be the chief impurity present. The real amount present cannot of course be obtained without a knowledge of the exact nature of the acids produced, but even this can be accomplished according to Ducloux (compts. rénd. lxxviii. p. 1160), by submitting the mixture of acids to fractional distillation, and estimating the proportion of acid which goes over with each fraction.

In conclusion I will give the analyses of a few spirits by the foregoing process.

A sample of Scotch whisky, strength 54·5 per cent. by weight in volume was found to contain 0·108 per cent. amylic alcohol (Ba in $\frac{1}{10}$ acid 53·49 per cent.)

The same spirit submitted to a process of purification gave no trace of fousel oil. (Ba in $\frac{1}{10}$ acid, 53·73 per cent.)

A sample of "Cape Smoke," strength 35·75 per cent. by weight in volume was found to contain by weight in volume 0·089 per cent. amylic alcohol. (Ba in $\frac{1}{10}$ acid, 53·39 per cent.)

A sample of common "Samsho," strength 21·51 per cent. by weight in volume, contained 0·04 per cent. amylic alcohol. (Ba in $\frac{1}{10}$ acid 53·46 per cent.)

A sample of fine "Samsho," strength 24·49 per cent. by weight in volume, contained 0·033 per cent. amylic alcohol (Ba in $\frac{1}{10}$ acid 53·42 per cent.), calculating in each case the proportion of amylic alcohol to 100 ethylic alcohol we get:

Scotch Whisky for 100 ethylic	0·19	per cent.	amylic alcohol.
Cape Smoke	"	"	0·24 " "
Common Samsho	"	"	0·18 " "
Fine	"	"	0·13 " "

A brief discussion ensued.

SOCIETY OF PUBLIC ANALYSTS.

DATES of Meetings in the present year:—

May 3rd. June 14th. November 15th.

We have great pleasure in announcing that the above meetings will, by the courtesy of "The Chemical Society," be held in the MEETING ROOM of that Society, Burlington House, Piccadilly, W.

ON THE ANALYSIS OF BUTTER.

By DR. JOHN MUTER, F.C.S.

Read at an Ordinary Meeting of the Society of Public Analysts, held March 15th, 1876.

BUTTER differs from all other fats inasmuch as it contains a notable proportion of fatty acids other than oleic, stearic, palmitic, and their congeners. If we analyse the pure glycerides of these latter acids we obtain, by the taking up of three molecules of water during saponification and subsequent liberation of the acids, amounts which almost exactly approximate themselves to theory. There is no process in the whole range of analytical chemistry more accurate in the hands of those who know the importance of never trusting to the eye to decide whether vessels &c., are free from fat, but of invariably drying every article used and extracting any fat with ether. If precision is to be attained, the principles of mineral analysis must not be applied. Fat precipitates cannot be treated as if they were barium sulphate, and expense in the shape of such articles as ether and absolute alcohol must not be spared. I am entitled to put this point strongly before public analysts, because of the experience in fats possessed by myself and my assistants owing to our having been specially thrown into this branch of analysis some years ago. Unfortunately, with a laudable desire, no doubt, to introduce simplified processes, Messrs. Angell & Hehner have touched dangerous ground, and proposed the washing of fatty acids on a filter, with hot water, taking it for granted that, because no fat was visibly coming through, they could manipulate thus in safety. I will venture to say however, that every one of the few chemists who have been called upon to work in fats for commercial or scientific purposes, would agree with me that such a process is in the highest degree dangerous. Not only should fatty acids never be trusted out of the vessel in which they are precipitated until they are finally transferred to the weighing capsule, but also every rod, beaker, and even the filter paper used to pass the washings, should be dried and extracted with a suitable solvent. Mr. Angell himself, evidently feels the difficulty, because in his book he gives a special instruction that "great care must be observed in the washing." I hold that processes requiring such delicate care are not suitable for use under a penal statute; and, indeed, I go further and say, that with even the highest precaution, a constant loss of at least 5 centigrams to 1 decigram is made in every analysis on this principle, using 5 grams of fat. By accurate methods, such as it will be my aim to point out in this paper, the following pure glycerides can be so nearly analysed to theory as to be made to show:—

Tristearin	95.70 per cent.
Triolein	95.52 "
Tripalmitin	95.27 "

and no process of washing on a filter ever could come within, at the nearest, half a per cent. of these results, except by an accident. A very striking case in point is afforded by Messrs. Angell & Hehner. After giving analyses of tallow, lard, and cocoa butter (the latter two being, by the way, about .5 per cent. short of the ordinary yield), they introduce an analysis of palm oil, in which they admit a deficiency, but fancy that it is accounted for by colouring matter. Now palm oil is a specialty of ours, one of my staff having for six months done nothing else almost, and I can assure you that there is no palm oil in the market yielding so low an amount of fatty acids by at least 2 per cent. Indeed it is a fact that commercial palm oil always yields over theory owing to free acidity, and the most highly coloured samples give no appreciable loss of weight when

the colour is destroyed by heat. Here, therefore, is the decigram loss in 5 grams plainly manifest.

Besides the glycerides already referred to, butter contains tributyrin in considerable proportion, with small traces of tricaproin and tricapyrin. I have not yet sufficiently separated these traces for estimation, as their fractional liberation from barium is very troublesome; but of this much I am certain, that they are only present to a very small amount. That this is so may be proved by supposing a butter to yield 88 per cent. of insoluble acids (oleic, stearic, and palmitic, the latter two being present in the proportion of the so-called margaric acid of older writers). This will represent 92.14 per cent. of glycerides, leaving 7.86 for glycerides of the soluble acids. If the latter were all tributyrin it would give a soluble acidity of 6.88, but in practice this does not come out. Taking a butter yielding an amount nearly like 88, we have—

Insoluble acids	.....	87.96	equal to	92.10	glyceride
Soluble acids (as butyric)	.....	6.72	,,	7.69	,,
		94.68	,,	99.79	total glyceride
Total	.....			

thus showing a deficiency of about .2 per cent. owing to the traces of higher soluble acids. The difference thus shown may be disregarded, as, although a little variable, it always comes within .7 per cent. Calculating therefore always as butyric, we come to this fact—that no analysis of butter can be held to be complete unless both the soluble and insoluble acids be estimated, and they come, when added together, within a fair range of 94.8, allowing for possible experimental errors to, say, the extent of .3 to .5 per cent. in either direction.

The process I adopt for the full analysis of butter is as follows:—

(1) 1500 grains of the butter are placed in a counterpoised porcelain dish, over a very low gas flame, and stirred with a thermometer at a heat not exceeding 230° F. until all the water is driven off, which is indicated by effervescence entirely ceasing, and the curd and salt settling perfectly down to the bottom of the dish, leaving the absolutely clear melted fat. The whole is then cooled and weighed, and the loss calculated to percentage of *water*. This is the only method of absolutely and rapidly drying a fat, and the large quantity taken ensures a more perfect estimate of the true amount of water in the sample. I have proved by careful experiment that the temperature of 230° has not the slightest influence on butter fat.

(2) Another portion of the butter is melted at a gentle heat, and poured off, as far as possible into a beaker, without disturbing the sediment. The remainder is poured on a weighed filter, placed over a beaker in the drying chamber, and, when all is through, the basin and filter are rinsed with petroleum spirit to remove all traces of fat, and the filter being dried and weighed gives *curd* plus *ash*.

(3) The filter after being weighed is placed in a weighed platinum crucible, and gently ignited. This gives *ash*, called *salt* in the report.

(4) The fat poured off from (2)—which ought generally to be about 1200 grains—if absolutely clear, is at once used for physical and chemical examination; but if *not* perfectly free from specks it must be filtered through a Swedish filter kept hot on the water bath. The processes necessary are, the taking of the specific gravity of the fat at 100° F., and if that gives an adverse indication, the estimation of the total fatty acids of the butter fat both soluble and insoluble.

FIRST.—The “*Actual Density*” at 100 deg. F.—This process was first publicly described by Mr. Bell, of the Inland Revenue Laboratory, in the Southwark Police Court. As employed by him, however, the results do not appear to be those of actual density, nor do I consider that the precautions to ensure accuracy are quite sufficient, considering the rapid expansibility of melted fats by heat. I will give his process in his own words: “The fat is taken out of the water bath and poured into the bottle until it is filled up to the neck. One person then takes the bottle, and another the residue of the fat, and both are brought to exactly 100° F., when the bottle is filled from the residue and stoppered in the usual way.” Now I have tried this method, but I find that, supposing the fat to be taken from the bath at, say, 200°, and each person cools his portion to 100°, then the pouring in and stoppering will frequently, by a little want of care, cause the bottle to be closed when a part of its contents has gone below the 100, to the extent of 2°; because when fat is taken at 100° “on the fall,” it will lose a degree of heat almost in a few seconds. At all events, the process can never be absolutely certain within one or two grains on the 1000 grain bottle. The results he gave in court embrace a range from 909·00 to 905·00, and these at once show that the actual density is not indicated.

I take the actual density of a fluid to be the weight of any given volume of it, as compared with that of an equal bulk of distilled water at the same temperature. Bell’s results compare butter at 100° with water at 60° to 62° F., and are not therefore actual densities; and I submit, that to get the true advantage of inequality of expansion, the water and butter must both be taken at 100° F. The process I adopt is as follows:—

A 1000 grain bottle is procured with a rather pear-shaped neck, and fitted with a thermometer stopper ranging from 32° to 140° F. The long mercurial bulb comes exactly down the centre of the bottle, and the scale is up above the stopper. The bottle is placed on the balance, and an accurate counterpoise prepared for it. It is then filled with recently boiled distilled water, at 95° F. The stopper is inserted, and the whole at once plunged up to the neck into a 12-oz. squat beaker partially filled with distilled water at 103° F. in which is placed a thermometer. As the temperature rises in the bottle, the water leaks out at the stopper, and in a few minutes (if the quantity of water in the beaker be properly regulated), a time arrives when the temperature of both thermometers equalize themselves at 100°. The joint between the stopper and the bottle is instantly wiped with a small piece of filter paper to absorb loose water, and the bottle is lifted out, thoroughly cleansed and weighed. By repeating this three times the actual contents of the bottle at 100° F. is obtained, and the weight taken, before a fall of more than 5° takes place. At first I let the bottle cool to 60° so as to avoid currents; but I found it was better in practice to weigh at once, and quite as accurate. This weight of water is scratched on the bottle with a diamond, and all is ready for the butter. The pure butter fat, prepared as already described, is taken from the bath and cooled to 95° F., it is then poured into the bottle, and the whole operation repeated *thrice*, exactly as with the water, and the mean of the three weighings thus obtained is divided by that of the water. The contrivance of having a “*rising*” fat heated by a “*falling*” water until the two equalize, is the height of accuracy, and moreover gives an appreciable rest in the variation of the temperature sufficient to enable the excess of fat which has leaked out to be removed exactly at the required temperature.

Mr. Bell stated in court that there was an analogy between the specific gravity and the per-centage of insoluble fatty acids, and here he is correct. The following are some of the figures he has given compared with the true results found by full analyses, the worst of which came to within .5 of the truth on the whole addition:—

Mr. Bell's "Gravity" at 100 deg. compared with water at 60 deg.	Mr. Bell's comparative fatty acids working by the filter process and without the check of a full analysis.
909.00	85.30*
908.00	86.45
907.40	86.87
906.52	87.50
906.18	87.85
905.75	88.30
905.32	88.75
905.00	89.15
The "Actual Density" at 100 deg. as compared with water at the same temperature.	The actual insoluble acids found submitted to the check of full analysis
.91382	87.47
.91346	87.89
.91337	87.98
.91290	88.48
.91286	88.52
.91276	88.62
.91276	88.61
.91258	88.80
.91246	89.00

The whole nine examples by my process are corresponding to butters between 908 and 907 by Mr. Bell's gravity, and the results show a much higher and more regular per-centage of fatty acids. The regular loss on the filter process I have already referred to, is strikingly manifested by the following comparison. I happened to have a butter which gave .91286 actual density, corresponding exactly to 907.4 of Mr. Bell's gravity, and, we see by the filter washing, Mr. Bell makes that show 86.87, while on full analysis by my process it shows 88.52, or as nearly as possible the decigram in five grams difference, as seen in the palm oil experiment.

While therefore we must admit the great correspondence of the density and acids when both are properly taken, it is to be noted that the moment you come to mix butter with other fats the whole thing is upset for quantitative purposes. The fats used for butter mixing are some of them of an "actual density" of .90659 (dripping) to .90294 (vegetable "butterine,") and therefore all we can say as regards specific gravity is that if a butter shows anything over .91100 "actual density," it may safely be passed over without further analysis as being good.

SECOND.—*The Total Fatty Acids.*—About 10 grams (or 150 grains) of the butter fat at 100° F. are weighed by difference from a suspended tube into a clean dry 15 ounce flask, and 5 grams of Potassium Hydrate, with 2 fluid ounces of rectified spirit are added. The flask is placed in a basin with hot water, and kept boiling for a considerable time, until on adding water not the faintest turbidity occurs. Ten ounces of water are added, and evaporation continued (just short of boiling) until all traces of Alcohol are dissipated. The contents of the flask are then made up to 7 ounces, with nearly boiling water, and a good fitting cork having been introduced, through which just passes a tube 2 feet long and ending in a small funnel, 5 grammes of full strength

* This result is an extraordinary instance of the filter process. No such butter is to be found in nature.

Sulphuric Acid are poured in down the tube followed by some water. The whole is then agitated with a circular motion until the soap, which rises suddenly, is changed into a perfectly clear and transparent stratum of fatty acids. The flask and contents are then cooled down to 40° F., till a perfectly solid cake of fatty acids forms. A few drops of cold water are run in to wash the tube, and the cork having been removed, a small piece of fine cambric is placed over the mouth of the flask, held *in situ* by an ordinary India rubber ring. The fat cake is caused to detach itself from the sides of the flask by a gentle movement, and then the filtrate is decanted, without breaking the cake, into a litre test mixer, with a good stopper. About an ounce of cold water is poured into the flask through the cambric, and the whole cake and flask rinsed out by gently turning round, and the washings added to the filtrate. Six ounces of water at 120° are now added through the muslin, which is then quickly detached, and the cork and tube inserted. The whole is again heated, this time to 200° , and kept constantly agitated with a circular, but not a jerky, motion for five minutes. This agitation so divides the fat that it almost forms an emulsion with the water, and is the only means of thoroughly and rapidly washing fatty acids without loss. In practice no Butyric Acid comes off at 200° , but any trace that might do so, is caught in the long tube. The cooling and filtering are then again proceeded with as above described (the filtrate being added to the contents of the test mixer), and the washings are repeated alternately cold with 1 ounce, and hot with 6 ounces of water, until they do not give the slightest change to neutral litmus. After thoroughly draining the residual cake by letting the flasks stand upside down for some time, the cambric is removed and the flask is laid on its side in the drying oven, with a support under the neck, until the acids are thoroughly fused, when they are poured while hot into a tared platinum capsule, dried and weighed. The film of fatty acid still remaining on the flask is rinsed out with ether, and dried in a small weighed beaker, and the weight added to the whole. If any drops of water be observed under the fatty acids in the capsule after an hour's drying, the addition of a few drops of absolute alcohol will quickly cause them to dry off. If any trace of fat is on the cambric it should be also dried and extracted with ether, but with care not to break the cake at the last pouring off, this does not occur.

The process is absolutely accurate, and the merest tyro cannot make any loss so long as he does not deliberately shake the melted acids against the cork, which he could not do if he practises a circular agitation while washing.

The filtrate in the test mixer is now made to a definite bulk of 1 litre, and in 200 c.c. the total acidity is taken with a weak solution of sodium hydrate. The solution I generally use represents $\cdot 01$ of $N H^3$ in each c.c., as it serves also for nitrogen combustions; but a useful strength would be decinormal soda, containing $\cdot 004$ $Na H O$ in each c.c. The acidity found is multiplied by five, calculated to $H^2 SO^4$ and noted as "total acidity as $H^2 SO^4$ ": 100 c.c. are next taken, and precipitated with barium chloride in the presence of a strong acidulation, with hydrochloric acid, well boiled and washed by three decantations, boiling each time; and, lastly on a filter, till every trace of soluble barium is removed. The precipitate is dried, ignited, and weighed as usual, multiplied by ten, and calculated to $H^2 SO^4$, and noted as "total sulphuric acid." Lastly, 100 c.c. are evaporated to dryness over the water bath in a tared platinum dish holding 120 c.c., and furnished with a cover of platinum foil, also tared. When dry the dish is covered and heated over a bunsen till all fumes cease, and a fragment of pure ammonium carbonate

having been added, the whole is again ignited and weighed. The amount of potassium sulphate found is multiplied by 10 and calculated to H^2SO^4 , and noted as "combined sulphuric acid." The rest of the calculation is obvious to any analyst, but I give an example:

Ten grammes taken.	
Total acidity as H^2SO^4	0.814
Total H^2SO^4	4.9
Combined H^2SO^4	4.4
4.9 — 4.4 = .5 free H^2SO^4	
0.814 — .5 = .314 acidity due to butter acids stated as H^2SO^4	
.314 × 176	
Then ————— = .564 butyric acid in 10 grammes taken which equals 5.64 per cent.	
98	

By this means we get the soluble acids indirectly by processes which are the every day work of nearly all commercial analysts.

I have only to remark that the barium sulphate should always be washed very carefully, and seeing that it regularly weighs a little over a gramme, it is advisable to boil up with dilute hydrochloric acid after ignition and see that the clear liquid gives no cloud with sulphuric acid.

The following may be taken as fair specimens selected from a great mass of results by my process, and as a proof of the almost impossibility of error we have the check given by the totals found. I may also state, that another fact which speaks well is, that I have taken the same sample, one to two months apart, without getting one-tenth per cent. variation in the amount of insoluble fatty acids.

I.—A rich butter which by theory from the density should yield

Soluble acids	7.05
Insoluble acids	88.8
	94.85

was analysed twice and in each analysis two determinations of sulphates were made.

	1st Analysis.		2nd Analysis.	
Soluble acids	6.92	6.89	6.85	6.93
Insoluble acids	87.86	87.86	87.87	87.87
	94.78	94.75	94.72	94.80

II.—A poor butter showing by theory from density 88.8

	Theory.	Practice.
Soluble acids	6.10	5.77
Insoluble acids	88.80	88.95
	94.90	94.72

III.—A butter showing from density 89—

	Theory.	Practice.
Soluble acids	5.94	5.76
Insoluble acids	89.00	89.10
	94.94	94.86

IV.—A sample of butter purchased at the same shop and same price as the Southwark disputed butter, and showing a similar amount of insoluble acid—

	Theory.	Practice.
Soluble acids	2.09	1.98
Insoluble acids	93.30	93.30
	95.39	95.28

V.—A sample of Belgian "Butterine," from vegetable fat—

	Theory.	Practice.
Soluble acids	0.00	0.23
Insoluble acids	95.60	95.50
	95.60	95.73

These are only a few of the mass of results I have, which I have selected to show my views of the composition of butter. They are each examples of a special class. No. I. being a first-class Aylesbury butter. No. II. an old low-class Dutch butter, kept six months, until quite unfit for food. No. III. a butter which had lost all character, and was not distinguishable from a piece of tallow, although genuine Friesland eight months ago. No. IV. was evidently two-thirds foreign fat; and No. V. was all vegetable fat, and the two-tenths per cent. of soluble acids are an experimental error.

I intend, if able to spare the time, to return to the subject at our next meeting, and answer the questions (1) What is the average composition of natural butter? and (2) How far may the butter be affected by time? as it would take me too long now to quote the many results I have. In the meantime, I may say that I have every reason, from my experiments, to take 88 as a *fair standard of butter calculation*, if associated with at least 6.3 of soluble acids. But I would not apply any charge of admixture to a butter which showed less than 89.5 insoluble with 5 soluble. You will notice that I give the standards of calculation and condemnation differently, and I think this is the proper way, because if a butter really more than passes the utmost possible limit of the article, even when rendered quite unsaleable by decomposition, the admixture being then definitely proved, should be calculated on the fair ordinary standard. This is a point which has been rather lost sight of in milk, and I think we should consider it in fixing any fresh standards. As to any great change in butter by time, calculated to invalidate the results of the standards I have given, I believe that when the supporters of that theory get rid of the filter-washing of fats, they will find apparently enormous changes were due to the fact that now and then by chance they fully estimated their acids. They will also, I think, find, except in the very height of summer, a butter with less than 87, a natural curiosity. It is worthy of note that as soon as admixture steps in, the total acids rise above 95 per cent. I have to thank my chief assistant Mr. De Koningh, an associate of this Society, for his accurate work in the practical portion of my researches.

In the discussion which ensued—

Mr. Otto Hehner said that it was evident that the results obtained by Mr. Angell and himself prior to the publication of their book, were too low in the percentages of fatty acids. Their experience, at that time, led them to assume a standard of 85.85, but they found since that 87 per cent. was the correct proportion. He considered that Dr. Muter's method of obtaining and estimating the volatile acids was a complete confirmation of the process which they had introduced, while, at the same time, he admitted the superior accuracy of Dr. Muter's method of manipulation.

Dr. Dupré took exception to several statements in the paper, and urged the following points:—

FIRST.—That the specific gravity of the melted fat should be compared with water at 60° F, or 62° F, or at 4° C.

SECOND.—That the method of heating the fat to the required temperature was not, in his opinion, sufficiently refined. He considered it necessary to keep it at the temperature in a water bath for at least ten minutes before weighing, in order to ensure accurate results.

THIRD.—The thermometer, he considered, should have an elongated bulb, reaching through nearly the entire length of the specific gravity bottle.

FOURTH.—That the loss on the basin and beaker used in the experiments which he had made on Hehner and Angell's process, was less than that found by Dr. Muter.

FIFTH.—That the mode of estimating the volatile acids was difficult, and three different estimations entering into the calculation, was more liable to error.

SIXTH.—The plan described by himself (Dr. Dupré), at the previous meeting, namely heating the butter fat with water in a closed tube to 500° F, at which temperature it breaks up into soluble and insoluble fatty acids and glycerine, the first of which can be readily estimated by standard alkali or conversion into barium salt, or secondly by heating butter fat in a closed tube at 500° F. with a standard solution of alkali, afterwards adding a corresponding amount of standard acid, separating the insoluble fatty acids, and estimating the remainder of the acid by deci-normal soda solution, which acid of course corresponds to the soluble acid produced by the butter fat.

SEVENTH.—That the butter should be melted for some hours before taking the fusing point, and that this should, in every case, be taken on a rising temperature.

Mr. Wanklyn stated that in his experiments he has found traces only of butyric acid, and Dr. Dupré's experiments, which seemed to give different results, showed a loss in the total of more than 4 per cent. He had been led to the conclusion that the amount of butyric acid increased with the age of the butter.

Dr. Dupré pointed out that this loss only occurred in his earlier experiments, when the silver tube leaked, but in his more recent ones, which he should shortly lay before the society, the loss rarely exceeded $\frac{1}{2}$ per cent.

Mr. Allen fully agreed with Dr. Muter's method of stating the specific gravities and also with his directions to dry at 230° F., instead of 212°.

Mr. Turner agreed with Dr. Muter as to the difficulty of washing, and pointed out that the so-called alcohol process which had been associated with his name was really a process which had been applied to the analysis of butter for a number of years past.

Dr. Stevenson said that his experiments led him clearly to the opinion that the fatty acids increased in amount as butter became stale.

After a few other remarks Dr. Muter, in replying, pointed out that he had estimated the free acidity of butter six months old and did not find it exceed .2 per cent., which was within the limits of variations of samples. He also pointed out two other alternative methods of indirect estimation of the soluble acids. (1) Neutralizing with volumetric potash and then evaporating, igniting and taking the alkalinity of the residue, and (2) a method which he now understood had been previously mentioned by Dr. Dupré, using a standard alcoholic alkali for saponification, and afterwards standard acid for separation of the fatty acids. The objections as yet to these two ways seemed to be (1) the tendency of neutral potassium sulphate to decrepitation and consequent loss, and (2) the difficulty of presenting a standard solution in spirit from rapidly altering in strength.

NOTES ON THE DETECTION OF ALUM IN FLOUR AND BREAD.

By J. ALFRED WANKLYN, M.R.C.S.

THE want of a method for the estimation (or even of the detection) of the sulphuric acid which forms part of the alum put into flour and bread has been felt by analysts.

Owing to the existence of sulphur in gluten to the extent of about one per cent., sulphuric acid makes its appearance in the ash obtained on calcining flour and bread, and, as I have shown, the sulphuric acid of the alum is overwhelmed by that naturally present

in the ash of flour and bread. It is, therefore, to no purpose to make estimations of the sulphuric acid in the ash of alumed bread.

From some experiments recently made in my laboratory, I have been led to seek for the sulphuric acid in the cold aqueous extract of flour.

The major part of the mineral matter of flour goes into the cold aqueous extract, whilst the total weight of the extract is only some five per cent. of the flour. Before determining the sulphuric acid in the extract I coagulate the soluble gluten and remove it by filtration.

RETAILING MILK IN THE STREETS.

THE question has arisen in more than one instance recently, whether an itinerant vendor of milk can be fined for refusing to serve an inspector under the Food and Drugs Act, or, in other words, whether a milkwalk may be considered either "premises," or "a shop," or "stores," and whether a house-to-house delivery of milk involves "exposure for sale."

To those interested in the question, we commend the following extracts from two letters, addressed respectively by the Home Office and the Local Government Board, to the Wandsworth Board of Works, in reply to an application from that body for an authoritative interpretation of the law.

Mr. Cross, says that "having consulted the chief magistrates of the Police Courts of the Metropolis, he is of opinion that Sec. 7, of the Act 38 and 39. Vic., cap. 63, "applies when a vendor 'exposes to sale,' *anywhere*, or *has on sale* by retail in any shop "or stores." 'He,' however, recommends that a case be stated for the opinion of one "of the High Courts of Justice."

The Local Government Board, referring to a case in point, say: "If the milk was "retailed at the corner of the street to all passers by, it was exposed for sale, and such "exposure may perhaps be held to bring the case within the statute, but if it was being "delivered from house-to-house, the case may be different."

The Board however recommend, that "before any amendment of the existing law is proposed, the judgment of the High Court of Justice should be obtained."

THE PREPARATION OF THE FERROUS PHOSPHATE OF THE PHARMACOPŒIA.

By REES PRICE.

(*Pharmaceutical Journal*, 3rd Series, No. 297. 1876.)

MR. REES PRICE'S experiments appear to show that the Pharmacopœia process of making ferrous phosphate by means of ferrous sulphate, sodic phosphate, and sodic acetate, is one which may be attended with a loss of one-fourth of the phosphate of iron, and that by using instead of acetate of soda, or acetic acid, an excess of phosphate of sodium, no loss occurs. He therefore suggests as a substitute for the process of the British Pharmacopœia the following:—

Granulated Ferrous Sulphate.....	224 grains
Sodic Phosphate	660 "
Cold distilled water	12 ounces.

A. W. B.

DR. LETHEBY.

We have to announce with extreme regret—a regret which will be shared by our readers—the death, somewhat suddenly, of Dr. Letheby. He had been unwell for some weeks, his complaint being, we believe, inflammation of the lungs; but he was expected to be present as a scientific witness in a case at the Richmond Petty Sessions on the 29th inst. At the last moment, however, a telegram was received notifying his decease.

Dr. Letheby was too well known in the chemical world, to require any lengthened obituary notice at our hands.

We may however, mention, that he was an early Member of the Chemical Society; that he took his M.B. degree in 1843, became Ph.D., and M.A. in 1858; that amongst the numerous appointments which he had held, were those of Medical Officer of Health and Public Analyst for the City of London; and that he was the author of numerous scientific and hygienic works. He died in his sixtieth year.

แผนกห้องสมุด กรมวิทยาศาสตร์

A NOVEL READING OF THE SALE OF FOOD AND DRUGS ACT.

At Westminster, Henry Fielding, a milkman, of 15, Lower Symonds Street, Chelsea, appeared in answer to an adjourned summons, charging him with selling, to the prejudice of the purchaser, some milk which was not of the nature, substance, and quality demanded, Mr. Pemberton, barrister, appeared for the prosecution; and Mr. Smyth, solicitor, for the defendant. The adulteration was not in dispute, but the summons being under the 6th section of the Adulteration of Food Act, and the inspector admitting that he purchased it solely for the purposes of analysis, it was asked whether the sale was to the prejudice of the purchaser. Mr. Pemberton said that if he proved that the article was not only different from the article demanded, but inferior in quality, the purchaser was prejudiced and an offence committed. Mr. Smyth said it was his duty to submit that the complainants had not proved their case. The proceeding was under a penal statute, and he was quite sure the magistrate would look at the statute strictly and give effect to it strictly. The word "prejudice," now appeared for the first time in an Adulteration of Food statute. He contended that it was introduced to enable any person buying food *bona fide* to have it analyzed, and to prevent an army of informers springing up. Mr. Pemberton contended that the purpose for which the article was bought was no part of the inquiry. Mr. Arnold said he could not tell what the Legislature intended by the words; but, as they were in the Act, they must have some meaning. Mr. Pemberton said that if any one paid more for an article than it was worth, it was to his "prejudice." Mr. Arnold said it was a very nice point and required consideration. He had read the Act very carefully since he had adjourned the case, but he should like to consider the matter further, as he was much struck by Mr. Pemberton's argument that the prejudice of the purchaser must mean a loss to the pocket of the purchaser. He should adjourn the case and consider his judgment. Another summons, in which the same principle was involved, was also adjourned.—*Times*.

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THE ANALYST.

ORGANIZATION AMONGST CHEMISTS.

The importance of some organization amongst actual practising Chemists (as distinguished from amateur and theoretical ones) whereby really efficient men may acquire a status which the public can recognise, and thus be able to know, with some amount of certainty, whether in cases of importance, the person consulted is really a Chemist of ability or only a Chemist self-styled, has long been recognised, and lately has led to a considerable amount of discussion amongst Chemists who, as part of a body, have suffered in reputation from the absurd blunders of a number of empirics who have usurped the name of Chemist.

That such an organization, if fairly formed, would be productive of the best results cannot be denied, and it is, therefore, with considerable regret that we learn, as we go to press, that a meeting is being called for the purpose of considering the subject, the invitations to which appear to have been issued on some principle of selection, to which we have not got the key. We have received some correspondence on the subject from Chemists of acknowledged position who have not been invited, but in the present embryo state of the question we think it wiser to withhold it.

ON THE DETERMINATION OF QUININE.

By A. H. ALLEN, F.C.S.

Read at a Meeting of The Society of Public Analysts, Feb. 16th, 1876.

BEING desirous of testing the accuracy with which prescriptions were dispensed in Sheffield, I recently had some mixtures made up of which Sulphate of Quinine was the principal constituent, solution being effected in the usual way by the addition of dilute sulphuric acid, and the mixture being sweetened by an admixture of simple syrup.

One of the prescriptions was arranged to contain 2 grains, and another 5 grains per ounce, of Sulphate of Quinine.

The method adopted for the estimation of Quinine in the above mixtures, has no claim to novelty, but experience having shown it to possess certain advantages, and to be susceptible of very considerable accuracy, besides being applicable to the estimation of quinine under a variety of circumstances, I have thought it worth while to record my results in detail.

In brief, the method employed consists of the concentration of the solution to a small bulk, addition of ammonia in moderate excess, agitation of the liquid with ether, and removal and evaporation of the ethereal solution.

The concentration of the solution appears to be of secondary importance except with regard to the economization of ether.

As a rule, I prefer to manipulate on 200 to 250 fluid grains (12 to 15 c.c.), of solution, concentrating the liquid to about that bulk if necessary. The concentrated liquid is introduced into a long tube or cylinder, of a capacity of about 800 or 1000 gr., furnished with a tightly fitting cork or stopper.

Enough ammonia is then added to leave a distinct odour of the gas, and then a volume of ether about equal to that of the liquid already in the tube. The cork or stopper is inserted, and the tube vigorously agitated for a minute or two. When brought to rest, the ether and aqueous liquid usually separate rapidly. (Separation is often facilitated by cooling the tube in a stream of water. In warm weather this precaution should always be taken, to prevent loss of ether from the ebullition which sometimes occurs spontaneously on opening the tube). If the separation is difficult or imperfect, it may be induced with certainty by a further addition of ether and subsequent agitation.

When the separation of the ether and water* is complete, the former is removed by a pipette† to a small weighed beaker, and the latter is shaken up with a further quantity of ether in a similar manner. It is seldom necessary to agitate with ether a third time, the amount of Quinine thus extracted being rarely weighable.

The ethereal solution of the Quinine when evaporated to dryness on a water-bath, leaves the alkaloid in a solid weighable state.

I at first supposed that the Quinine obtained by the evaporation of the ethereal solution, would exist as trihydrate ($C^{22} H^{22} N^2 O^2 + 3 H^2 O$); the precipitate by ammonia being stated to possess that composition. Further research, however, has conclusively proved this assumption to be erroneous, as the following experiments show.

A sample of Howard's Sulphate of Quinine was completely analysed. The water was determined by drying at 110 deg. C., the sulphuric acid was precipitated as $Ba SO_4$, and the quinine was determined by the above described process, viz.: addition of ammonia and agitation with ether. It was conclusively proved that agitation of the ammoniacal solution with ether removes the *whole* of the Quinine, the aqueous liquid showing no fluorescence when strongly acidified with sulphuric acid, and giving no green colour with the bromine and ammonia test.

The Sulphate of Quinine in question gave the following results. For convenience of comparison, I have also stated the percentage composition of crystallized sulphate of quinine, containing 7 H^2O , and 8 H^2O . The freshly prepared salt is *said* to contain 8 H^2O , but practically that amount of water is not met with, owing to the rapid efflorescence which occurs.

It will be seen that the sample in question gave results agreeing very closely with the composition of the 7-atom hydrate. (See Table foot of next page.)

The mean of the indirect estimations of Quinine, obtained by subtraction of the sum of the percentage of water and sulphuric acid from 100.00, is 3.31 per cent., less than the mean of the direct estimations by agitation with ether.

The known hydrates of Quinine have the following percentage composition as compared with the residue from the ether.

		Quinine.	Water.
Trihydrate	$(C^{20}H^{24}N^2O^2 + 3 H^2 O)$	85.71 per cent.	14.29 per cent.
Monohydrate	$(C^{20}H^{24}N^2O^2 + H^2 O)$	94.74	5.26
Ether Residue	... ..	95.72	4.28

* Cinchonina and other alkaloids insoluble in ether, are indicated here at the junction of the two fluids, as described by Mr. W. W. Stoddart. Magnesia partially remains as a flocculent precipitate in the aqueous solution.

† The pipette should be furnished with a piece of narrow india-rubber tubing, so as to allow the eye to be brought into a convenient position for observing the progress of withdrawal.

It will be seen, therefore, that the ether residue contains about one per cent. less water than corresponds to the monohydrate.

In two of the above estimations of Quinine, the alkaloid was determined by concentrating the filtrate from the sulphate of barium precipitate, adding ammonia and shaking with ether. In the other cases the quinine was determined in separate portions, cane sugar being added in two instances. Of the three experiments giving upwards of 77·9 per cent. of residue, one was made in the BaSO⁴ filtrate, and two in separate quantities, of which one contained sugar.

It appears, therefore, to be fully established that the ethereal residue is of constant composition, approximating to that of the monohydrate of quinine. Crystallized sulphate yielding 77·59 per cent. of residue, the amount of the former can always be found by multiplying the weight of the residue by $\frac{100\cdot00}{77\cdot59}=1,289$.

If the quinine sulphate has undergone efflorescence of course the amount will be over-estimated. The crystallized salt is liable to lose water till it approximates to the composition of a 4-atom hydrate. If the salt used have really this composition, and the ether residue be multiplied by the above factor, the calculated factor will be 106·6 per cent. of the true amount. It is evident, therefore, that the results are liable to be in excess of the truth.

As an example of the accuracy of which the process is capable in practice, I may quote the following results obtained from the analysis of a sample of sulphate of quinine which had been very much exposed to the air, and which, therefore may be assumed to have possessed a composition approximating to that of the 4-atom hydrate. Unfortunately neither the water nor sulphuric acid was actually determined. It will be observed that most of the estimations were made on very small quantities, and that the substance obtained is of less weight than the substance sought, instead of greater weight, as is usual in analysis. The addition of a large excess of ammonia was not found to affect the accuracy, and equally good results were obtained by the use of soda. A considerable quantity of cane sugar was added to the solution in each case.

	Water.	H ² SO ⁴	QUININE.	
			Calculated.	Found.
(C ²⁰ H ²⁴ N ² O ²) 2H ² SO ⁴ + 8H ² O (=890)...	16·18	11·01	72·81	
(C ²⁰ H ²⁴ N ² O ²) 2H ² SO ⁴ + 7H ² O (=872)...	14·45	11·24	74·31	
Experimental Results:—				
1	14·18	11·35	...	77·93
2	14·41	11·30	...	77·92
3 ... ..	...	...	...	77·14
4 ... ..	...	...	...	77·45
5 ... ..	...	...	...	77·05
6 ... ..	...	...	...	77·73
7 ... ..	...	...	...	77·91
Mean	14·395	11·325	74·28	77·59

DETERMINATIONS OF SULPHATE OF QUININE IN SOLUTIONS CONTAINING MUCH CANE-SUGAR.

Exp.	Quinine Sulphate taken.	Ether Extract.	= per cent.	× 1.289 = 7 atom hydrate.	× .938 = 4 atom hydrate.
1	2 grains	1.61 grains	80.5	103.7 per cent.	97.3 per cent.
2	2 "	1.66 "	83.0	107.0 "	100.4
3	3 "	2.49 "	83.0	107.0 "	100.4
4	10 "	8.21 "	82.1	105.9 "	99.3
5	3 "	2.47 "	82.3	106.2 "	99.6
6	3 "	2.49 "	83.0	107.0 "	100.4
7	3 "	2.51 "	83.6	107.7 "	101.0
Mean.	.....	.....	.....	106.36 per cent.	99.71 per cent.

The above are *all* the determinations of quinine which were made on the sample in question. Experiments 1, 2, 3 and 5, were made with a very large excess of ammonia; experiment 4 with a slight excess. In experiment 6 soda was substituted for ammonia. In experiment 7 a large excess of sulphuric acid was employed to dissolve the Quinine, and the solution was evaporated until considerable charring of the sugar had occurred. The ether residue was somewhat coloured.

The above results clearly show that the method is fairly accurate, and the results remarkably constant, considering the small amounts employed in each experiment.

Of six mixtures containing sulphate of quinine and simple syrup, which were made up by druggists in Sheffield from a physician's prescription in the usual way, four were found by the above process to contain the prescribed amounts within reasonable limits of variation, while in two, the amounts of sulphate of quinine found were respectively about $\frac{3}{4}$ and $\frac{2}{3}$ of the prescribed quantities.

I next tried if the process was applicable to the estimation of the quinine in the citrate of iron and quinine. This preparation is stated in the British Pharmacopœia to yield on addition of ammonia, a precipitate of quinine amounting to 16 per cent. of its weight. There is no mention made of any washing to which the precipitate is to be subjected, and no directions are given as to the mode of drying. As a matter of fact an exceedingly gentle heat causes agglomeration of the precipitate, and prevents its removal from the filter. In consequence of the solubility of quinine even in cold water, even careful washing causes a perceptible difference in the result.

In fine, the Pharmacopœia instructions are very imperfect. On this account, I estimated the total quinine in a sample of Howard's citrate, by precipitating the solution with a slight excess of ammonia, rinsing the precipitate off the filter and evaporating the rinsings and drying the residual quinine at 100 deg. C. The filtrate from the ammonia precipitate was concentrated, and the quinine extracted by agitating with ammonia and ether. In one experiment, the precipitated hydrate of quinine was washed with cold water, in the other it was left entirely unwashed. The results were:—

	Unwashed.	Washed.
Precipitated Quinine	17.71 per cent.	15.13 per cent.
Ether-residue from filtrate .....	.83 "	1.32 "
" " washings	none	
	-----	-----
	18.54	16.45

According to the above results this sample of citrate comes up to the British Pharmacopœia standard of yielding 16 per cent. of precipitated quinine, if the precipitate be left unwashed, but washing brings it below the proper amount. Two experiments were made by treating a strong solution of the citrate with excess of ammonia, and then agitating with ether in the usual way, when I obtained 16.35 and 16.40 per cent. of ether residue, a result which shows a very close accordance with that previously obtained. The ether process is remarkably easy of execution in the case of the citrate of iron and quinine, not requiring more than some twenty or thirty minutes for its completion, and I think it would advantageously replace the present unsatisfactory and badly-detailed Pharmacopœia process.

I have also tried the applicability of the ether process to the determination of the Quinine in the official wine and tincture, but the results were somewhat in excess of the truth, owing to the presence of foreign matter of the orange taken up by the ether.*

On the whole, it is evident that the ether process is capable of giving results which, under favourable circumstances, are strictly accurate, and in others it leaves the quinine in a convenient and nearly pure state for further examination. As my object was primarily to effect the accurate determination of quinine in the presence of sugar only, I have not worked out exhaustively the problem of estimating it in complex liquids, and have rather aimed at the determination of the *total alkaloid* present than that of the actual *Quinine*, as distinguished from other cinchona bases.

My acknowledgments are due to Mr. L. N. Lean who has given me valuable assistance throughout the investigation, and has personally performed many of the manipulations.

DISCUSSION.

Dr. Muter said that certainly the process employed by Mr. Allen was a good one, and he had had considerable experience of it. It was a process invariably taught in the South London School of Pharmacy, as the best method of separating the alkaloids from scale preparations, with this difference, that there chloroform is preferred to ether; because with ether quinine and quinicine only are extracted, whilst with chloroform you also get cinchonine and quinidine. This is important, as the chemist might have used unwittingly quinine containing cinchonine. Instead of weighing the ether residue in estimating quinine he considered it preferable to either get it as a definite neutral sulphate, or to precipitate it as herapathite, the latter being very constant in composition, one part dried at 212 representing .565 of quinine. In the examination of orange wine for quinine, the acid liquid should be first washed with ether, which removes matters soluble in that liquid other than alkaloids. He had frequently applied this process to the detection of quassine and gentianine in supposed pure quinine bitters. The agitation of the acid solution with ether or chloroform, as a rule, separates bitter principles and glucosides, and as far as he knew only one alkaloid, viz. colchicine, comes out to ether in the presence of an acid. A process of titration for the estimation of emetine in ipecacuanha is given in his (Dr. Muter's) book on *Pharmaceutical Chemistry*, which is very rapid and simple, and might be easily applied also to quinine in a mixture.

* The discussion on the paper having elicited valuable suggestions from several chemists, respecting the determination of the alkaloid in the wine and tincture of quinine, I think it better to reserve the further description of my experiments till I have had the opportunity of supplementing them.—A.H.A.

Dr. Stevenson said that some time ago when investigating the strength of quinine wine, he had successfully used the process of precipitation by ammonia, and extraction with ether, as described by Mr. Allen. The wine was merely boiled so as to drive off, the alcohol, and not concentrated to such an extent as the author of the paper had described; but four or five shakings with ether were practised. Dr. Stevenson had found that by using a quinine salt of known composition, and calculating on the assumption that the ether residue was a monohydrate, satisfactory results were obtained. Indeed, he thought he had seen it stated on good authority that the ether residue was a monohydrate of quinine. There was some doubt respecting the true formula of disulphate of quinine. The B.P. assigns to the salt 7 molecules, the French codex, $7\frac{1}{2}$ molecules, and the U.S. Pharmacopœia, 8 molecules of water. It was doubtful whether the salt contained usually 7 or $7\frac{1}{2}$ molecules of water, and it appeared to be pretty certain that it did not contain 8 molecules. The commercial article is perfectly dehydrated by exposure in the water bath, and contains about 14 per cent. of water as stated in the B.P., but being a very efflorescent salt, the percentage of water might be very much less than the above quantity.

Dr. Dupré enquired if Mr. Allen had tried the volumetric estimation of quinine by means of a standard solution of the double iodide of potassium and mercury, which was said to give excellent results? He congratulated Mr. Allen on the courage he had displayed in raising a discussion on such a subject, remarking that his own experience showed that a considerable amount of adulteration was practised in relation to drugs and medicines (*i.e.*, if the leaving out of an appreciable proportion of the active agent is to be considered adulteration).

He had noticed, moreover, that chemical compounds, such as sulphate of quinine hydrochlorate of morphia, iodide of potassium, &c., &c., were nearly always found to be pure wherever purchased, whereas all compound drugs and medicines which should contain a certain definite proportion of an active ingredient, were frequently deficient in that ingredient, and must therefore be looked upon as adulterated.

Mr. Wanklyn made a few remarks.

Mr. Thomson drew attention to some of the results which he had obtained in the analysis of compound medicines.

In replying,

Mr. Allen said that he made no claim to having originated the process, though he believed the extent to which it was capable of giving accurate results had not been previously investigated. With regard to Dr. Muter's valuable suggestion that accurate results might probably be obtained from the wine and tincture of quinine, by agitating first in an acid solution, he might say that he had observed that quinine was absorbed by ether, from acid solutions (probably as sulphate), to a sufficient degree to vitiate the results; but if chloroform be substituted for the ether, as suggested by Dr. Muter, he had no doubt the desired object would be effected. Mr. Wanklyn's suggestion, that the actual quinine in the ether residue, could be ascertained by titration with standard acid, seemed admirable, especially if some acid soluble in alcohol were employed.* As to the temperature of dehydration of quinine sulphate, he had employed 110 deg. C for the purpose, but it was interesting to learn from Dr. Stevenson, that the salt became anhydrous at 100 deg. C. Mr. Allen did not at all contend for the presence of eight, or even seven and a-half atoms of water in the crystallized sulphate. He had been merely interested

in the water indirectly, and quite agreed that more water than corresponded to seven atoms was not met with in practice. As far as he could ascertain, the existence of the monohydrate of quinine had previously been doubtful, and the dihydrate was apparently entirely new.† For the estimation of the iodide of potassium in the medicines he had recently condemned in Sheffield (and which merely contained aromatic spirits of ammonia in addition), Mr. Allen said he had precipitated one quantity as iodide of silver, after acidifying with nitric acid, and another in the original solution, by ammonio-nitrate of silver. The agreement in the weight of the two precipitates proved the freedom of the iodide of potassium employed from any sensible admixture of chloride, bromide, or iodate.

LIQUOR AMMONIÆ ACETATIS, B.P.,

By J. THRESH, F.C.S.,

(Pharmaceutical Journal, 3rd Series, No. 301, 1876, p. 787.)

MR. THRESH comments upon the varying strength of Liq. Amm. Acet.; he analysed seven samples, three of which were purchased from wholesale, and four from retail chemists, with the following results (No. 1 was prepared by himself, Nos. 5, 6, 7 and 8 were concentrated preparations labelled as stated)—

No.	Re-action.	Sp. Gr.	Action of SnCl_2 .	Per Cent. of Ammon. Acet.
1	Neutral	1·016	No Colour ...	6·9
2	„	1·016	Slight Colour	7·0
3	Strongly Alkaline	1·015	None „ ...	6·5
4	Alkaline... ..	Not taken	None „ ...	4·6
5 (1·2)	„	1·018	Slight Colour	7·9
6 (1·5)	„	1·014	„ „ ...	5·8
7 (1·7)	„	1·011	Deep „ Colour	4·9
8 (1·7)	„	1·015	Slight Colour	6·5

Mr. Thresh thinks that in the next edition of the B. P. the solution should be made with solution of ammonia instead of with carbonate, that the characters, tests, &c., should be added, and that it should be directed to be kept in green glass bottles to avoid contamination with lead.

A. W. B.

PERSIAN OPIUM.

Mr. W. D. Howard [Pharmaceut. Journal, 1876, No. 298, p. 720,] has recently analysed a sample of Persian opium. The *undried* substance yielded—

	Per cent.
Morphine Crystallised from alcohol ...	10·40
Codine (anhydrous)	0·29
Narcotine	2·50
Thebaine	0·57
Cryptopine	0·09
Papaverine	trace

A. W. B.

* Since the above paper was read I have obtained very encouraging results by titration.—A. H. A.

† The description of the elements proving the existence of these hydrates is omitted from the present paper.

THE DETECTION OF THE COLOURING MATTERS OF LOGWOOD,
BRAZIL WOOD, AND COCHINEAL IN WINE,

By A. DUPRE, PH. D., F.R.S.

Read at the Annual Meeting of the "Society of Public Analysts," held January 26th, 1876.

Logwood, Brazil Wood, and Cochineal are said to be frequently used for imparting colour to wine, though I must confess that I have never found them in any wine I have examined. It is however but fair to add that until recently I knew of no, fairly reliable, method for detecting the presence of two at least of the above colouring matters, supposing them to have been added for the purpose of modifying the colour of a naturally red wine. Sorby's experiments have been made with fresh solutions of the colouring matters experimented on, and as these matters when in solution change to some extent in process of time, his experiments cannot be safely used for the examination of a wine without some further investigation. The following simple process, based on experiments made with solutions about a year old, will however, I believe, answer all requirements.

The natural red colouring matter present in wine* is incapable, or almost incapable of dialysis, whereas the above colouring matters dialyse, comparatively speaking, readily. In order therefore to test a wine, we simply set it to dialyse for two or three days when, if it be pure, † a trace only of the colouring matter will be found to have passed through the dialyser, and what little has passed will have the colour of the wine very much diluted. If, however, the wine contains any of the above mentioned colouring matters the water outside the dialyser will be found of a marked yellow or brownish yellow colour, very different from that of the wine inside the dialyser. This solution may now be used for obtaining the chemical, and optical reactions of the colouring matter free or almost free, from the interfering influence of the natural colouring matter of the wine. In the case of logwood and brazil wood, these tests do not yield the same marked and characteristic results in the old, which they yield in the fresh solutions. I will therefore, not attempt to describe them, but would rather advise everyone who intend making such examinations to keep some infusion or tincture of the woods, of known age, in his laboratory, so as to be able to compare their respective reactions directly with the inspected colouring matter obtained from the wine. The colouring matter of cochineal yields however, three well marked absorption bands when its ammoniacal solution is examined by the spectroscope, and by means of these bands the presence of even a small proportion of this colouring matter may be recognized in the wine itself. The portion dialysed, yields these bands however somewhat more sharply. Other colouring matters said to be sometimes employed in the manufacture of wine, may perhaps be separated by similar means, and I hope some members of this Society may be induced to try experiments in this direction. In conclusion, I would remark, that the parchment paper to be used in these experiments, should be of good substance, and that great care should be taken in fixing it over the dialyser so as to prevent the setting up of capillary action between the folds of the paper, by means of which, portions of the contents of the dialyser pass over into the outer vessel producing effects which may be mistaken for true dialysis.

* I have examined Claret, Red Rhine Wine, and Australian Wine, and Port Wine, and have no doubt most other natural Red Wines will behave in a manner similar to these.

† The natural colouring matter of a pure wine will not dialyse, from this however it does not follow that a wine, the colouring matter of which does not dialyse, is therefore pure. The colouring matter from Rhatany Root; for example I find does not dialyse.

ACCURACY IN DISPENSING.

The panic created by the investigation into the manner in which Dispensing Chemists "make up" the prescriptions presented to them, which, in the course of his official duties, Mr. Allen, the Analyst for the Borough of Sheffield, recently instituted, will be fresh in the memory of our readers, but the sequel may not be so widely known. Mr. William Thomson, of the Royal Institution, Manchester, determined to extend the range of the examination which Mr. Allen had commenced, and, with that view, had two prescriptions made up in a large number of towns and cities in different parts of England and Scotland. The results of this investigation, which were necessarily of considerable interest, Mr. Thomson proposed to communicate in the form of a Paper, "On the degrees of Accuracy displayed in the Dispensing of Physicians' Prescriptions by Druggists in different Towns throughout England and Scotland."

This Paper has rather a curious history. It was intended to be read at a Meeting of the Pharmaceutical Society on the 1st of March, and an explicit announcement that it would be so read appeared in the Pharmaceutical Journal of February 26th, but notwithstanding such official notification, the Paper was not read before the Pharmaceutical Society either on the date named or on any other occasion. The reason for the rejection of the Paper was given, somewhat tardily, in the Pharmaceutical Society's Journal of March 11th. It appears that "when the nature of the Paper became known the trivial and insufficient nature of the grounds upon which conclusions were drawn was so manifest, that it was decided not to accept the Paper," even though the acceptance of the Paper had been already officially announced.

Mr. Thomson, however, found an audience if not in Bloomsbury Square, and read his Paper before the Manchester Philosophical Society just a week after it was intended to be read before the Pharmaceutical Society. The strangest point in the affair is, however, that whilst Mr. Thomson's Paper was rejected by the Pharmaceutical Society, and ignored by its organ, the "Chemist and Druggist" published it *in extenso*, having received the manuscript at its own solicitation.

It should be a matter of congratulation to the trade that they possess in the "Chemist and Druggist" an organ which does not fear a fair discussion, but honestly opens its columns to both sides.

POTASSIUM IODIDE.

Mr. Thos. F. Best, F.C.S., [Pharmaceut Journal, 1876, No. 298, p. 720] has analyzed some samples of commercial iodide of potash, and calls attention to the presence of an excess of alkali, chiefly in the state of carbonate.

No. 1 contained	...	per cent.
" 2 "	...	5.44
" 3 "	...	5.35
" 4 "	...	2.32
" 5 "	...	1.78
" 5 "	...	.53

From the author's practical experience he considers that commercially pure iodide should not contain more than from 15 to 20 per cent.

A. W. B.

THE PREPARATION OF DEXTRINE-MALTOSE (MALT SUGAR) AND ITS USE IN BREWING.

BY WM. GEO. VALENTIN, F.C.S., ROYAL COLLEGE OF CHEMISTRY, SOUTH KENSINGTON.

Abstracted from "Journal of Society of Arts," March 24th, 1876.

THE author describes some improvements made by himself and Mr. Cornelius O'Sullivan, in the preparation of a sugar for brewers' use.

In order to show the advantage of dextrine-maltose, the author first dwells upon the composition of malt, showing that by a study of the constituents contained in malt before and after infusion, in connection with those contained in the fermented beer, much additional insight into the brewing process may be gained.

The published analysis of malt are, upon the authority of Mr. O'Sullivan, not to be relied upon.

Oudemans states that malt contains 8 per cent. of dextrine, O'Sullivan cannot find any; again, the amount of sugar is usually set down at from .4 to 1 per cent; O'Sullivan finds from 16 to 20 per cent. About half of this is due to the transformation during the malting process of starchy matter, the remainder of the sugar is ready formed in barley, and differs from the one produced by malting.

The starch of barley contains a carbohydrate of the type having a laevo-rotatory action on polarised light. Kühnemann calls this body "Sinistrin," but from its general character, O'Sullivan is inclined to think that it is "Inulin."

The following table gives the detailed composition of two samples of pale malt, every item of which has been estimated directly and not by difference:—

	Malt No. 1.	Malt No. 2.
Starch	44.15	45.13
Other Carbohydrates (of which 60 to 70 per cent. consist of fermentable Sugars) Inulin (?), and a small quantity of other bodies soluble in cold water	21.23	19.39
Cellular matter	11.57	10.09
Fat	1.65	1.96
Albuminoids—		
(a) Soluble in alcohol of sp. gr. .820 and in cold water	.63	.46
(b) Soluble in cold water and at 68° C	3.23	3.12
(c) Insoluble in cold water but soluble at 68° to 70° C	2.37	1.36
(d) Insoluble at 68° to 70° C, but soluble in cold water (albumin proper)	.48	.37
(e) Insoluble in cold water and at 70° C	6.38	8.49
	13.09	13.80
Ash	2.60	1.92
Water	5.83	7.47
	100.12	99.76

When ground malt is submitted to the mashing process, certain of the albuminoid bodies contained in the malt act upon the starch, and the latter is dissolved.

The wort, therefore, contains the transformation products of the starch, principally dextrine maltose of the other carbohydrates, the soluble albuminoids, the soluble portion of the ash, and a little soluble fat.

Boiling with hops removes a portion of the albuminoids, but the starch products are but slightly altered.

When the boiled hopped wort is subsequently submitted to the action of yeast, the carbohydrates, other than those derived from starch, yield alcohol first, and the portion which is fermentable (60 to 70 per cent.) disappears almost altogether, and there remains in the beer, when the first stage of the fermentation is over, and when it is fit to go into the casks, the alcohol and a portion of the carbonic acid derived from the carbohydrates other than starch, and also from a portion of the products of the transformation of the starch itself, effected by the ferments. Hence the whole of the dextrine, a considerable portion of maltose, the remainder of the albuminoids, the soluble matter of the hop, and a few other constituents are left for after fermentation.

In order to understand the part which the dextrine and maltose play in the after history of the beer, the author examined the constitution of a typical Burton Pale Ale, when the principal fermentation was finished. The sample showed an original gravity of 1063, and gave when finished and ready to be put into casks a distillate of spirit grains .992, equal to 33.7 degrees of gravity lost. The unboiled wort of this beer, supposing it had been brewed from No. 1 malt and reduced to the above specific gravity, viz. 1063, after allowing for concentration on boiling, would contain in every 100 parts by measure the following solid constituents:—

Maltose ...	...	...	...	...	...	...	6.66
Dextrine ...	...	...	...	...	...	...	3.44
Other Carbohydrates, fermentable	...	...	...	...	...	...	3.30
Ditto unfermentable	...	...	...	...	...	...	1.48
Albuminoids ...	...	...	...	...	...	...	1.45
Ash, Phosphates, Sulphates, &c.	...	...	...	...	...	...	0.17
					Total	...	<u>16.50</u>

After boiling with hop (and correction for loss by evaporation, so as to keep it at the normal original gravity of 1063) it was composed as follows:—

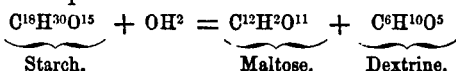
Maltose ...	...	...	...	...	...	...	6.66 per cent.
Dextrine ...	...	...	...	...	...	...	3.44
Other Carbohydrates, fermentable	...	...	...	...	...	...	3.80
Ditto unfermentable	...	...	...	...	...	...	1.00
Albuminoids ...	...	...	...	...	...	...	1.05
Hop extract ...	...	...	...	...	...	...	0.33
Ash ...	...	...	...	...	...	...	0.27
					Total	...	<u>16.55</u>

Hence it follows that the fundamental constituents of the hopped wort had undergone but little change, when the principal fermentation with yeast was finished and the ale ready to be put into the cask, the beer contained:—

					Alcohol and solids in 100 parts.
Alcohol ...	...	...	...	...	4.48 sp. gr. .992
Maltose ...	...	...	...	...	1.52
Dextrine ...	...	...	...	...	3.44
Carbohydrates fermentable	...	...	...	...	trace.
Ditto, unfermentable	...	...	...	...	1.00
Albuminoids ...	...	...	...	...	.66
Hop Extract ...	...	...	...	...	.33
Non-volatile Products of the Fermentation...	...	...	...	...	.47
Ash ...	...	...	...	...	.24
					<u>7.66</u>

If we examine the malt analyses given above, and suppose that during the mashing process the malt yielded an extract of 74 per cent., we perceive that the starch amounts to little more than 59.6 per cent.; the maltose and dextrine in the wort to a little more

than 61 per cent. of the extract, the increase being due to the binding of water. This very closely corresponds to the theoretical percentage of these bodies, obtainable, if starch splits up, according to the equation:—



that is, 32·15 per cent. of dextrine and 67·85 of maltose.

If the composition of the boiled wort given above be examined, it will be found that about 64 per cent. is fermentable matter. In all well conducted brewing operations, at the time of racking the beer, if the original gravity be determined, few instances will occur in which the amount of matter fermented is more than 64 per cent. of the original solid matter before fermentation. There may be cases in which this number is exceeded, as in old beers, in which the after-fermentation had taken place, or badly brewed beers, in which proper attention had not been paid to the mashing operation.

It is pretty well understood that if a pale ale, the worts of which had, say a specific gravity of 1063—1064, can be got into the cask when it is reduced by fermentation down to 1020—1021, things are going on rightly. The meaning of this is not far to seek. The wort would contain in every 100 parts, by measure, 16·5 parts by weight, or thereabouts of solid matter of the composition already referred to. The specific gravity of the finished beer being taken at 1021, the specific gravity of the spirit contained in the finished beer would be 992, or 8 less than 1000. The specific gravity of the finished beer, taken at 1021, the specific gravity of the beer without the alcohol would amount to 1029 (1021+8). This represents 7·6 per 100 of solid matter, or 16·5—7·6=8·9 of converted matter, and when expressed in percentage numbers=53·9, say 54 per cent., thus leaving still in the beer, as shown above, about 10 per cent. (on original extract) of fermentable matter. This matter is maltose, and it serves to keep up, by its slow and gradual fermentation, the condition of the beer in cask.

Malt being sweet, and it not being understood to what the sweetness was due, cane sugar, invert sugar, and glucose, or so-called saccharines of various kinds have been proposed as substitutes.

If cane sugar be submitted to the action of yeast, it will be found, if sufficient yeast be added, and the temperature of the mixture be maintained at from 20° to 30° C. that the whole of it ferments in four or five days, and yields 51 to 51·5 per cent. of alcohol, together with a certain proportion of succinic acid, glycerine, and other products. The residue left on fermenting a portion of the cane sugar always tastes acid and "thin;" the acid taste is no doubt due to the succinic acid, and the thinness to the peculiar sharp bodiless taste of the sugar.

If one-third of the malt extract in the pale ale mentioned above be replaced by cane sugar, the wort before boiling would then have the following composition:—

	Per 100 parts by measure.			
Cane Sugar	5·57
Maltose	4·63
Dextrine	2·14
Other Carbohydrates, fermentable	2·20
Ditto, non-fermentable	0·99
Albuminoids	0·98
Ash	0·11

After boiling with the hop it would contain—

				Per 100 parts by measure.
Cane Sugar	...	...	...	5.67
Maltose	...	...	...	4.53
Dextrine	...	...	...	2.14
Other Carbohydrates, fermentable	...	...	...	2.63
Ditto, non-fermentable	...	...	...	0.66
Albuminoids	...	...	...	0.70
Hop Extract	...	...	...	0.39
Ash	...	...	...	0.21
				16.73

The analysis is of a beer in which the same amount of hops was used as in the previous case. The numbers are before fermentation. It contains—

Cane Sugar	...	...	...	5.57
Maltose	...	...	...	4.63
Fermentable Carbohydrates	...	...	...	2.63

12.63 in 16.73 parts.

i.e., 75 per cent. of fermentable matter.

Cane sugar can never be used as a substitute for malt in the brewing of keeping beers. Keeping, even for a short time, attenuates them so much, that all body and flavour are gone.

The next substance to be dealt with is the so-called "invert sugar." The analysis of two samples I have before me. They appear as semi-solid, straw-coloured, honey-like substances. No. 1 gave 85 per cent., and No. 2, 86.88 per cent. of solid matter. Hence 85 parts of cane sugar would go as far as 100 parts of No. 1; and 86.88 of cane sugar as far as 100 parts of No. 2; but 100 parts of cane sugar yield 105.26 parts of invert sugar.

				Per centage composition of two samples of so-called Invert Sugar.	
				No. I.	No. II.
Cane Sugar	...	...	...	13	26
Invert Sugar	...	...	...	87	74
				100	100

Their value as substitutes for malt can be easily estimated from what has been said above upon cane sugar, and from the fact that invert sugar only yields from 48 to 49 per cent. of alcohol, by fermentation.

The next set of bodies are the so-called "saccharines," or glucoses, &c., produced by the action of sulphuric acid upon starch or starchy substances.

The following are analyses of five samples of saccharines from different makers:—

- Sample No. 1.—Rather brown; very hard; English manufacture.
- Sample No. 2.—Pale straw colour; softish; French manufacture.
- Sample No. 3.—Rather white; somewhat hard; English manufacture.
- Sample No. 4.—Rather white; somewhat hard; German manufacture
- Sample No. 5.—Whiter; somewhat hard; German manufacture.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Glucose	80.0	58.85	67.44	63.42	61.46
Maltose	None.	14.11	10.96	13.60	13.20
Dextrine	None.	1.70	None.	None.	None.
Neutral carbohydrates, with a little albuminoids	8.2	9.38	4.30	8.40	8.60
Ash	1.3	1.40	1.60	1.50	1.60
Water	10.5	14.56	15.70	13.18	15.20
Total	100.00	100.00	100.00	100.00	100.00
Total solid matter	89.5	85.44	84.30	86.82	84.80
Percentage of matter of use to the brewer	80.0	74.66	78.40	76.92	74.60

These analyses require little explanation, and very little comment of any kind.

The glucose is of the $C^6 H^{12} O^6$ type, and yields only 48 to 49 per cent. of alcohol, on fermentation.

The neutral carbohydrates are useless to the brewer, for although they increase the specific gravity of the beer, they are devoid of taste and "body-giving" properties. They, under no condition, yield alcohol, and cannot be converted like dextrine by the slow and gradual action of the beer into bodies capable of yielding this substance.

If the analyses of these saccharines be examined and compared with that of the malt-wort, it will be seen that they have only one constituent in common, viz., maltose, and this exists in the saccharines in such small quantity as to be of little consequence.

A slight consideration of the composition and properties of dextrine-maltose will show at once its great superiority over all other malt substitutes offered to the brewer.

It contains in 100 parts in round numbers:—

Maltose ...	...	...	...	...	67
Dextrine...	...	...	...	...	33
					100.0

Maltose yields the same proportional quantity of alcohol as cane sugar does, and the alcohol it yields is, in flavour, as far superior to the raw alcohol of the glucose of the saccharines, as that of fine malt whiskey is to potato spirit. In fact, the fine flavour of malt spirit is due to the fermentation of maltose, and that of the so-called potato spirit, to that of glucose. This is another reason why the saccharines have not come into more general use. There is far more yeast forming albuminoid matter in malt-wort than is required to ferment its saccharine constituents, and an addition of dextrine-maltose in varying proportions will have the additional effect of removing a further quantity of this yeast-forming matter from the beer before it goes into the casks.

In the manufacture of dextrine-maltose, when rice is employed it should be husked and finely ground. The rice-meal is first steeped in from 1 to $1\frac{1}{2}$ times its weight of cold acidulated water, or in water not higher than $40^{\circ} C$, and thoroughly agitated by mechanical means. It is then gradually introduced into acidulated boiling water, in the proportion of 100 parts by weight of rice to 250 by weight of the latter, care being taken not to allow the temperature to fall much below $90^{\circ} C$. The amount of acid—by preference sulphuric—may vary. We employ from $1\frac{1}{2}$ to 2 or 3 parts per cent. A dilute acid is preferable, for although the converting action is not quite so rapid, it proceeds much more regularly.

The vessel in which the rice-meal is converted consists of an ordinary mash tun, lined with sheet lead and provided with steam coils and a stirrer. As soon as the rice has become thoroughly diffused throughout the boiling water, a rapid conversion is observed. The liquid boils up briskly, and the steam has to be checked for a while to prevent its boiling over. This action is evidently owing to a chemical change. The rice-paste becomes rapidly thinner, when kept at a boiling temperature for about an hour or an hour and a-quarter. It is best and most expeditiously tested by neutralising a sample with baryta-water or chalk, filtering and examining the clear solution by means of the polariscope.

The conversion may be considered complete when the rotatory power is $+171^\circ$ or thereabout, indicating two parts of maltose (rotatory power $+150^\circ$) and one part of dextrine (rotatory power $+213^\circ$), *i.e.*

$$\frac{2 \times 150^\circ + 213^\circ}{3} = 171^\circ$$

By always infusing the same quantities of rice-meal and keeping up the same temperature, it is possible, after a few experiments, to dispense with the polariscopic determination altogether, and to obtain a liquor containing the proportionate quantities of dextrine and maltose, as they are found in malt-wort. The acid liquor is then carefully neutralised with good chalk to the extent of about 90 per cent., finishing off with milk of lime. This operation can be carried out with the greatest delicacy. It is preferred to leave the liquor, however, rather a trifle acid than alkaline. The strength of the liquor, after filtering off the grains, and the gypsum through Taylor's filtering bags, usually amounts to 1,115 to 1,125, or 30 to 32.5 per cent. of solid matter, *i.e.*, about double the strength or original gravity of malt-wort required for brewing strong ales. It is of a light amber colour and filters very readily. It is next evaporated either in an open pan, or with greater advantage in a vacuum pan, to a concentration of about 1,200, or about 52 per cent. of solid matter. A little more gypsum and a little flocculent albuminoid matter are at this stage best separated by filtration, and the concentrated liquor finished off in a properly constructed vacuum pan, or in an open steam-jacketed pan, provided with an agitator, till it acquires a stiff viscosity. It is then run off hot into forms, and cast into cakes of convenient weight, which on cooling, set hard, and are ready to be sent to the brewery. 78 to 80 per cent. of the starch in rice, in fact every particle, can be converted into dextrine-maltose.

The cost of manufacture is not more than 25s. to 30s. per ton.

R. H. H.

PROSECUTIONS UNDER THE SALE OF FOOD AND DRUGS ACT.

At Alfreton Petty Sessions Mr. Alfred Schofield, grocer, Market-place, Alfreton, was charged with selling $\frac{1}{4}$ lb. of caper tea, on the 15th March, which was adulterated with mineral matter.—The prosecutor went into the shop of the defendant, and asked the assistant for $\frac{1}{4}$ lb. of caper tea, which was supplied to him, for which he paid 1s. 2d. He divided it in three equal parts, and sealed the parcels. One he left, one was forwarded to the public analyst, A. H. Allen, and one he kept.—It was deposed by the analyst that he examined the tea, and found that it was adulterated with 8 per cent. of mineral matter, 6 per cent. of which was small stones rolled up in the leaves.—Mr. Schofield stated in defence that the tea was old stock, and was sold precisely as he bought it. It was not kept in the shop, and was only supplied when customers asked for it. He had learned since the information that it was often adulterated, but did not know that when he sold it.—Fined in the mitigated penalty of £5, which was paid.

THE FOLLOWING IS THE FIRST CASE FROM SCOTLAND, of milk adulteration, which has been remitted to Somerset House.

On the 11th of March James Mathie, Inverkip, was charged before Sheriff Smith, at Greenock, with having sold a quantity of milk of the quality known as skim, which was not of the quality demanded by the purchaser.

Mr. William McCowan, Public Analyst, deposed that he had analysed the milk referred to, and found that it contained at least 21½ per cent. of added water, and also 122 grains per gallon of added salt.

After hearing agents for both parties, the Sheriff expressed his opinion that it would be well to have another analysis of the milk, since the analysis was disputed; it would be desirable that the public should know whether they could rely upon their analyst. The sample was then ordered to be sent to the Commissioners of Inland Revenue.

The case was again called before Sheriff Smith, on the 6th of April, when the Inland Revenue Chemist's report was read, which was to the effect that considering the amount of decomposition which had taken place, they were of opinion that the milk had been adulterated with 24 per cent. of added water. They also found an excess of salt over and above that ordinarily found in genuine milk, to the extent at least of 80 grains per gallon. The Sheriff said, that as the evidence of Mr. McCowan had been fully borne out by the London chemists, he would impose a fine of £2 2s. with £3 3s. for expenses.

THE PRACTICE OF ADULTERATING BUTTER—Frederick Dobell, butterman, of 68, Wellington-road, Kentish Town, was summoned by the vestry of St. Pancras for selling a quantity of adulterated butter.—It appears that the sanitary inspector went to the defendant's shop and asked for a pound of butter, which was served him, and he paid 1s. 4d. for it.—Dr. Stevenson, the public analyst, certified that in it there was 75 per cent. of substance other than butter.—The defendant said he had sold the butter as he bought it from the wholesale merchant. He paid 1s. 2½d. per pound for it and sold it at 1s. 4d. Mr. Mansfield said he believed that for some time past persons had been sending bad butter from Holland.—It was mentioned that it was called "bosh." Mr. Mansfield ordered the defendant to pay a fine of £5 and 2s. costs. Thomas Lodge, butterman of 5, Prince of Wales-crescent, Kentish Town, was also summoned for a similar offence, and it was proved that the butter was adulterated 70 per cent.—The defendant made the same excuse as the last defendant, and was ordered to pay a similar fine, the magistrate stating that they could proceed against the merchants.

At the Clerkenwell Police Court, four persons were prosecuted under the Adulteration Act, with the following results: Alfred Willen, of 4, Corporation Buildings, Farringdon Road, was ordered to pay a fine of £3 and costs, or to be imprisoned for one month, for selling milk mixed with 30 per cent. of water; Alfred Coker, general dealer, 4, Clerkenwell Green, was fined 10s. and 2s. costs, or in default of payment seven days' imprisonment, for selling milk adulterated with 11 per cent. of water; John Ager, milkman, 150, King's Cross Road, fined £3 and costs, or one month's imprisonment, also for vending milk with 30 per cent. of water; and a penalty of 20s. and costs, with the alternative of fourteen days' imprisonment, was inflicted on Theodore Eden, of 3, Weston Street, Clerkenwell.

Richard Cheviles, cheesemonger, of Hackney-road, was summoned before Mr. Bushby, by the vestry of the parish of St. Leonard, Shoreditch, for selling as butter an article which was adulterated.—Mr. E. Walker, vestry clerk, supported the summons, and the defendant was represented by a solicitor whose name was not stated.—The purchase having been formally proved, the certificate of Dr. Stevenson, public analyst to the parish was put in, and showed that the article purchased as butter was adulterated with common fat, not butter fat, at least 50 per cent.—The

defendant, by his solicitor, said that he had purchased the "butter" of a salesman in Leadenhall Market, at the rate of about 14½d per lb., and sold it the same as he received it at 1s. 6d. per lb., and had no idea that it was adulterated. The defendant, called as a witness on his own behalf, admitted, however, that he did not think "real" butter could be sold for 1s. 6d. per lb., and further that he had no warranty from the salesman that it was butter. Mr. Bushby said the warranty would have been a protection to him. He considered the case made out, and inflicted a fine of 40s., and 2s. costs. The money was paid.

THE URBAN AND SUBURBAN MILK-CAN.—An instructive case was tried last Saturday at Bath, in which a milkman admitted that he carried two cans, the one containing pure milk, which he distributed in the suburbs, where there was a public analyst; the other a milk adulterated with at least 20 per cent. of water, which was disposed of in the city, because there was no such official there!—*Lancet*.

THE SALE OF FOOD AND DRUGS ACT.—William Lindsay Emmerson, M.D. Aberd., L.R.C.S. Edin., L.S.A. Lond., has been appointed public analyst to the counties of Leicester and Rutland for one year, vice Young, whose appointment has expired—10s. 6d. per analysis, minimum £70 for the year.

SOCIETY OF PUBLIC ANALYSTS.

THE next Ordinary Meeting of this Society will be held on Wednesday, May 3rd, in the "Meeting" Room of the Chemical Society, Burlington House, Piccadilly, at 6.36 p.m., when the names of the Candidates for admission as Members will be read to the meeting. After which various papers will be read and discussed.

At 6 p.m. on the date and at the place above named, and before the Ordinary Meeting, an Extraordinary Meeting will be held for the purpose of considering the desirability of making such a change in the name or style of the Society as shall indicate that its members do not consist exclusively of Analysts holding public appointments under the "Sale of Food and Drugs' Act;" but that, as is already provided in the constitution, "ALL ANALYSTS IN ACTUAL PRACTICE," are eligible for election as members.

NOTE ON THE ESTIMATION OF THE GRAVITIES OF FATS.

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

THE small quantity of Butter received for analysis, especially in disputed cases, is frequently insufficient to fill even a small specific gravity bottle. In such cases the well known specific gravity "bubbles" may be used with advantage, even if the quantity of fat is as little as 200 grains.

By adopting the following mode of procedure, only one or two bubbles will be required.

Pour the filtered liquid fat into a test tube of suitable size, put in the bubble, cool the fat until the bubble just rises, then transfer the tube to a suitable water bath, and raise the temperature of the water very slowly until the bubble begins to sink, read the temperature at this time for comparison with genuine butter.

The following results will show the bubbles likely to prove most suitable:

Two bubbles were selected, the sp. g. of No. 1 was 899.7, of No. 2 895.7, both of course taken at 60 F. In a sample of Butter Fat which at 100° F had an "actual density" of 913 No. 1 bubble sank at 131° F; No. 2 at 144° F. In another sample of fat, having an actual density of 911.3, No. 1 bubble sank at 123° F; No. 2 at 135° F.

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THE ANALYST.

THE ANALYSIS OF BUTTER.

It is satisfactory to notice that the question of the analysis of butter which has been for some time pretty definitely settled amongst analysts generally, appears at last to be in a fair way of being understood by the Inland Revenue Chemists.

Some short time ago a prosecution was instituted by a Metropolitan Board against a dealer, who had sold a sample of butter, which was certified by the district analyst to contain foreign fat.

The analysis was disputed, and the sample was referred to Somerset House, and the chemists there, reported that the results were not inconsistent with those of genuine butter. Dr. Muter, Dr. Dupré, Mr. Wigner and others, confirmed the original analysis, but the *ipse dixit* of Somerset House was accepted and the case was dismissed.

Since then, another butter case has arisen, which has an interest of its own, from the fact that it was stated by the defendants' advisers that the sample on which he was prosecuted was part of the same butter which the Inland Revenue chemists had certified to be genuine, and in which the prosecution failed, and, as a matter of fact, the figures of the analysis of the two butters were substantially the same.

This case was also referred to the Somerset House chemists, who certified to even a larger proportion of foreign admixture than that found by Mr. Wigner. Thus according to this "final Court of Appeal," as it has been called, what is genuine butter one week contains at least 70 per cent. of foreign fat, the next

It is, however, "never too late to mend," and it is to be hoped, that the education of the Somerset House officials may not stop short at butter, but may extend, for instance, to milk, about the analysis and constituents of which they appear at present to have much to learn.

SOCIETY OF PUBLIC ANALYSTS.

AN Extraordinary General Meeting was held at Burlington House on the 3rd inst., to consider the desirability of making such a change in the name or style of the Society as should indicate that its members do not consist exclusively of analysts holding public appointments under the "Sale of Food and Drugs' Act." A resolution proposing that the word "Public" be omitted from the title was moved and seconded.

An amendment to the effect that the name of the Society be not altered was then proposed and seconded, and after discussion was put to the vote and lost.

A second amendment that the matter be referred to the council for further consideration and report, was then proposed and seconded, and the original resolution having been by permission withdrawn, the amendment was put as a substantive motion and carried unanimously.

The ordinary meeting was then held.

The names of the following candidates for admission as members were read:—

Wm. Bettel, Public Analyst for Middlesboro'; H. C. Bartlett, Ph.D., F.C.S., 7, South Square, Gray's Inn; John Clark, Ph.D., Public Analyst for Glasgow, &c.; Otto Hehner, St. Catherine's House, Ventnor; A. Bostock Hill, L.R.C.P., L.S.A., 16, Moore Street, Birmingham; J. A. R. Newlands, F.C.S., 9, Mincing Lane; Wm. Thomson, F.C.S., Royal Institution, Manchester; R. P. Tatlock, F.R.S.E., F.C.S., Public Analyst for Glasgow; William Wallace, Ph.D., F.R.S.E., F.C.S., Public Analyst for Glasgow. After which the following papers were read and discussed:—

On an abnormal sample of new milk, by J. Pattinson.

Milk standards, by Alfred Hill.

The determination of the melting point of butter and other fats, by T. Redwood,

The next Meeting of the Society will be held on Wednesday June 14th.

MILK STANDARDS.

BY ALFRED HILL, M.D.

Read before the Society of Public Analysts at Burlington House, May 3rd, 1876.

As there is no more important article of diet than cows' milk, and as no kind of food is more subject to adulteration, it becomes a matter of the greatest importance to Public Analysts as well as to milk consumers, that a safe and proper standard of the quality of cows' milk should be generally accepted. Such a standard is a great desideratum on many grounds.

It is with a view to assist in the settlement of this *vexata quæstio* that I have ventured to make it the subject of a short paper, and the more particularly so in view of an opinion delivered by the Somerset House Chemists, to whom was recently submitted a sample of milk from Coventry, a portion of which I had analysed and pronounced skimmed. I have always considered in setting up a standard for my own guidance, that the analyses of genuine milk published many years ago by M. M. Henri and Chevallier, fairly represented the average quality of milk yielded by cows fed on different sorts of proper healthy food, they are as follows:—

			Normal Milk.	Fed on Beet.	Fed on Carrots.	Average.
Solids not Fat	...	...	9·85	10·38	10·25	10·16
Fat	...	...	3·13	2·75	3·08	2·99
Total Solids	...	...	<u>12·98</u>	<u>13·13</u>	<u>13·33</u>	<u>13·15</u>

and after a considerable amount of experience I find little reason to modify my opinion. According to the observations of Müller and Eisenstück, (acting for the Agricultural Society of Sweden,) quoted by Mr. Wanklyn in the Manual of Public Health, the milk of a herd of fifteen cows of different breeds contained on an average 12·8 per cent. of solids, and never once during an entire year contained less than 11·5 per cent. of solids. The highest percentage of solids observed on any day throughout the year was 14·08. "My own observations" says Mr. Wanklyn, "are completely in accord with the Swedish results, and it may be accepted as a well established fact, that cows' milk does not contain *less than 11·5 per cent. of solids*, and seldom less than 12 per cent. of solids." If this remark applies to a herd of several cows, and not to individual cows, I emphatically endorse it, and with a few rare exceptions I endorse it altogether, inasmuch as it is borne out by the results of the analyses I have made, many of which I produce in this paper.

Before giving the results of my general experience, and comparing them with those of other experimenters, I will quote the results of my analysis of the sample of milk before referred to, which on the 1st of March was submitted to me by the Inspector:—

Solids not Fat	...	...	...	...	8·67
Fat	...	...	...	...	2·47
					<u>11·14</u>
Ash	...	...	...	...	0·72

These results, or my opinion founded upon them, that cream had been abstracted being disputed, the portion of the sample retained by the Inspector was sent to Somerset House, to be analysed by the Chemical Officers of the Inland Revenue, and at the hearing on the 1st of April, the following report from them was read.

"The sample of milk was received here on the 20th of March, from Mr. Inspector Richard Coombes.

The bottle was securely sealed.

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

	per cent.
Solids not Fat	8·21
Fat	2·83
Water	88·96
	<u>100·00</u>
Ash	0·62

These results, according to our own experience, do not justify the conclusion that either cream has been abstracted from, or water added to, the milk.

The reasons for our coming to this conclusion may be briefly stated for the information of the Court and prosecution.

1st. The fat present in genuine milk varies very considerably, and in some instances we have found the proportion of Fat in milk, known to be genuine, as low as in the above sample. In this matter we speak from actual experience, having experimented upon numerous samples of milk obtained from various parts of the country.

These samples were milked from the cows in the presence of an officer of this department, and every precaution was taken to ensure accuracy, both in taking and analysing the samples so obtained. We may instance, as bearing directly on the present case, an average sample of milk which we procured from a Staffordshire dairy of 13 cows, containing only 2·86 per cent. of fat.

2nd. When a sample of milk is obtained from a can or pail in the ordinary course of sale by retail, the successive portions as ordinarily drawn, will contain a gradually diminishing proportion of fat, unless great care is taken to thoroughly rouse the milk in the can each time. From the results of the analyses of the first, middle, and last portions, of milk as obtained from the cows, as well as from the analyses of samples drawn from the top, middle, and bottom, of cans or churns of milk, *the tendency of cream to rise to the top or surface has been in all cases clearly established.*

We have largely experimented in this direction, both upon milk as obtained from the cows and on churns of milk as they arrive at the railway stations in London, and the result of our experience is, that where a sample of milk is obtained from the middle or towards the bottom of a can, serious injustice might be inflicted upon the owner if the proportion of 2·8 per cent. of fat was considered conclusive evidence of the abstraction of cream.

Finally, the specific charge in the present case is the abstraction of cream, but as the "solids not fat" appear low in our analysis, it is proper to point out that after making the necessary allowance for the decomposition that has taken place, we find that the quantity of 'solids not fat' in the sample, is not lower than has been obtained by others as well as by ourselves in numerous samples of genuine milk.

As witness our hands this twenty-eighth day of March, one thousand eight hundred and seventy-six.

J. BELL, R. BANNISTER, G. LEWIN."

It will be observed that there is no very great discrepancy between the analytical results obtained at Somerset House and by myself, the principal difference between us is as to the interpretation to be put upon them.

The milk having been referred to Somerset House, I requested Mr. E. W. T. Jones, to analyse the remainder of the portion submitted to me. The following is a copy of his report.

31st March, 1876.

Report on sample of milk marked "No. 3, A. H.," handed to me by Dr. Hill yesterday.

1. I have made two estimations of the Solids and Fat, the figures as under in each case supporting one another.

	1st Experiment.	2nd Experiment.	Mean.
Total Solids' ...	11.01	10.93	10.97 per cent.
Fat	2.57	2.55	2.56 "
Solids not Fat ...	8.44	8.38	8.41 "

2. I have carefully determined the acidity of the sample, and by experiment proved that the Lactic Acid or the decomposition suffered by the milk does not detract from the practical accuracy of the above determinations.

On the above results I have to remark, that I consider the sample has been watered to the extent of about one tenth, this conclusion being based upon the paucity of the "solids not fat" which in genuine milk never fall below 9 per cent., and in mixed milk from a number of cows are invariably 9.3 to 9.4 per cent., indeed within a shade they amount to this in ninety-nine cases out of the hundred in milk from single cows. I must also mention that the fat in this sample is low and favours the opinion that a portion of the cream has been removed.

E. W. T. JONES, F.C.S.

This Report fairly confirms my results, which however, are actually a little above Mr. Jones' as regards solids not fat, and total solids, and his opinion also is in accordance with mine, that the milk has been tampered with. At the first adjourned hearing of the case before the magistrates, two witnesses were put forward by the defence, viz.: Dr. Anderson, a medical practitioner of Coventry, and Mr. Bird, a druggist, of Birmingham. The first named witness said he had taken the specific gravity of the milk, and measured the quantity of cream, and therefore stated that the milk was of good quality, perfectly genuine, and such as he should not object to order for his patients, or use himself. In reply to the bench he admitted he had not made a full scientific chemical analysis. As a proof of the value of Dr. Anderson's chemical opinion, I may state, that he informed me that he did not believe in the Ether process of analysing milk. Mr. Bird, was however, to produce both the chemical results and the opinions intended to refute my own; the opinions came first, they are more easily got at than results, and are not so tangible or capable of refutation. He had examined the milk, and he found it to be perfectly genuine; he totally disagreed with me, he did not, however, put forward his note book, or even his analytical results, but he produced a letter book, containing a copy of his report on the milk. These are the figures:—

Fat ... ..	...	...	...	2.6
Casein and milk sugar ...	...	...	...	6.9
Total ... ..	...	...	...	<u>9.5</u>

And upon these results he unhesitatingly pronounced the opinion that this milk from a large herd of cows on a Warwickshire farm was perfectly genuine. Comment is unnecessary.

From a report of the case in the "Coventry Times," I subsequently learnt that portions of the milk had been forwarded to Dr. Redwood, and Dr. Voelcker, as shown by the following extract: "His client," (Mr. Wilks) "had gone to the highest authorities possible, viz.: Professor Voelcker and Professor Redwood, and if the case had gone on he would have called Professor Redwood and Professor Voelcker into the witness box; but what would have been their testimony, was determined by the reports which they had given. Professor Voelcker had analysed portions of the milk—of this very milk—and he had said, "It is a genuine milk in my judgment, and, as you will notice, somewhat richer in fat than the sample handed me by Professor Redwood," and added, "It is too bad to condemn such a sample of milk as the one sent me by Mr. Alfred Bird." Professor Voelcker's analysis of this milk was as follows:—

Water	...	...	...	...	...	88.992
Fat	...	...	...	...	...	3.144
Milk Sugar, Casein, &c.	...	...	...	...	...	7.114
Mineral matter, Ash	...	...	...	...	...	.700
			Total	...	...	<u>99.950</u>

The results obtained by Dr. Redwood are not given, though Dr. Voelcker says in his report, that the portion examined by him was somewhat richer in fat than the sample handed to him by Dr. Redwood. Let us see how the results of analysis of this much-analysed sample of milk came out under the hands of the different operators.

		Solids not Fat.	Fat.	Total Solids.	Ash.
Dr. Hill	...	8.67	2.47	11.14	.72
Inland Revenue Chemists	...	8.21	2.83	11.04	.62
Mr. E. W. T. Jones	...	8.41	2.56	10.97	
Dr. Voelcker	...	7.814	3.114	10.958	.700
Mr. Bird	...	6.9	2.6	9.5	exclusive of Ash.

There is not that degree of accordance which one could have desired to see, except in the first three series of results. These are, perhaps, as near, under the circumstances, as could be expected, but it will be seen that in every case the figures are below the standard proposed by this Society, and as far as my experience goes, below those yielded by the milk of any healthy, properly, or even improperly, fed dairy of cows.

During the last year, I have for my own guidance, had several herds of cows milked out in the presence of either my assistant, my son, or myself, and I have satisfaction in submitting the analyses of these samples to your notice. (*See next page.*)

The results in No. 1 Series having been obtained under an antiquated method of analysis, I give only the solids and the ash. Nos. 2, 3, and 4, Series, I found to be individually, as well as on the average, remarkably good milks, and having found them so, I inquired for a dairy in the town, where the animals were constantly kept "up," and where the food was poor, consisting very largely of grains. The milks in No. 5 Series, were obtained from such a dairy, where the avowed object, as expressed to me by the dairyman, was to feed the cows on a cheap food,

	DESCRIPTION.	SOLIDS NOT FAT.	FAT.	TOTAL SOLIDS.	ASH.
1872. June 10. No. 1 Series.	Average of 6 milks from as many Cows, on a farm a few miles from Bir- mingham. At grass. Milked in my presence			12.93	0.77
1875. July 23. No. 2 Series.	From a farm at Harborne, milked in the presence of my Assistant... ..	9.92 9.68 10.00 10.41 10.51 9.11	3.01 2.96 3.11 3.64 4.02 3.06	12.93 12.64 13.11 14.05 14.53 12.17	0.72 0.74 0.75 0.83 0.80 0.76
	Average	9.94	3.30	13.24	.77
1876. March 30. No. 3 Series.	From a farm on the borders of the Borough. Six cows partly stall-fed on mangel, hay and a little grains. Occa- sionally grazed. Milked in my pre- sence	9.29 9.72 9.94 9.52 9.73 9.47	3.52 3.69 3.61 3.85 3.48 3.74	12.81 13.41 13.45 13.37 13.21 13.21	0.88 0.82 0.78 0.72 0.61 0.66
	Average	9.61	3.63	13.24	0.74
April 24. No. 4 Series.	Five stall-fed cows at West Bromwich. Food—hay, bean flour, and grains. Milked in presence of my son, Dr. Bostock Hill	10.41 9.05 9.91 9.81 9.04	3.30 3.15 3.04 3.90 2.74	13.71 12.20 12.95 13.71 11.76	0.70 0.77 0.70 0.74 0.73
	Average	9.64	3.23	12.86	0.73
April No. 5 Series.	Dairy of 7 cows in the Borough, never turned out, fed largely on grains with a view to yield a large quantity of milk, regardless of quality. Milked in my presence	8.80 9.20 10.40 9.65 10.66 9.88 9.60	2.38 2.16 3.40 2.95 4.04 2.88 2.71	11.18 11.36 13.87 12.60 14.70 12.76 12.31	0.68 0.70 0.62 0.76 0.68 0.74 0.80
	Average	9.74	2.93	12.68	0.71
March 30. No. 6 Series.	Sent me by a farmer, and described as a bulk sample from 14 cows on a War- wickshire farm. Food—mangels	9.52	2.87	12.39	0.72
No. 7 Series.	Samples of milk purchased by the In- specter in Coventry at the same time as the adulterated sample, viz.:— March 1876	9.20 9.66 9.90 10.15	3.20 3.60 3.50 2.88	12.40 13.16 13.40 13.30	0.68 0.66 0.69 0.66
	Average	9.70	3.29	13.06	0.67
No. 8 Series.	Samples of milk purchased by the In- specter in Alcester, Warwickshire, in September and October, 1874	9.30 10.09 10.77 9.97	3.61 3.52 2.94 3.45	12.91 13.61 13.71 13.42	0.74 0.79 0.79 0.72
	Average	10.03	3.38	13.41	0.76
	Good country milk (Wanklyn)... ..	9.28	3.07	12.45	0.71
	Chevallier and Henri	10.16	2.99	13.15	0.68
	Poggiale (average 10 cows) ... ..	...	4.38	13.70	0.55
	Boussingault ... ..	...	3.90	...	0.55
	Vernois and Becquerel ... ..	...	3.61	...	...

which would induce a large yield of milk, without any regard to its richness. An inspection of this table shews that only two out of the seven cows, in spite of the artificial feeding, gave a poor milk; these are the first and second, the cream in both cases is low, but in only one are the solids not fat, much lower than usual, while in one or two others where the cream is a little low, the solids not fat are decidedly high, and the result is an average yield, only a little low in cream, but high in solids not fat and in total solids. Now this result being in spite of poor and artificial feeding, I contend that 9·3 per cent. of solids not fat, forms a sufficiently low standard for the guidance of Analysts in forming an opinion of adulteration, and that the still lower standard recommended by this Society of 9 per cent. solids not fat, and 2·5 per cent. fat, is fair and extremely liberal to the milk dealer, and besides meeting every proper case, is also low enough to admit of a very considerable amount of adulteration in rich milks such as are presented in the first four Series.

Assuming the possibility of the fat being so low as that given in the Somerset House Report, owing either to the quantity being naturally low, or owing to the cream having risen out of the lower strata of milk in the can, there is still the difficulty of accounting for the small quantity of "solids not fat," which, unfortunately for the milkman, but fortunately for analysts and consumers, do not rise like cream. This fact, however, is faced with admirable courage, and we are told that as the "solids not fat," appear low . . . it is proper to point out that after making the necessary allowance for the decomposition that has taken place, we find that the quantity of "solids not fat," in the sample, is not lower than has been obtained by others, as well as by ourselves in *numerous* samples of genuine milk."

We are not told what allowance was made for decomposition, but such decomposition must have been extremely small, I dissent entirely from the conclusion that a milk with such a small quantity of cream, *associated with so small a quantity of solids not fat*, can possibly be genuine. I am prepared to admit that with poor or improper feeding the cream may be as low or even lower in *individual* or *rare* instances, but the other solids of the milk will not be so low at the same time, and even if this were so as regards some half-starved, ill-fed or unhealthy single cow, it could not apply to a healthy animal, still less could it apply to a large herd of cows similarly favourably circumstanced. I am fully aware that some remarkably low results have been obtained by other chemists, *e.g.* 9·70, and even 9·30 per cent. of total solids by Dr. Voelcker, but the cows yielding these are admitted to have been in an actually starving condition, and such milk as this can hardly be considered normal or fit to be set up as a "milk standard."

Some low results are also quoted in the Chemical News, vol. xxxii. p. 28, by my friend, Dr. J. Campbell Brown, from the analyses of milks obtained under very unfavourable circumstances, the cows being "badly fed," "half starved," &c., No. 8, No. 9, No. 10, in Dr. Brown's letter, but I cannot think that these ought to be considered genuine milks, or even if they are, they would occur only exceptionally, and are unfit to be taken as standards of quality. Some other results shew the importance of relying not altogether on the quantity of fat alone, or on the quantity of "solids not fat" alone, because it is often seen that with low "solids not fat" there is a high proportion of fat

and *vice versa*, and in such cases as No. 4, No. 5, and No. 6, cited by Dr. Brown in the same letter, this is well exemplified.

With regard to the separation in the can to which so much importance is attached in the Somerset House report, I do not admit that the analyst has anything to do with that, because such a principle being conceded where is the line to be drawn? Not even it seems to me at the point when all the cream has so separated. This, however, is as complete a *reductio ad absurdum* as can well be conceived, but it is logically quite consistent and shews the difficulty of dealing with such cases. The analyst ought rather to assume that the milkman knows his business, and that before he deals out each portion of milk he will take the precaution (of the necessity for which he is well aware) to stir up the milk in the can. It was stated in defence in the Coventry case, that the milk is conveyed about the town in a large can or churn, suspended on a sort of hand cart, and that the contents of the can are drawn off by a tap fixed near the bottom. This may be an explanation of the small amount of cream in the milk, but it is not an excuse; in the first place it proves too much in accounting for a diminution of cream which had been previously denied; in the next, if this mode of conveying the milk leads to such a state of things, it is easy to substitute a better one. It is manifestly unfair to the purchaser to draw off a lower layer of milk deprived of its cream and to leave this upper layer of cream and milk till the last; possibly not to be sold at all but to be returned to the dairy. It would be as fair to take the first runnings, poor in cream, and sell them as genuine milk (which of course in a sense they would be) and retain the last portions rich in cream for making butter. The milk so sold would be genuine, but the proceeding would nevertheless be a fraud.

From the concluding statement of the Somerset House report, it appears that the Analysts there, consider that neither the small quantity of cream nor the low amount of "solids not fat" are inconsistent with the milk being genuine. Now if this be so, there is no possibility of a standard being set up higher than the lowest quality of milk, ever obtained in any case from any animal under any unfavourable condition of health or feeding. Such a standard is very safe not to inflict any hardship on the dairyman, but analysts were not appointed for the sole purpose of protecting milkmen. They have duties towards the public generally, and I contend that to pass milks of the low quality considered by the Somerset House Analysts to be genuine, is not only opposed to the experience of Chemists in general, and to the very fair and in many cases too low standard of this Society; but it is opposed to truth and to the public interest. Referring to milk No. 4, in No. 7 Series, in order to reduce the solids not fat, to the quality yielded by the Coventry sample in the hands of the Somerset House Analysts it would be necessary to add nearly 23 parts of water to 100 parts of the milk, and to reduce No. 3 milk in No. 8 Series to the same point, it would require 31.5 parts of water to be added to 100 parts of the milk. However tender this might be towards the milk dealer, it would be very hard towards the purchaser and grossly unjust.

In conclusion, it is to be sincerely hoped that the discussion upon this important question may lead to its satisfactory settlement, and that in future there may be an absence of conflicting opinion as to the standard of pure milk between the Public Analysts of this country and the Inland Revenue Chemists.

ON AN ABNORMAL SAMPLE OF NEW MILK.

By JOHN PATTINSON, F.C.S., Public Analyst for Newcastle-upon-Tyne and South Shields

Read before the Society of Public Analysts, at Burlington House, May 3rd, 1876.

THE composition of some samples of new milk I have recently examined, differs so much from that which usually prevails, that I deem it of importance to bring the results I have obtained before the members of this Society; more especially as there can be no doubt of the genuineness of the samples.

In December last, the owner of a dairy farm in the neighbourhood of South Shields, brought me a sample of milk for analysis, representing that the sample was just as given by a cow in his possession. I found the milk to contain:—

Solids not fat	6.68 per cent.
Fat	2.92 „
Total Solids	<u>9.60 per cent.</u>

To satisfy myself that milk of such poor quality could be given by a healthy cow, I arranged with the farmer to go and see the cow milked myself, and to obtain another sample. This was done on the 5th of January last. The cow was a roan-coloured Durham short-horn, which had calved, I understand in the March of last year. It and seven other cows, Durham short-horns, were stall-fed, not being allowed to go out excepting once a-day to obtain water. I was told that they were fed upon turnips three times a-day, a mixture of brewer's grains and one pint of peas meal, three times a-day, and as much hay as they chose to eat. The milk that I saw taken from the roan short-horn, I found to contain as follows, the analysis being made in duplicate:—

	1	2
Solids not Fat	7.04 per cent.	7.06 per cent.
Fat	3.22 „	3.25 „
Total Solids	<u>10.26 „</u>	<u>10.31 „</u>
Sp. gr. of New Milk ... ..	...	1023.4
Ditto Skimmed ... ..	...	1026.3
Percentage of Cream ... ..	...	11½

The milk was observed to have a peculiar saline taste, and in order to find out the cause of this, the amounts of ash and chlorine were determined. It was found to contain 0.94 per cent. of ash, and 0.27 per cent. of chlorine, equal to 0.45 per cent. of sodium chloride. This amount of chlorine is much larger than that which is usually found in milk, and it will be seen hereafter that it is much larger than is found in the milk of some, at any rate, of the cows in the same shed fed on exactly the same food. The same percentage (0.45) of common salt was added to distilled water, and the solution was found to have a saline taste of just about the same intensity as the milk. There can be no doubt, therefore, that the peculiar taste was owing to the presence of an alkaline chloride. On inquiry, I found that no salt, as such, was given to the cows with any of their food.

In order to ascertain if the roan cow was in a healthy state or otherwise, I went again to the farm, accompanied by a veterinary surgeon. After a careful examination he pronounced the cow to be perfectly healthy. She was about six years of age, and very fat. The farmer's opinion was that she was going dry, as she was now giving less

milk than previously. On this occasion, not only did I obtain a sample of this cow's milk, but also a sample from another cow, a white one, which was represented as giving very good milk. I also took an average sample of the milk of all the eight cows in the shed. I saw all the cows milked, and am quite certain that nothing was added to the samples that I obtained. The feeding in all cases was the same as before described. The milk of the roan cow had the same saline taste possessed by the last sample, but neither of the other samples had this peculiar taste. The roan cow gave seven pints, and the white one, nine and a-half pints of milk, all the cows were milked "dry." On analysis the following results were obtained:—

	Milk from Roan Cow.	Milk from White Cow.	Average Milk from Eight Cows.
Solids not Fat	6.94 per cent.	9.76 per cent.	9.14 per cent.
Fat	3.00 "	3.71 "	3.53 "
Total Solids	<u>9.94</u> "	<u>13.47</u> "	<u>12.67</u> "
Sp. gr. of New Milk ...	1023.1	1032.0	1031.0
Ditto Skimmed	1025.2	1035.2	1034.2
Cream	15.0 per cent.	11.0 per cent.	9.3 per cent.

A more complete analysis was made of each of these samples, with the following results:—

	Milk from Roan Cow.	Milk from White Cow.	Average Milk from Eight Cows.
Water (by difference) ...	90.15 per cent.	86.80 per cent.	87.54 per cent.
Fat... ..	3.00 "	3.71 "	3.53 "
Caseine	2.00 "	3.97 "	3.05 "
Milk Sugar	3.90 "	4.65 "	5.15 "
Ash	0.95 "	0.87 "	0.73 "
	<u>100.00</u>	<u>100.00</u>	<u>100.00</u>
Chlorine in Ash... ..	0.27 per cent.	0.14 per cent.	0.13 per cent.
Equal to Sodium Chloride	0.44 "	0.23 "	0.21 "

The milk sugar was found by evaporating the dilute alcoholic solution, weighing the residue and deducting from it the portion of ash it contained. The solid matters of the complete analyses are somewhat less than the total solids found by evaporation, probably owing to the latter containing some combined water.

The amounts of chlorine are larger in all cases than other chemists have found, so far as I am aware. The highest amount of chlorine I have been able to find in published analyses, is in an analysis by Haidlen, which shows 0.107 per cent. of chlorine; but usually the amount of chlorine found is from 0.06 to 0.08 per cent. In the analyses I made, the chlorine was determined in the watery solution after evaporating the milk at 212° F., and extracting the fat by ether, not in the ash left after ignition, as is done by some analysts; for I find that a notable quantity of the chlorine is lost by volatilization during ignition. This may perhaps account for the higher amount of chlorine found in some of my analyses. Another way of accounting for the excess, is that the farm is situated near the sea, and the hay will therefore probably contain more salt than hay grown farther inland. Be this as it may, there still remains the remarkable fact that the poor milk of the roan cow contains about twice as much chlorine as either of the other samples, although all the cows were fed on precisely the same kind of food. I myself have never before had a sample of genuine new milk of poorer quality; and this is undoubtedly, the general experience.

The following discussion ensued on the two foregoing papers :—

Mr. Wanklyn pointed out that though a notion had lately sprung up in certain quarters that the "solids not fat" in milk did sometimes fall below 9·3 per cent., yet it was only in cases where the cows were diseased, or where the sample of so-called milk was really "strippings" that such a thing took place. Strippings differed from average milk inasmuch as they contained an excessive proportion of fat, and the application of the proper formula would immediately eliminate any error due to this fact by providing for the calculation of the ratio between "solids not fat" and water. The case of abstracted fat or cream presented more difficulties, and he thought a convention should take place on the subject.

Mr. Allen mentioned, that although Dr. Hill's results were obtained on the fresh milk, and the others on the samples which had been kept some weeks, yet it would be observed that the "total solids," found by Hill, Jones, and the Inland Revenue Chemists were practically identical. In the case of Mr. Jones, the analysis was made after that of the Inland Revenue Chemists, and as he repeated his determinations, and took special precautions to ensure accuracy, his results were valuable. As the "total solids" found by the Inland Revenue Chemists agreed so closely with the results obtained by Dr. Hill on the fresh milk, it was quite clear that very little decomposition had taken place. In this case the proportion of total solids found by two different chemists in the stale milk, clearly prove that change had only occurred to an insignificant extent, but the Inland Revenue Chemists differ from Messrs. Hill and Jones, in obtaining a larger proportion of fat, and it might appear to be possibly due to the fat being determined at Somerset House by subtracting the "solids not fat," from the "total solids." As two chemists of large experience in milk analysis, agreed in finding a maximum of 2·56 per cent. of fat, it is impossible to avoid the conclusion that the Inland Revenue Analysis was erroneous. Nevertheless, he thought Dr. Hill was rash in pronouncing the milk to be skimmed, as it is certain that genuine milk was to be met with containing as little as 2·5 per cent. of fat. The presumption was that it was skimmed, but he did not think the proof conclusive. On the other hand, he thought the milk might fairly have been condemned as adulterated with water. The speaker objected to the misuse of the word "standard." The Society of Public Analysts never prescribed a standard at all. They recommended that 9·00 of "solids not fat," and 2·5 per cent. of fat should be recognized as the "limits" of these constituents of milk, but in calculating the probable amount of dilution in a watered milk, average milk should be taken as the standard.

Mr. Rimmington said it was impossible for analysts to take cognizance of such exceptional samples of poor milk. He considered the standard generally acted upon, viz., 9·0 "solid not fat," a very fair one, and more favourable to the seller than the buyer. It is quite low enough, and admitted of 10 or 15 per cent. water being added to very good milk. It would be better to give up the analysis of milk altogether, if nothing better can be done for the public than the standard which Somerset House endeavours to set up. If once such a limit be assented to, nothing better would be supplied.

Mr. Jones said the figures given in his analysis were the mean of two closely concordant analyses, and he thought, on the fair assumption of their correctness, they proved conclusively that the milk was a watered one. He would meet the observations as to decomposition probably interfering with the analytical results, by stating in the first

place, that these analyses were the latest made of this milk, and that the lactic acid was neutralized by adding the requisite amount of sodic carbonate to form sodic lactate, which being insoluble in ether could not increase the figure for fat, or lessen the "solids not fat."

Dr. Dupré expressed his pleasure that Dr. Hill had again brought forward several of the points to which he (Dr. Dupré) drew the attention of the Society some months since. It could not be too emphatically stated that, since the milk supplied in towns is always derived from a *number* of cows, no results obtained with the milk of *single* cows should be admitted as furnishing a standard, or even a guide for comparison. Secondly, as the public have a right to insist that the milk they buy is taken from healthy cows, and which (to say the least) are not *actually starving*, all results obtained under such conditions as those of Dr. Voelcker should be absolutely rejected. Lastly, milk vendors are bound to supply all their customers with milk of fairly uniform quality; no excuse for a deficiency of cream, based on the well-known fact that cream has a tendency to rise to the surface, should be for a moment allowed. The milk vendor can, with very little trouble, prevent the cream from separating, by simply emptying the measure with which he takes out the milk, several times back into the can before supplying his customers.

Dr. Muter pointed out that analysts had themselves contributed to the confusion on this subject, by ingenious defences, the only merit of which was their ingenuity. His own experience was, that the milkmen in his district systematically brought the milk down to his standard. He wished that Dr. Hill had examined the ash so as to detect carbonate of soda or borax if they were present.

Dr. Redwood said the sample of milk analysed by him, was sent by Mr. Wilks, of Coventry, together with a sample to be forwarded to Dr. Voelcker. He was told, the only question at issue was, whether cream had been abstracted. The result of his analysis did not, in his opinion, justify the conclusion that cream had been abstracted, and he reported to that effect. He did not recollect the real quantity of fat he obtained, but believed it was about 2.4 per cent. and genuine milk from healthy cows, even the entire milk from a herd of cows, would sometimes, yield as small a proportion of fat as that. Fat was the most variable constituent of milk, and it was very quickly affected by the quality of the food of the animals. His experience had not afforded him such uniform results as those described by Dr. Hill. With reference to the case at Coventry, he agreed with a remark which had been made by a previous speaker, that judging from the analysis of Dr. Hill, there was more evidence of its having been watered than skimmed.

In reply, Dr. Hill stated that his invariable custom was to determine by actual weighing, both the "solids not fat" and the fat, and that he checked the combined weight of these two determinations by the weighing of a separate portion of milk evaporated to dryness. Dr. Hill further said that the result of the analysis would have justified either the conclusion that cream had been abstracted or water added, and he thought it highly probable that both forms of sophistication had been resorted to. He was, however, influenced in the case in question to report abstraction of cream, by the consideration that, comparing the sample in question with the other samples of milk purchased by the Inspector in Coventry at the same time, he found a greater proportionate difference between the quantities of fat than between those of "solids not fat."

ON THE DETERMINATION OF THE MELTING-POINTS OF BUTTER AND OTHER FATS.

BY T. REDWOOD, Ph.D.

Read before the Society of Public Analysts, at Burlington House, May 3rd, 1876.

IN a discussion which followed the reading of papers by Dr. Tripe, Mr. Angell, and Mr. Heisch, in May of last year, on methods for determining the fusing points of fats, I alluded to a method which I have long adopted for effecting that object. The purport of what I said is briefly reported in the "proceedings" of this society, at page 137, but the description of the process, which I gave in general terms, omits some points of detail which I wish now to add. I have found the process a very convenient one, which appears to afford accurate results, and to be well suited for the determination of the melting points of fats, especially where several have to be operated upon.

The apparatus in the form best suited for general use, consists of a basin, two small beakers and a thermometer. I use an enamelled iron basin, about six inches in diameter and three and a-half inches deep. In this I place a beaker four and a-half inches deep and three inches in diameter, and within this beaker is placed another much smaller one, supported by its projecting rim on a disc of tin-plate or copper, the outer edge of which rests on the mouth of the larger beaker. Some mercury is put into the smaller beaker to a depth of about an inch, and cold water into the larger beaker so that its surface shall be half an inch or an inch higher than that of the mercury. A small drop of the fat, which has been previously melted and heated to several degrees above its melting point, but has been allowed to cool again to near its setting point, is put on to the surface of the cold mercury. This is best done by means of a thin glass rod, about one-eighth of an inch in diameter, the end of which has been rounded off in the blow-pipe flame. It is important that the drop should be very small, and its temperature when placed on the mercury not much above its melting point, for if it be too hot it will spread over the surface of the mercury, which is not desirable. If the rounded end of the rod be slightly dipped into the melted fat and then brought to the surface of the mercury, a small hemispherical particle will attach itself there and speedily congeal, becoming more or less opaque in doing so. The weight of one of these hemispherical masses, which should not be more than the eighth of an inch in diameter, will be from $\frac{1}{10}$ to $\frac{1}{10}$ of a grain. Having placed the drop of fat on to the mercury, the bulb of a thermometer with sufficiently minute graduations is introduced into the mercury, and hot water poured into the basin. The heat is thus communicated to the contents of the small beaker slowly through the water in the larger beaker, and the rise of temperature in the mercury may be easily regulated and should take place at the rate of about one degree per minute. The mercury by virtue of its comparatively good conducting power, acquires a uniform temperature throughout, which is indicated by the thermometer and at the same time communicated to the fat. The fat, when the temperature approaches its melting point, becomes partially transparent, and if the stem or elongated bulb of the thermometer be now brought up against it, the moment fusion takes place the liquid fat will run into the channel formed by the repulsion of the mercury and the outside of the thermometer tube.* This process presents the following advantages:—

* Two samples of what I believe to have been genuine fresh butter, tested by this process, after having been purified by solution in ether, gave respectively 80.5° and 81.5° F. as their lowest, and 83.5° and 84.5° as their highest melting points.

1. The heat-conducting power of the mercury, on which the fat is placed, ensures the equalisation of the temperature as indicated by the thermometer and at the same time communicated to the fat.

2. The direct contact of the fat with the mercury, without the intervention of a bad conducting medium, such as glass, ensures a more immediate and correct indication of the temperature at which liquefaction takes place than would otherwise occur.

3. The minuteness of the quantity of fat operated upon reduces to a minimum the time occupied in its melting, and thus facilitates the determination with exactness of its melting point.

4. The time occupied in preparing small tubes and charging them with the fat is saved, and several experiments in succession may be easily and rapidly made with the same apparatus.

In the discussion which followed Dr. Dupré enquired whether the author had made any accurate experiments on the influence of previous fusion on the melting point of butter fat, or as to the time which should be allowed to pass between the fusion of the fat and the taking of the melting point, as he, Dr. Dupré, had found the melting point vary as much as 10° F., and even more from the correct point, when taken immediately after a previous fusion.

Mr. Wigner pointed out that the old plan of coating the bulb of the thermometer with the fat to be tested, and slowly heating in a water bath seemed to give results as accurate as any other process. He then made a few remarks on the relation between the temperature at which the specific gravity bubbles rise in melted fats, and the actual densities of the fats.

In reply, Dr. Redwood said, he did not attach much importance to the melting-point of butter as a characteristic by which to judge of its genuineness or otherwise, but he adopted what he found to be the most convenient and accurate method of making the determination. He did not find that there was any marked difference in the results obtained by his process as compared with those obtained by melting the fat in thin capillary tubes, but there was a material difference as compared with the sinking of glass bulbs by Mr. Angell's method. What he had observed and found it important to pay particular attention to was, that in butter, as well as other fats, such as tallows, there were at least two melting points dependent upon, the way in which the fat had been previously subjected to the action of heat, and they may differ in butter, to the extent of 3 or 4° F., the lower melting point being that of the fat after it has been heated, to several degrees above its first melting point, and the higher melting point being that of fat which has been previously melted at the lowest possible temperature, and then immediately allowed to congeal.

ON THE DETECTION OF NITROUS ACID IN NATURAL WATERS AND OTHER DILUTE SOLUTIONS.

By R. FRESERIUS.

(Zeitschr. f. Anal. Chem. XV. 230-232.)

In a previous number (vol. 12, p. 427) the author recommended the following as the most sensitive and reliable method for detecting nitrous acid in natural waters. The water, after acidification with pure acetic acid, is distilled and the distillate received into potassic iodide, and starch solution, acidified with sulphuric acid.

To this method Kämmerer raised the following objections:—

1. That nitrates upon warming in presence of organic substances are reduced to nitrites; and
2. That the nitrous acid after liberation might upon warming be reduced by organic matter to nitrous oxide, nitrogen, or ammonia.

In the present paper Dr. Fresenius quotes the results of Plugge and Gratama to disprove the first objection raised by Kämmerer, and gives a series of experiments showing the second objection to be wrong.

Still maintaining, therefore, the accuracy of his own method, Dr. Fresenius gives a caution against its use for waters where bacteria in the presence of hydrocarbons may have reduced nitrates; and in such as contain abnormal substances, which would destroy the nitrous acid when formed *e.g.* sulphuretted hydrogen.

F. J. L.

ON THE SEPARATION OF MORPHIA AND SUGAR.

The Pharmaziesche Zeitung, Berlin, of the 28th March, contains a paper by Dr. Schacht on the separation of morphia and sugar, a subject of some interest to analysts in this country, when we remember the frequent occurrence of morphia poisoning by sweetened soothing syrups, and other patent medicines containing this Alkaloid. Dr. Schacht having found the estimation of morphia in powders containing sugar, to be by no means satisfactory, made the following experiment: 0.075 grs. of muriate of morphia was mixed with 0.5 grams of sugar, and the mixture treated with commercial absolute alcohol, to which a trace of hydrochloric acid had been added. On the addition of ammonia to the resulting yellow solution, no precipitate was obtained. In the second experiment, the mixture was treated in the cold, without the addition of acid; the alcoholic solution evaporated in the water bath, and the residue dissolved in acidulated water; on treating this solution with ammonia and amylic alcohol, it yielded a residue which was coloured red by sulphuric acid, and consisted of a compound of sugar and morphia. The author was not more successful when he treated the substance in the cold with amylic alcohol, and the results yielded by chloroform were still more unsatisfactory. Acid carbonate of potash, precipitated the greater part of the morphia from the aqueous solution, but not enough for quantitative purposes. From these results the author concludes that the separation of morphia and sugar is as yet impossible. Dr. Schacht promises to communicate his further investigations on this subject.

H. de A. P.

VOLUMETRIC ESTIMATION OF SULPHURIC ACID.

MR. EDWARD HART, in the *American Chemist*, for February, 1876, in pointing out certain difficulties in the volumetric estimation of sulphuric acid, suggests the following process. A straight tube of glass is drawn out to a fine point at one end, and into the other end some fine asbestos is introduced, and tightly pressed down towards the contracted end. The tube is then drawn out just behind the asbestos. When the small end is placed in a turbid fluid, and suction applied at the wide end, the liquid, perfectly cleared, ascends into the tube. When the action is reversed and the clear liquid is forced through the small end, a few drops appear turbid, but the bulk of the liquid remains clear and fit for testing. A few drops of the liquid are forced into a very small and carefully cleaned test tube, and a drop of standard solution of barium chloride from the burette added. Should a precipitate be formed, the test tube and filtering pipette are rinsed into the bulk of the solution, and more barium chloride added. On the proper point being reached, a precipitate is formed in the clear liquid by both barium and sulphuric acid solution. The solution, after each addition of barium chloride, is heated nearly to boiling. Mr. Hart states that where great exactness is not requisite this process is valuable. The average of four determinations of sulphuric acid in cupric sulphate, gave 31.92 per cent., the theoretical quantity being 32.08.—C. A. C.

LOAN COLLECTION OF SCIENTIFIC APPARATUS SOUTH KENSINGTON MUSEUM.

THIS exhibition of apparatus is of special interest to all scientific men. On the whole it has been very judiciously collected and arranged. The advertising element so common to similar exhibitions has been greatly reduced, though of course not entirely eliminated, but it is in only one or two exhibits that any obtrusive appearance of this kind presents itself.

Pneumatic apparatus is well represented by every form of instrument used from the earliest air pump to the most improved "Sprengel," and from the Bunsen eudiometer to the McLeod apparatus.

The show of balances is meagre, several of the newer makers who have brought out specialities, especially those of the short beam type, being unrepresented. Telegraphic apparatus also makes a very poor show.

The "Gramme" magneto-electric machine, of course works well and attracts attention.

The biological apparatus is especially good, and well arranged, and there is also a very fine collection of acoustic apparatus embracing several novelties.

We may also notice with special commendation the exhibits by "The Pedagogic Museum" of Russia, which certainly appear to us superior for educational purposes to any similar collection we have seen elsewhere.

The conference on various subjects which have been held almost daily in one of the rooms have as a rule been interesting, and well attended. At the first chemical one the review by the President, Dr. Frankland, of ancient and modern eudiometric apparatus was listened to with much interest, as were also papers by Dr. Gilbert and others. We regret that we have not space to produce these and other papers *in extenso*.

PROSECUTIONS UNDER THE "SALE OF FOOD AND DRUGS ACT."

At the Greenwich Police Court, Mr. William Newnham, grocer and cheesemonger, of Lewisham Road, Greenwich, appeared to an adjourned summons, taken out at the instance of the Greenwich District Board of Works, charging him with selling an article of food—to wit, butter—which was adulterated. Mr. Spencer attended to prosecute, and Mr. Robinson appeared for the defence. The case had been previously before the court, when Mr. Wigner's certificate showing that the sample of butter analysed by him as being bought at the defendant's shop, at 1s. 2d. per pound, contained more than 50 per cent of foreign fat, supposed to be of vegetable origin, was produced. Upon this an adjournment of the case was asked for, it being agreed that a second portion of the sample should undergo analysis at Somers House. A certificate was now produced from that department, signed by Mr. Bell, Mr. Bannister, and Mr. Lewin, to the effect that, from the specific gravity of the fat and amount of fixed fatty acids obtained from it, they were of opinion that the sample analysed had been adulterated with not less than 70 per cent. of fat other than butter fat. The details of this analysis were thus given:—Water 7.11, curds 2.32, salt 1.99, and fat 88.58. Mr. Robinson, on hearing this result, said that it was widely different from what was expected, and although he could not dispute the accuracy of Dr. Bell, he wished to call evidence in the case, and also to put questions to Mr. Wigner in respect to analysis in the tests for adulterated butter. Mr. Patteson said that the second certificate showed a greater amount of adulteration than the first certificate, and he did not see what object there was in calling other evidence. Mr. Spencer objected to any other evidence being taken to re-open the case unless Mr. Bell was afforded an opportunity of being present, as it would have the effect of prejudicing the character of a public officer. Mr. Robinson said it was at the wish of the defendant that Mr. Bell had attended; but he was not going to advise the defendant to bear the expense of another adjournment. Mr. Wigner was then examined, in continuation of the evidence taken at the first hearing, and said, in answer to questions, that he found the sample to contain 89.25 per cent. of fat, and that the analysis of this fat showed fatty acids 91.85 per cent. A microscopical examination showed that the butter had been melted, and a further microscopical examination of the curd showed that it (the curd) consisted mainly of vegetable tissue. It was quite possible for the defendant to have inferred from the appearance, taste, and smell, of the butter sold, that it was adulterated. It had turned rancid when he commenced an examination of it on the afternoon of the day he received the sample—the day the butter was purchased—or the next morning. He denied that fresh butter of the highest class was more likely to turn rancid than other butter. For the defence, Mr. Robinson called an analyst and two agents to importers of butter from the northern parts of Europe, the latter of whom said that the butter so imported underwent a certain process in this country by the adding of new milk, &c., and was so much in repute that it had risen in price 3d. and 4d. per pound within the past four or five months. It was a butter, they said, which was sold to the poorer classes, and would keep longer from getting rancid than even fresh-made butter. The defendant was also examined, and stated that he bought the butter of a good firm in the Borough, and had sold it as butter. He said he could not tell from its appearance that it was adulterated, its appearance being equal to Dorset butter, but not its flavour. Mr. Patteson said there was no doubt the adulteration had been proved, and he believed the defendant had sold it as he bought it. He must impose a penalty, and he fined the defendant £2 and £1 costs.

WORKING OF THE SALE OF FOOD AND DRUGS ACT.—Henry White, dairyman, 1, Bowling Green Row, Woolwich, was summoned for refusing to sell Mr. John Carty, the inspector appointed under the Act, a sample of milk for the purpose of analysis. Mr. Carty said he called at defendant's shop and asked to be served with a pint of milk, offering 3d. in coppers and a jug. Defendant said he had no milk; but witness noticed a can on the counter half full with milk, with measures hanging to the side of it. He told the defendant that he was liable to be fined £10, whereupon White said, "I don't care; I shall not serve you."—Defendant said he told the inspector that the milk in the can was ordered by customers.—Carty denied this, and Mr. Balfour fined the defendant 10s. and costs.

ADULTERATED BUTTER.—Thomas Schofield, grocer, 1, Mary Ann Street, North Woolwich, was summoned for selling adulterated butter.—Mr. Carty, the officer appointed under the Sale of Food and Drugs Act, said that he purchased half-a-pound of butter at the defendant's shop, telling the wife, who served him, that it was for analysis. He sealed it up in a bottle in the presence of the defendant and his wife, and sent it to Mr. Wigner. He produced his certificate, showing that the butter contained more than 50 per cent. of fat. Defendant said that he bought the butter of a Mr. Price, believing it was genuine. He was a poor man, and hoped the magistrate would be lenient. Mr. Patteson told defendant that he ought to have procured a written warranty that the butter was genuine, and he could then have proceeded against the wholesale dealer. Of the half-pound of butter, costing 8d., there was less than four-penny-worth of butter. He let him off with a fine of 10s., and costs.

At the Leeds Police Court, John Derrick, shopkeeper, Mill Street, was summoned for selling new milk which was not of the quality demanded. The milk had been purchased by one of the assistant inspectors, who informed the defendant that it would be analysed. The defendant then said he hoped they would not analyse it this time, as he had mixed it with some old milk, and had taken the cream off. The borough analyst found that the milk contained 29 per cent. of water. The defendant now said he did not put anything in the milk. It must have been put in it before he got it. He only made 9d. a day out of the job. Mr. Bruce said his attention had been called to a decision of the London police magistrates, that the person taking proceedings must do so without prejudice. He would consider the case, and would adjourn it for ten days.

Some charges of adulteration have been heard at Westminster Police Court with peculiar results. A milkman was summoned before Mr. Arnold for selling an article of food that was not of the nature, substance and quality demanded by the purchaser. The sanitary inspector of St. Luke's Parish, Chelsea, had bought at the defendant's shop a quart of milk, which was found to contain 26 per cent. of water—a proportion which, we are almost superfluously told, "would render it unfit for the food of children and invalids." The addition of water was not disputed, and, after an argument on an extremely nice point, to which we shall presently allude, the magistrate, pronouncing the case a very bad one, fined the man £10 and 4s. costs. Not having the money to pay, or even goods on which to distrain, the milkman was sent to prison for three months, and, as this was apparently the second conviction in less than two years, his fate will not excite much pity. Another case of minor gravity was also decided against the accused, the offence being the old one of selling chicory in coffee without apprising the purchaser of the fact. The defendant pleaded inadvertence; but as there was no less than 40 per cent. of chicory, he was mulcted in the sum of 50s. and 23s. costs. The peculiarity of these cases is that, notwithstanding the severity of the inflictions, the magistrate came near absolving the guilty tradesmen altogether. The counsel for the milkman advanced the ingenious plea that, as the milk had not been sold as an article of food for consumption, but merely for the purpose of analysis, there could not have been any "prejudice to the purchaser;" and Mr. Arnold was "inclined to think the argument good and substantial." Ultimately, in giving his decision, he said that it was with much reluctance he felt himself obliged to follow the reported cases and the judgments of other magistrates, and to pronounce against the accused, as otherwise the Act would be useless. Now when one of the ablest and most experienced magistrates on the bench regrets that he has no alternative but to decide as his learned brethren had done before him, it is reasonable to suspect the Act has been badly drawn up, and if it has been it is not worse than many others which the most learned Judges profess themselves puzzled to construe. But in the present instance Mr. Arnold was surely over-fastidious, and the plea which so impressed him was only a dexterous quibble. The purchaser of the milk, the sanitary inspector of the parish, if not personally prejudiced, was the representative of other consumers who had been or would be so, and who could only reach the offender through their local authority. To make good his case of "no prejudice," the milkman's counsel would have to prove that milk so adulterated had not been sold to any consumer at any time, and that what the sanitary inspector got was a sample specially adulterated for his benefit—which is absurd. The purpose of the Act was not to define the object of the buyer, but to show the motive of the seller, and this is sufficiently secured when the latter vendors over his counter an article sold in the usual way to a person of whom he knows nothing, except that he gives a price for a commodity supposed to be genuine. If there were any doubt on the point, the simplest plan would be to bring in an amending Bill, striking out entirely the words "prejudice to the consumer," and allowing no more to stand than the fact of sale in market overt.

The following appeal case will be read with interest as laying down, we believe for the first time, a distinct point at which Gin ceases to be Gin and become Gin and water. If this judgment be upheld we may expect to see numerous prosecutions for adulterating spirits by "letting down" with water:—

(Before Baron Cleasby and Mr. Justice Grove.)

FASHLER v. STEVENILT.

This was an appeal from a conviction under the 6th section of the Sale of Food and Drugs Act of last year. The question was, whether when a man asks for gin it is an offence to sell gin which is scientifically described as gin of low alcoholic strength, but which some people might call gin and water.

Mr. Graham (with whom was Mr. Wills, Q.C.) argued for the appellant; the respondent did not appear.

The appellant was a publican at Sleaford in Lincolnshire. The respondent, an inspector of police bought at the appellant's house a bottle of gin for which he paid 2s. 6d. Having previously given the appellant notice of his intention to do so, he had it analyzed. He then layed an information before the Justices, and charged the appellant with an offence under the 6th section of the Sale of Food and Drugs Act of last year. That section enacts that no person shall sell to the prejudice of the purchaser any article of food which is not of the nature, substance, and quality of the article demanded by such purchaser. The analyst proved that the gin in question contained 4 parts of sugar, 26 parts of alcohol, and 70 parts of water. He stated that it was gin of a low alcoholic strength. It was proved that there is no recognized standard of alcoholic strength for gin, but that it varies from proof to 20 degrees below. The gin in question was 44 degrees below proof. It was not proved that the appellant knew of the strength or weakness of the gin. The Justices fined him 1d., with costs. It was contended that there was no evidence upon which the Justices ought to have convicted.

Baron Cleasby thought the conviction was right. When the respondent asked for gin, he meant such gin as is ordinarily sold, and to sell him such gin as that in question was to sell, to the prejudice of the purchaser, gin which was not of the quality demanded. The amount of water proved to have been discovered with the gin afforded evidence that it had been added for the purpose of fraudulently increasing its measure.

Mr. Justice Grove concurred. He thought that when it was proved that the gin contained so much more water than gin ordinarily sold, the onus was thrown on the seller of proving that he did not know of the state in which it was.

THE BIRMINGHAM ADULTERATION CASE.

IMPORTANT DECISION.

On the 29th inst. at the Birmingham police Court, decision was given in the case of Richard Hughes, drysalter, Prospect Row, who was summoned for infringing the Adulteration Act, by selling, on the 19th of February, as pure, two ounces of milk of sulphur which was adulterated. The magistrates present were Mr. T. C. S. Kynnersley (stipendiary), Dr. Heslop, and Messrs. Ellis and Goodrick. Mr. Jesse Herbert (instructed by the town Clerk) appeared in support of the summons, and Mr. Tanner (Rowlands & Bagnall) represented the defendant.

Mr. Kynnersley said he should like to ask, in the first instance, whether druggists would consent in future to use a distinctive label stipulating that the article they retailed as milk of sulphur contained sulphate of lime?

Mr. Tanner having consulted with his client, said, although Mr. Hughes would be perfectly willing, individually, to do this, still the case was looked upon as a representative one, and there were a number of persons who felt strongly on the subject, and would most likely object to concede to such a proposal. He thought it would be better, therefore, if the Magistrates gave their decision upon the facts as proved.

Mr. Kynnersley accordingly gave decision as follows:—On Monday, the 22nd of May, the defendant Richard Hughes appeared before Dr. Heslop and myself on a summons obtained by Robert Woolley, inspector of nuisances for the borough, under the 38th and 39th Vic., c. 63, sec. 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," under a penalty not exceeding £20; and it was proved that on the 19th of February George Leaton, acting under the instructions of Mr. Woolley, went to the shop of the defendant, who is a drysalter and grocer in the borough, and asked for two ounces of milk of sulphur, and received from him as such milk of sulphur two ounces of a powder which was subsequently analysed by Dr. Alfred Hill, borough analyst, and found to contain according to the certificate which was produced to us, 67 per cent. of sulphate of lime and 33 per cent. of pure sulphur. The certificate also stated that the article was a fraud, and injurious to health. Dr. Hill also, on examination, gave it as his opinion that it was so injurious because the effect of sulphate of lime, like all lime salts, would be to constipate the bowels, and to promote the formation of calculi, if there was any tendency in the constitution to such secretions. I may mention here that this opinion was controverted by Dr. Anthony, a witness called by the defendant, who stated that in his judgment sulphate of lime was not only not injurious to health, but that the sulphur was made more laxative by its addition. But I confess his evidence did not carry conviction to my mind. Dr. Heslop did not agree with him; and certainly I never heard that children's confectionery was improved by sulphate of lime being largely used in its composition. Now, it was not contended on the part of the prosecution that the presence of so much lime was an adulteration in the sense of a deliberate addition to the sulphur, nor is the term adulteration used at all in the present statute, and when Dr. Hill speaks of it as a fraud he means, I am sure, a legal not a moral fraud; but it was contended that the article complained of was prepared according to the formation of an old-fashioned, obsolete, and exploded pharmacopœia of 1746, which necessarily involved the presence of sulphate of lime; whereas if it had been prepared as it ought to have been, in accordance with all the more recent pharmacopœias, it would have been wholly free from lime, which Dr. Hill and others consider an unnecessary and a noxious ingredient, and, therefore, that the article sold was not of the "nature, substance, and quality demanded by the purchaser," and that the sale of it was "to his prejudice." The fact as I understand it, is this:—In order to produce milk of sulphur (*lac sulphuris*) or sulphur precipitatum (for it is intended by the prosecution, and, as I think, I shall show, justly contended, that the two are synonymous and convertible terms) it is necessary that the sulphur and lime should be boiled or heated together in water, and treated with the addition of an acid. Under the Pharmacopœia of 1746, the acid employed was sulphuric acid, and this involved the formation of a substance called sulphate of lime, which only requires drying or heating to become the well known plaster of Paris. This is mixed with the sulphur, and is the identical article sold by the defendant, except that the proportion of lime appears to be much larger than in any of the other cases that have been made the subjects of prosecution under the section. In all the recent pharmacopœias the acid employed is hydrochloric or muriatic acid, and in this preparation the lime wholly disappears, and the produce is the pure sulphur precipitatum, which contains no lime at all. I may not be technically exact in this description, but that is what I understand to be the case. The value of the latter is exactly double that of the former; and the question is whether a person who sells under the same name with the pure article a mixture of which only one-third is pure sulphur and two-thirds plaster of Paris, does not come under the provisions of this statute as selling a drug which is not of the nature, substance, and quality of the article demanded. Now, the defendant contends, and calls several most respectable chemists—gentlemen of the highest possible character—to support him, that milk of sulphur (*lac sulphuris*) and sulphur precipitatum are totally different things, that *lac sulphuris* is not sulphur precipitatum, and sulphur precipitatum is not *lac sulphuris*; that the substance containing lime is properly called *lac sulphuris*, and the substance which does not contain it is properly called sulphur precipitatum, and that this is a distinction well known and acted upon by all druggists, grocers, and drysalters, and therefore he does not wrong in selling the impure article under the name of milk of sulphur, which he contends is the article demanded under that name. But I am convinced that this is a position which cannot be maintained. The evidence in this case is entirely against it. On the same day on which the article in question was purchased from the defendant as milk of sulphur, twelve other purchases were made of milk of sulphur from other tradesmen. In ten of them the article was found to be pure sulphur precipitatum without a particle of lime, and in only two others was any lime detected. Moreover, in a general trade list which was shown to us, the two articles appeared under the same name "sulphur precipitatum," but with this distinction; the first was what the defendant calls "milk of sulphur," but attached to it was this note, "this contains sulphate of lime." The other, the price of which was exactly double that of the first, was described as "pure," and this really appears to be decisive on the whole question. Moreover,

in Dr. Pereira's *Materia Medica*, and in several other books of undoubted authority, the pure article is called by both names—*lac sulphuris* and *sulphur precipitatum*, and the impure one is not recognised at all, or, if it is, it is distinguished as containing sulphate of lime. This being the case, can it be just and right that the practice advocated by the defendant of selling the impure article under the same name and at the same price, as the pure should be allowed to continue? I think not, and it ought to be put a stop to, and therefore I am of opinion—and in this I am most happy to say I am borne out by Dr. Heslop, to whom I beg to record my deep obligation for the invaluable assistance which he has most kindly afforded me, though he is not responsible for the language in which I have conveyed my opinion or the reasoning which I have employed—that a person who sells as milk of sulphur an article which contains only one-third part of pure sulphur, and two thirds of plaster of Paris does sell to the prejudice of the purchaser, a drug which is not of the nature, substance, and quality of the article demanded by such purchaser. If, as is stated, there are many persons who prefer the impure article on the ground that it is more easily missible with water, by all means let them have it, but let them demand it *eo nomine*, and let it be sold with a distinctive label, stating, as in the trade list, that it "contains sulphate of lime." There can be no hardship in this to the druggist, but without such label I think it ought not to be sold as milk of sulphur. I should be very glad if the trade generally would have consented to adopt such a distinctive label, and to relieve me from the necessity of pronouncing a decision which will, I fear, give pain and offence to many most respectable tradesmen; but, as I must decide the question, I must do it according to what I believe to be consistent with law and common sense. It is a great comfort to me to know that my decision may be very easily questioned by an appeal to one of the superior courts, and it is most desirable that a matter which is considered of such importance—though I confess I think the importance is a good deal exaggerated—should be finally settled. My decision must therefore be in favour of the prosecution, but as the object is not to punish for an act the illegality of which has been denied, but to declare it illegal and prevent its repetition, I impose merely a nominal penalty of one shilling, and make no order about costs.

Mr. Tanner applied for a case, which was granted. He said he thought the better course would be to go to the Court of Queen's Bench instead of the Court of Quarter Sessions, and he should take the necessary steps in the matter.

THE ANALYST.

SOCIETY OF PUBLIC ANALYSTS.

On the 14th inst., an Ordinary General Meeting of the Society of Public Analysts was held, at Burlington House; the President (Dr. Redwood), occupying the chair.

After the formal business had been transacted, the Scrutineers (Messrs. J. H. Scott and H. H. Slater), reported that the following gentlemen had been elected as members of the Society:—

W. Bettel, Middlesborough; H. C. Bartlett, Ph.D., F.C.S., London; John Clarke, Ph.D., Glasgow; Otto Hehner, Ventnor; A. Bostock Hill, L.R.C.P., and L.S.A., Birmingham; J. A. R. Newlands, F.C.S., London; W. Thomson, F.C.S., Manchester; R. R. Tatlock, F.R.S.E., F.C.S., Glasgow; W. Wallace, Ph.D., F.R.S.E., F.C.S., Glasgow; James Baynes, Jun., F.C.S., Hull. The name of Mr. C. Harrison, Lincoln, who applied to be admitted as a member, was duly read in accordance with a rule of the Society.

The following papers were then read by their respective authors, and discussed:—

What is Milk of Sulphur? By Alfred Hill, M.D.; On the Composition and Analysis of Butter Fat, by A. Dupré, Ph.D., F.R.S.; On the frequent presence of Cane Sugar in certain samples of Wine, by C. A. Cameron, M.D., F.R.C.S.; On Mercuric Iodate, its preparation and re-actions, by C. A. Cameron, M.D., F.R.C.S. On some recent cases of Milk Adulteration, by E. W. T. Jones.

We regret that the pressure on our space necessitates our postponing till our next issue the publication of the paper by Dr. Dupré, and the two papers by Dr. Cameron.

WHAT IS MILK OF SULPHUR?

Read by ALFRED HILL, M.D., before the Society of Public Analysts, June 14th, 1876.
To every medical man and student of chemistry and *materia medica*, well informed, the answer is simple enough. It is sulphur reduced to a minute state of division by precipitation from chemical solution.

In a case recently heard at Colleshill, which has been widely published, I endeavoured, without success, to convince the Magistrates that precipitated Sulphur and Milk of Sulphur are one and the same thing. It was maintained successfully by the Defendant that Sulphur precipitatum is not Milk of Sulphur, and that a mixture of precipitated Sulphur and sulphate of Lime is exclusively properly so termed. Sometimes a different view is taken by magistrates, but more frequently not, and I think it will be profitable to us, as Public Analysts, to consider for a short time this very practical question.

The sample upon which proceedings were taken contained 59.75 per cent. of crystallized calcium sulphate, and the correctness of this statement was not disputed. The defence in effect was that the purchaser had been supplied with the article which he demanded, and that the alleged adulteration was covered by the sub-section of the Act which said "that no offence should be deemed to have been committed where any matter "or ingredient not injurious to health had been added to the food or drug, because the "same is required for the production or preparation thereof as an article of commerce."

I will state the chief points of the defence as briefly as possible.

That the Pharmacopœia of 1724 called the preparation *lac sulphuris*, and it ordered the preparation to be made from lime and sulphuric acid.

That the sulphate of lime is a necessary ingredient of the drug.

That it was necessary to enable the drug to mix with water.

That the sulphate of lime increased the activity of the drug.

Mr. Alfred Bird totally disagreed with Dr. Hill's statement.

Mr. Bird stated "milk of sulphur" to be a distinct preparation from sulphur precipitatum; he had known that ever since he was an apprentice. He had always sold the two articles as perfectly distinct. Milk of sulphur was not an impure article. He stated that he had always sold the lime compound for milk of sulphur, and he always should. Chemists dare not sell anything else than this mixture for milk of sulphur. Mr. Bird further stated that the *cheaper* article is sold because it is the most beneficial. Precipitate of sulphur was only produced as a *chemical curiosity*, and there was no use specified for it in the London Pharmacopœia. It was only *ignorant* medical men who did not know the difference between the two. Trade lists of chemicals were put in to prove that they were distinct articles. Mr. Croxall said the bench were of opinion that there were two articles known to the trade as milk of sulphur and sulphur precipitatum, and that the sample sold was a fair sample of milk of sulphur. The summons would therefore be dismissed.

In answer to these statements I say that the Pharmacopœia of 1724 did not order *lac sulphuris* to be made with lime, but either with lime or carbonate of potash, as alternative methods. That the sulphate of lime is not a necessary ingredient of the drug. That the sulphate of lime is not necessary to enable the drug to mix with water, as water is not a proper medium in which to administer it. That instead of increasing the activity if the drug it diminishes it *pro rata*. That instead of chemists not daring to sell pure precipitated sulphur when asked for milk of sulphur, I say that out of 13 samples of milk of sulphur lately purchased by the Birmingham inspector, 10 were perfectly pure, and of 12 samples purchased in Birmingham since the Coleshill case 6 were pure. One of the latter was labelled "Pure Milk of Sulphur," showing that some chemists regard both kinds as milk of sulphur. One was a mixture of precipitated sulphur, sulphate of lime, and *flowers of sulphur*. It is untrue that the cheaper substance is sold because it is the most beneficial; the witness must have meant most beneficial to the seller as it is certainly not so to the buyer.

Although drug lists, judiciously selected, were put in to prove Defendant's case, I have since found drug lists which prove the opposite, *e.g.*, Burgoyne, Burbidges & Co.'s list describes both kinds as sulphur precipitatum, the one "*commercial*," containing sulphate of lime, and the other "*pure*;" while the list of Hodgkinson, Prestons & King, designates them both *lac sulphuris*, one being distinguished as "Pur. P.B."

As the whole question in the Coleshill case turns on the point of identity or non identity of milk of sulphur and precipitated sulphur, I propose to enquire what are the opinions of various authorities of repute, published during the last century and a half, as far as I have been able to consult them.

Dr. Thomas Thomson in his "Elements of Chemistry," published as far back as 1810, on page 13 states, "When sulphur is dissolved in any liquid, as in a solution of potash, and then precipitated by an acid, it is always in a state of white powder, known by the name of "*lac sulphuris*." This sentence needs no comment, because the introduction of sulphate of lime is impossible, but the substance is nevertheless called *lac sulphuris*.

Brande, in his "Manual of Chemistry," vol. 1, page 38, says, "For some pharmaceutical purposes sulphur is precipitated from its alkaline solutions by an acid, and, when washed and dried, is in the form of a yellowish-grey impalpable powder; this is the *milk of sulphur and precipitated sulphur* of the Pharmacopœia." There is nothing here

to justify the inference that milk of sulphur must contain sulphate of lime, but, on the contrary, that it may be formed from any alkaline solution, whether calcareous or not.

In the "Chemistry" of Brande & Taylor, 1863, p. 237, is a similar passage, thus, "For some pharmaceutical purposes sulphur is precipitated from a solution of tersulphide of potassium or pentasulphide of calcium by hydrochloric acid, and when washed and dried it forms a pale yellowish-grey impalpable powder; this is the *milk of sulphur and precipitated sulphur* of the Pharmacopœia." Here again the sulphur precipitated by the special acid mentioned, the hydrochloric, or from sulphide of potassium, is called milk of sulphur, when of necessity sulphate of lime is excluded.

Muspratt, who is an excellent authority on such a question as this, says, "Sulphur occurs in commerce in another form intended expressly for medical use. When in this shape it is called *milk of sulphur*, and consists of sulphur in a very minute state of division. . . . Lime is almost invariably used by the manufacturers as a solvent, but they are *guilty of substituting sulphuric acid for hydrochloric as a precipitant*. By so doing, instead of forming the soluble chloride of calcium, which is easily removed by washing, they form the very insoluble sulphate of lime, which mixed with the sulphur, forms the article commonly sold by druggists as milk of sulphur, and thus what should be pure sulphur is contaminated by this worse than useless sulphate of lime, often to the extent of more than 50 per cent. In one sample obtained from a druggist, and which was stated to be pure, 56 per cent. of sulphate of lime was found. It is useless to argue that such a sophistication is harmless, for, although not positively poisonous, the introduction into the stomach and bowels of a quantity of this insoluble matter cannot but be productive of harm."

In Gmelins' Handbook of Chemistry, Vol. I, p. 159; translated by Henry Watts, for the Cavendish Society, we find:

Milk of Sulphur, Lac Sulphuris. Sulphur separated in the cold from aqueous solutions containing hydrosulphuric acid. To obtain it, prepare one of the following solutions: (a.) An aqueous solution of liver of sulphur. (b.) The solution a, thoroughly saturated by boiling with sulphur. (c.) Sulphide of potassium obtained by igniting sulphate of potash with charcoal, then dissolved in water, and the solution saturated with sulphur at a boiling heat (Bucholz). (d.) Solution of caustic potash boiled with sulphur till saturated. (e.) One part of quicklime slaked with three parts of water, and then boiled with two parts sulphur and thirteen parts water. One of these liquids, after being left to stand for some days, then filtered and properly diluted with water, is precipitated by sulphuric, hydrochloric or acetic acid free from metal. With e only hydrochloric or acetic acid can be used.

In the manual of *Materia Medica*, by Royle, 3rd Edit., 1856, page 29, we find: "Sulphur precipitatum, L. precipitated sulphur. Lac sulphuris or milk of sulphur. This is omitted from the other British Pharmacopœias, on account of its impurity, nearly two-thirds by weight of that of the shops being sulphate of lime. To prepare it, one part of sublimed sulphur is boiled with two parts of slaked lime in eight parts of water. To the solution thus produced, which contains sulphuret of calcium and hyposulphite of lime, hydrochloric acid is added in sufficient quantity to form with the lime, chloride of calcium and sulphur is precipitated. Sulphuric acid may be *fraudulently* substituted for hydrochloric when sulphate of lime falls down with the sulphur."

In the 6th Edition, 1876, the heading is the same with the substitution of P.B. for L., and the following remarks: "Precipitated sulphur is now generally disused on account of the *fraudulent* substitution of sulphuric for hydrochloric acid in its preparation. When the former acid is used both lime and sulphur are precipitated, the former as insoluble sulphate, forming the chief portion of the precipitate."

Dr. Attfield, a high authority on Pharmaceutical Chemistry, says: "By far the larger proportion of precipitated sulphur met with in commerce is still (1867) adulterated with sulphate of calcium," and he calls the adulteration a "fraud."

Dr. Muter also regards the terms *lac sulphuris* and *sulphur precipitatum* as synonymous.

Perhaps it would be difficult to find a better authority on *Materia Medica*, than the late Dr. Pereira, a Doctor of Medicine, a Fellow of the Royal Society, a Fellow of the Royal College of Physicians of London, a Professor of *Materia Medica* and Examiner in *Materia Medica* in the University of London, and presumably as well qualified by his education and general and special knowledge and experience as Mr. Bird.

In the 4th Edition of Pereira's *Materia Medica*, vol. 1, p. 357, we read: "Sulphur precipitatum, precipitated sulphur; *lac sulphuris* or milk of sulphur. The precipitated sulphur of commerce is most extensively *adulterated* with sulphate of lime. In its preparation, sulphuric acid has been substituted for hydrochloric acid by which the product contains nearly two-thirds its weight of crystallised sulphate of lime." And in "Nelson's Medicines, their uses and mode of administration, 7th Edition, 1867, by Rawdon Macnamara, L.R.C.P., Professor of *Materia Medica* in the Royal College of Surgeons of Ireland," under the heading, Sulphur Sublimatum, p. 23, is the following remark, "precipitated sulphur, which was at one time very generally employed instead of sublimed sulphur has *nearly fallen into disuse* in consequence of the very impure state in which it is sold; It has however, been introduced into the British Pharmacopœia, and a formula has been given for its preparation."

These extracts clearly prove that precipitated sulphur, whether produced from sulphides of potassium, sodium, or calcium by sulphuric acid, hydrochloric acid, or acetic acid, and therefore, whether perfectly pure, or mixed with sulphate of calcium, has been for 150 years, and still is properly designated by either the term, *lac sulphuris*, *milk of sulphur*, *sulphur precipitatum*, or *precipitated sulphur*, all of which are synonymous terms.

Dr. Paris in his celebrated work, "Pharmacologia," 1822, writes—sulphur precipitatum, L. *lac sulphuris*, P.L. 1720. This *when pure*, differs, in no other respect from sublimed sulphur, than in its superior whiteness, which it owes to the presence of a small quantity of water."

Dr. Ballard in his *Materia Medica* sets down the two names as synonymous, and the same with every author on *materia medica* or chemistry, whom I have been able to consult.

Much stress was laid by the defence in the Coleshill case, on the statement that the precipitated sulphur of the early pharmacopœias was made from lime and sulphuric acid, and that sulphur so precipitated in association with sulphate of lime, is the only true *lac sulphuris* or milk of sulphur, and something totally distinct from sulphur precipitated alone, or without sulphate of lime. I was not prepared at the time for this assertion.

never dreaming that such a contention would be put forward, or it would have been easy to have refuted it by this very Pharmacopœia of 1724, which was produced in order to prove the defendant's case. On subsequently referring to this Pharmacopœia of 150 years ago, it appears that only so much was quoted by the defence as was thought desirable. The following is the recipe for the preparation of "Lac Sulphuris" in the Pharmacopœia Collegii Regalis, Londinensis, 1724.

Sulphuris partem unam.

Calcis vivæ vel *Salis Tartari* (i.e., carbonate of potash) partes tres. coque in aquae fontanae: q.s. ad solutionem sulphuris, filtra, calide, præcipita cum Spiritu Vitrioli edulcora et sicca.

It is here seen that the name of the preparation is "Lac Sulphuris" and no Sulphur Precipitatum, also that this "Lac Sulphuris" consists of sulphur and sulphate of lime, if the quicklime be used, but of pure sulphur, that is without sulphate of lime, if the alternative method by *Salis Tartari*, or carbonate of potash be used. No other illustration is needed to refute the statement that the term milk of sulphur is applied only to the mixture of precipitated sulphur, with sulphate of lime, because we see that it is referred with equal authority to that which is prepared in such a manner that the presence of the alkaline earth-salt is impossible.

In the London Pharmacopœia of 1746, singularly enough, while the preparation is directed to be made with lime, and diluted spirit of vitriol, the term "Lac Sulphuris" is dropped, and that of "Sulphur Precipitatum" substituted for it. This is still further proof of the falseness of the contention, that the term milk of sulphur refers to a mixture of sulphur and sulphate of lime, while precipitated sulphur is the sulphur without the sulphate of lime, for now it appears that just the reverse is the case.

In the London Pharmacopœias of 1763 and 1771, the directions for the preparation of "Sulphur Precipitatum," (there is now no mention of the term "Lac Sulphuris,") are the same as in that of 1746, but in the Pharmacopœia of 1788, an intelligent change is observed, the lime, sulphur and vitriol process of the three previously mentioned works is abandoned, and an improvement is also made upon the double process of the 1724 issue, which was really better than those of the three subsequent Pharmacopœias in giving a good as well as a bad process, for now though sulphuric acid or vitriol acid, as it is here for the first time called, is retained, lime is banished altogether, and potash is substituted for it, thus there are ordered prescribed quantities, *kali sulphurati*, i.e., (liver of sulphur) aq: distillat and *acidi vitriolici diluti*, and so the sulphur which is precipitated is free from lime, or any other admixture.

To the chemist of the present day, these changes, and the earlier crude processes appear very strange antiquated and even grotesque, but it must not be forgotten that we have the advantage of living in times when modern chemistry has undergone a most unparalleled impetus and development, and we have much to be thankful for in this respect, but in 1721, and onward to the end of the eighteenth century, the science of chemistry, as we know it, was only in its infancy, and its efforts were naturally weak and unsteady. Evidence of increasing growth and strength is however given in the improved formula of the Pharmacopœia of 1788, and this is still more noticeable in that of 1808, when the cheaper lime was again ordered to be used in place of the costlier potash, and the difficulty of contaminating the precipitated sulphur by sulphate of lime was obviated by the introduction of muriatic in place of the sulphuric acid.

It occurs to me that the long use of sulphuric acid was due to the greater readiness with which it was obtainable, having been well-known from the time of the Alchemists, and being at that time easily produced by the distillation of green vitriol, while muriatic acid seems to have been rarer and much less employed. As the latter became more common and cheaper, it would naturally be brought into use, in many cases where sulphuric acid had been used before. However; this may be, muriatic acid introduced for the preparation of precipitated sulphur in the Pharmacopœia of 1808, has ever since maintained its place.

If any doubt remained upon the question of the terms *lac sulphuris* and *sulphur precipitatum* being synonymous it is set at rest by the translation of the London Pharmacopœia of 1851, by Richard Phillips, F.R.S.L. & E., F.G.S., late President of the Chemical Society, Curator of the Museum of Practical Geology; in which we find Sulphur Precipitatum, P.L. 1824, Precipitated Sulphur; Lac Sulphuris, P.L. 1721; Sulphur Precipitatum, P.L. 1746; P.L. 1788; P.L. 1809.

Impurities, Adulterations and Tests, Dilute Sulphuric Acid is often employed in the preparation of Precipitated Sulphur, and it then is largely *contaminated* with sulphate of lime, which is easily detected by the tests in *Materia Medica* (Sulph. Precip.)

Medicinal Uses. The same as sulphur, to which *when properly made* it is to be preferred.

Not only is the identity of the two substances here distinctly declared, but the article containing lime is said to be contaminated and the opinion is expressed that *when properly made*, that is when free from Sulphate of Lime, it is a valuable medicine, leaving it to be inferred that when not properly made it is an inferior article.

The *Pharmacopœia Gallica* of 1818, recommends that sulphur be boiled with either potash, soda, or lime, in water, and that the sulphur be precipitated from its alkaline solution by the addition of acetic acid, and the same form is given in the *Pharmacopœia Français* of 1819.

So that though lime is or may be used according to the Pharmacopœia of the two countries, its precipitation is obviated by the use of acetic acid.

The *Pharmacopœia Borussia* (Prussian), 1829, under the heading "Sulphur Precipitatum (Lac Sulphuris)," orders the substance to be prepared from caustic potash, sulphur and sulphuric acid; in this case though sulphuric acid is used, the introduction of calcium sulphate is carefully avoided by the use of potash in place of lime. Then follows the remark, "totally volatile," implying that no lime must be present. In the 1846 edition of the same Pharmacopœia, under the same heading, the article is directed to be prepared from calcaria, sulphur and hydrochloric acid. Lime is here introduced probably because it is cheaper than potash, but the same care to exclude impurity is exhibited by the substitution of hydrochloric for sulphuric acid.

If we consult the chemical works, not Pharmacopœias, of other countries, we find that the use of lime, so as to contaminate the precipitated sulphur with a lime salt is carefully avoided. This has been already partly shewn by the quotation from the English translation of Gmelin's Handbook, and if we consult other German authorities, we find that not only is the same object always kept in view, but also that in this careful exclusion of lime, the sulphur which is precipitated is still distinctly called *milk* of sulphur or its equivalent; thus "Schwefelmilch" is the common German name for Gefällter Schwefel, just as milk of sulphur is the common English name of precipitated sulphur.

The quotations I have made, shew clearly that there is no reason whatever for the assertion that there is a distinction between the terms milk of sulphur and precipitated sulphur, they show that milk of sulphur containing lime, is an antiquated, impure and long abandoned form of the drug, and it ought therefore no longer to be sold. The drug is weakened in its action by dilution with the lime salt, and in cases where it is habitually used the lime is highly calculated to prove injurious. Not only is the drug weakened by the admixture, but the dose is enormously increased in bulk, a great objection in an already bulky substance; the presence of the lime salt commonly increases the necessary dose 150 per cent., for if a person requires a dose of 2 drams of actual sulphur, he must take 375 grains, or nearly an ounce of some such samples as I have examined, a quantity quite sufficient to deter any ordinary person from its use.

Although the hearing of the Coleshill case resulted in its being dismissed, I felt convinced that if a similar case could be heard, the decision must be given in favour of the principle of pure medicines, and this conviction has been realised by a case tried at Birmingham, on the 22nd May, the decision upon which was given by Mr. Kynnersley, on the 29th May, and a copy of which appeared in No. 3 of "*The Analyst*," which, no doubt, every member of the Society has seen.

This Birmingham sample contained no less than 67 per cent. of sulphate of lime, or more than two thirds of its weight.

It seems to me a great mistake that druggists who pride themselves on the advances which as a body they have really made, through the improved, general, and pharmaceutical education they have latterly received, should constitute themselves champions of an impure drug. I cannot help thinking they would be much better consulting their own reputation and public interest by dealing only in the pure article. To say that the people prefer the impure sort is absurd, for it is inconceivable and opposed to my professional experience, that the public know the difference or even that two distinct sorts exist; but assuming for the sake of argument, that they do know, it is the duty of every druggist worthy of the name, to educate the public by explaining the difference and refusing to supply the impure kind; but says Mr. Bird, no chemist dare sell the pure precipitated sulphur if asked for milk of sulphur, then I ask how is it that out of thirteen samples bought in Birmingham on the same day, by the name of milk of sulphur, three only contained sulphate of lime and ten were perfectly pure, and consisted of Mr. Bird's "chemical curiosity," and I would further call to mind that one of the defendant's witnesses in the Birmingham case, himself a druggist, astonished the court, and no doubt the trade representatives who brought him forward, by stating in evidence that he kept only one kind, the pure, and that when a customer came to his shop for milk of sulphur he supplied him with this pure precipitated sulphur.

This is no doubt the truth, and very creditable it is to the druggist in question, who, however, does not stand alone in this matter, for as we have seen ten druggists out of thirteen in one day similarly supplied the pure article. I trust I have succeeded in satisfactorily answering the question at the head of my paper, in proving that milk of sulphur and precipitated sulphur are not two substances recognised as distinct by either scientific chemists or medical men, ancient or modern, but that the distinction is merely technical among only some druggists for trade purposes, and one with which, therefore, we as Analysts have nothing to do in carrying out the provisions of the sale of Food and Drugs Bill. To my mind there is not the least doubt that both names indicate the same article, of which there are two sorts in the market, a pure and an impure, and that it is the duty of both Analysts and Medical men to do all in their power to suppress the use of that which is adulterated.

Mr. Allen said that the history of *lac sulphuris*, as given by Dr. Hill, was extremely interesting, but a similar preparation was described in several older works than the Pharmacopœia of 1721. Thus in one case, "sharpionic or spirit of vinegar" was ordered to be used, and in another this was replaced by hot urine. Leaving the question of the exact meaning of the term "milk of sulphur" to be fought out between Dr. Hill and the druggists, Mr. Allen said he avoided the question by directing that "precipitated sulphur" should be asked for. The result appeared to be exactly the same, the "adulterated variety" (as it was called by Pereira) being frequently sold even when "precipitated sulphur" was specially asked for. He had no doubt that it would be as warmly contended by these vendors that milk of sulphur and precipitated sulphur were identical, as it was in Dr. Hill's cases that they were entirely different preparations.

It was curious that in one of the cases in which Dr. Hill was concerned, he stated the amount of sulphate of lime contained in the sample as considerably greater than that found by Mr. Bird, the gentleman employed by the defence. A little knowledge was a dangerous thing, and it appeared highly probable that the discrepancy was due to Mr. Bird's having been aware that sulphur was volatile and the impurities fixed, but ignorant of the fact that the residue left on ignition required to be calculated into the hydrated sulphate of calcium before its weight could be held to represent the extent of contamination of the original sample.

Mr. Allen had recently examined several samples which had been sold as "precipitated sulphur," and the results were of some interest. Two were genuine, one contained sulphate of calcium, and another consisted of the orange oxysulphide of antimony. The vendor of the latter sample pleaded in defence that he had been in business thirty years, and a medical man was called as a witness to his accuracy in dispensing. The defendant stated that he was well acquainted with the difference between the two preparations, and the purchaser asked for "precipitated sulphur of antimony." It was shown, however, that the sub-inspector who purchased the article had never heard of such a substance, and had read the words "precipitated sulphur" from his note-book, without knowing what kind of preparation he was to expect. The vendor was ultimately fined 50s. and costs, and subsequently admitted to the inspector that when he asked for "precipitated sulphur" he could not think what stuff was meant, and sold the antimony as the article probably required. The same druggist has also recently furnished the first conviction under Section 7 of the Sale of Food and Drugs Act, for selling a compounded drug not compounded in accordance with the demand of the purchaser. A mixture made up by him from a physician's prescription was found to contain 247 grains of iodide of potassium instead of 160 as ordered—at least the portion of the sample submitted to Mr. Allen contained 24·7 grains per ounce. As it seemed possible that the large excess present was due to imperfect mixing of the sample before division, Mr. Allen had the inspector's portion opened by a magistrate's order, but the analysis of this fully confirmed that of the original analyst's portion, and the defendant was fined 50s. and costs. At the hearing the vendor's solicitor made an ingenious defence based on the imperfect admixture theory, and was considerably disgusted on discovering that Mr. Allen had anticipated the objection and had provided against it by procuring the analysis of part of the inspector's portion.

In four other cases a prescription was submitted containing "precipitated sulphur" as the chief ingredient, and in two of these sulphate of calcium was found.

Mr. Allen concluded by calling the attention of the Society to a very probable contamination of precipitated sulphur, especially when it was obtained as a secondary product, as was now frequently the case. If the hydrochloric or sulphuric acid used were contaminated with arsenic, this dangerous impurity would be precipitated as sulphide along with the sulphur.

The common employment of sulphuric instead of hydrochloric acid was easily explained, as it was only since the enforcement of the Alkali Acts that the latter acid had been able to compete with the former, and that would be still more the case before the present method of soda manufacture became general.

Dr. Redwood said he entertained a very different opinion from that which had been expressed by the author of the Paper. He thought there were two distinct questions involved in the consideration of the subject relating to the sale of milk of sulphur, and he wished to offer a few remarks with reference to both the questions, which were as follows:—

1. Are the terms "milk of sulphur" and "precipitated sulphur" strictly and necessarily synonymous, or may they not be legitimately, as they often are in practice, used to signify two different things?

2. Is the preference which many persons give to the sort of precipitated sulphur, commonly called milk of sulphur, containing sulphate of lime, in comparison with the precipitated sulphur of the British Pharmacopœia, founded on any real and substantial advantages which the former possesses over the latter; or does it originate in and is it entirely founded upon an ignorant prejudice which it is the duty of druggists to endeavour to remove?

With reference to the first of these questions, he considered that the term "precipitated sulphur" could only be correctly taken to mean the preparation described under that name in the present Pharmacopœia, and no druggist was justified in supplying under such name an article containing a large quantity of sulphate of lime; nor should the interpretation be confined to cases in which precipitated sulphur was ordered by a medical man, but it should also apply to its sale to the public for use as a domestic medicine, unless the person selling it had reason to believe, from something conveyed or implied, that the article popularly known as milk of sulphur was preferred and required. But although there should be no doubt as to the meaning of the term "precipitated sulphur," especially among druggists who were supposed to understand and to be governed by the requirements of the Pharmacopœia, it was otherwise with reference to the term "milk of sulphur." This term, or its Latin representative, *lac sulphuris*, was first used officially in the London Pharmacopœia of 1721. Dr. Hill would excuse him for calling his attention to the date of issue of the Pharmacopœia in which the formula was first given, which was 1721 and not 1724 as stated in Dr. Hill's paper. As described in that formula, milk of sulphur was directed to be made by dissolving sulphur in water by means either of lime or salt of tartar, and then precipitating with sulphuric acid, thus yielding, in one case, a mixture of sulphur with sulphate of lime, and in the other sulphur, without sulphate of lime. At that time, clearly the term "milk of sulphur" meant either of those preparations. It might be fairly supposed that both the methods indicated in the Pharmacopœia were sometimes adopted, and that those who used the article were therefore enabled to compare the two products. It might be also

concluded that a preference was given even then to the preparation containing sulphate of lime, for, in the next edition of the Pharmacopœia, in 1746, the alternative method of dissolving the sulphur with salt of tartar was omitted. It was worthy of remark that this was the first edition of the London Pharmacopœia in the preparation of which scientific knowledge had been brought to bear, yet although prepared under the direction of a scientific committee, the preparation containing sulphate of lime was retained under the name of precipitated sulphur, while the other name and preparation were dropped. At that time, then, namely 1746, and up to 1788, the name "precipitated sulphur" was officially applicable only to the preparation containing sulphate of lime, while the name "milk of sulphur" signified either that article or sulphur free from sulphate of lime. In 1788, for the first time, hydrochloric acid was directed to be used for precipitating the sulphur, and since that time precipitated sulphur has always officially signified sulphur, not pure, but free from sulphate of lime. Such being the history of the official introduction of the two articles referred to, and of the use of the names "milk of sulphur" and "precipitated sulphur," he (Dr. Redwood) had always considered, and he still maintained, that the name "milk of sulphur" had a double meaning, and that while it might be looked upon as a synonym for precipitated sulphur, it was at the same time equally applicable, and was in fact the only name that would be popularly understood and that could be applied to the preparation of sulphur with sulphate of lime, which had received the sanction of two committees of the London College of Physicians and for centuries had been used and approved of by a large proportion of the public who were in the habit of using milk of sulphur. He denied therefore that milk of sulphur which contained sulphate of lime was an adulterated article. It was one of the varieties of precipitated sulphur which had been sanctioned by medical authority, and still more by the opinion of those who were accustomed to take it, and who, with reference to an article of this kind, were capable of judging of its effects, and were justified in refusing to be supplied with a different article, to which they objected. This was not the only case in which a name which had been used in a superceded Pharmacopœia, and which had been replaced by an altered name as applied to an altered formula, had been used legitimately and properly to designate the preparation to which it was originally applied, and to distinguish such from the succeeding representative of that preparation. In confirmation of this he might allude to the cases of paregoric elixir, and cathartic extract or compound extract of colocynth, the former as modified in composition by the London Pharmacopœia of 1809, and the latter as modified in 1851. He could not suppose that those present would be able fully to appreciate the difficulties often experienced by druggists in meeting the requirements of the public in the supply of popular medicines, such as those he had named and several others.

With reference to the second question, he considered that milk of sulphur containing sulphate of lime possessed real and substantial advantages over the other preparation, which justified the preference given to it by the public. Not only was it less disagreeable in taste and smell, more easily mixed with water, and more easily taken because it did not, as the other did, stick about the mouth in attempting to swallow it; and all these were important qualities in a medicine often given to children; but in addition to these qualities it would be found, if the two preparations were properly examined, that the sulphur existed in milk of sulphur in a more pure and less nauseous state than that

in which it existed in precipitated sulphur. The method usually adopted in examining these preparations afforded a very imperfect insight into their respective natures. By the application of heat one was volatilised entirely and the other left a residue of sulphate of lime, from which it was inferred that one was pure sulphur and the other was not. If examined in another way, however, a different conclusion might be arrived at. Let each powder be treated with bisulphide of carbon, by which the sulphur would be dissolved, leaving in one case a dark-coloured oily residue of persulphide of hydrogen, and in the other case pure silky crystals of hydrated calcic sulphate. If he were going to take precipitated sulphur himself or to give it to a child, he would prefer it with the latter rather than the former admixture. The sulphate of lime, he believed, rendered the sulphur more active, not only by its stimulating action on the intestinal canal, like that of cream of tartar in the *confectio sulphuris* of the Pharmacopœia, but also by its mechanically dividing the particles of the sulphur and rendering it diffusible in the contents of the stomach; while the oily persulphide of hydrogen which precipitated sulphur contains breaks up in the stomach into sulphur and sulphuretted hydrogen which causes disagreeable eructations. He had no hesitation, therefore, in saying that in his opinion the term, milk of sulphur, was correctly and legitimately used to designate a preparation of sulphur containing sulphate of lime, which had been authorised by the College of Physicians under that name; and further, that this preparation was preferable in several respects and possessed substantial advantages over the precipitated sulphur of the present Pharmacopœia.

In reply Dr. Hill could not understand why the President should consider that the Pharmacopœia of 1846 ordered a mode of preparation containing lime, because that Pharmacopœia was more scientific than previous ones, for the Pharmacopœia of late times followed a totally different course, and it could hardly be contended that they are less scientific than those of the eighteenth century. But if they are more scientific it is clear that the directions set forth in them are the best, and these we know are specially framed with a view to avoid the admixture of a lime salt.

That sulphur precipitated with lime is purer than sulphur precipitated without lime is a question not to be seriously discussed, and if the question were followed out it would lead to the conclusion that 67 per cent. of sulphate of lime being an improvement 97 per cent. would be a still greater advantage, and that the exclusion of sulphur altogether would bring the drug to its very highest state of activity and efficiency.

THE MICROSCOPICAL STRUCTURE OF CERTAIN FRUITS AND ROOTS TO BE MET WITH IN THE JAMS AND PRESERVES OF COMMERCE.*

By ARTHUR ANGELL, F.R.M.S.,

Public Analyst for the County of Hants.

This Pamphlet contains lithographic reproductions of a series of Camera lucida drawings of the structures of the fruits most commonly used in the manufacture of jam. The literary part consists chiefly of a clearly written introduction, and of tables which serve as a key to the engravings. The drawings themselves have evidently been executed with care, and, in some cases, we can ourselves verify their accuracy. The Book will, undoubtedly, be of value to all analysts engaged in the microscopical examination of fruit or jam.

* GILBERT, High Street, Southampton.

WEST BROMWICH MILK CASES.

By E. W. T. JONES, F.C.S.

Read before the Society of Public Analysts, June 14th, 1876.

On the 10th February last, amongst other samples were submitted to me, two of milk marked respectively 40 C, and 43 C, which I analysed with the following results:—

	40 C.	43 C.
Solids not Fat	7·96	8·15 per cent.
Fat	2·57	3·50 „
Total Solids	10·53	11·65 „
Ash	0·62	0·64 „

The analysis being repeated, gave corroborative figures, so I certified that 40 C contained 14 per cent., and 43 C, 12 per cent. of added water. Summonses were taken out, and on the cases coming on for hearing, numerous arguments were advanced to show that the proceedings were irregular. These failing, however, the only chance of getting the cases dismissed was to prove that the milks were genuine by analysis.

Now it subsequently came to light, that the portions left with the vendors had been analysed with results confirmatory of mine, but the defendant elected to have the inspector's portions submitted to the Somerset House chemists, they were received by them on the 9th May, and as a result of their examinations, the following certificates, came to hand:—

INLAND REVENUE LABORATORY.

SOMERSET HOUSE, LONDON,
18th May, 1876.*[Report on Sample of Milk marked No. 40 C.]*

THE sample was received here by post on the 9th inst., in a bottle securely sealed. The milk was in an advanced state of decomposition, the gas evolved having evidently burst the bottle, and a portion of the milk was lost. From the position of the bottle, the milk lost would probably contain more fat than the portion remaining, but the amount of solids not fat would not be materially affected thereby.

As we have stated in our certificate relating to sample 43 C, the decomposition has the effect of reducing the proportion of solids not fat, and this circumstance has to be taken into account when considering the results yielded by the residue in the bottle. The results are as follow:—

Solids not fat	8·14 per cent.
Fat	2·43 „
Water	89·43 „
	<u>100·00</u>
Ash	0·66
Free Acid estimated as Lactic Acid	0·68

After having made the necessary addition to the amount of "solids not fat," to compensate for the loss by decomposition, the total is low for a genuine milk, but not lower than has been frequently found in genuine samples.

The amount of "fat" contained in the residue is lower than is usually found in genuine milk, but as the sample in this case was only a partial one, we cannot draw any conclusion from this fact.

The "ash" is not lower than is found in many genuine milks.

We very much regret that we are unable through the accidental loss of a portion of the milk, to form a definite opinion upon the character of the sample, and to render the magistrates greater assistance in coming to their decision in the case.

(Signed) J. BELL,
R. BANNISTER,
G. LEWIN.

INLAND REVENUE LABORATORY.

SOMERSET HOUSE, LONDON,
18th May, 1876.

[Report on Sample of Milk marked No. 43 C.]

THE sample was received by post on the 9th inst. The bottle was securely sealed. The milk was in an advanced state of decomposition, having gone beyond the lactic fermentation. This decomposition would naturally affect the proportion of solids not fat as compared with the quantity present in the milk when fresh, and an allowance must be made for the loss in question in determining whether water has been added or not. The results of our analysis are as follows:—

Solids not fat	...	...	...	8.14	per cent.
Fat	...	...	...	3.50	"
Water	...	...	...	88.36	"
				<u>100.00</u>	
Ash	...	...	...	0.78	
Free Acid estimated as Lactic Acid				0.92	

When the necessary allowance for "solids not fat," lost by the decomposition of the milk has been made, the amount is lower than is present in milk of first quality, but not less than is frequently found in genuine milk of low quality.

The quantity of "fat" represents a milk of fair quality, and exceeds the proportion found in many genuine milks.

It will be observed that the percentage of ash is .78, and there are very few milks found to contain a larger proportion of ash than this amount, whilst the great bulk of genuine milks contains a smaller proportion. This in our opinion is an important fact in judging as to the character of the sample.

Under these circumstances we do not feel justified in pronouncing the milk to be adulterated with water.

(Signed) J. BELL,
R. BANNISTER,
G. LEWIN.

I would draw attention to the agreement between our respective analyses, which is the more remarkable, considering the age of the samples when last analysed, and the decomposition alleged to have taken place. I cannot quite satisfy myself whether an allowance *has* been made for the decomposition, and the lactic acid found included in the figure of "solids not fat," but it will be noticed that the 100 is made up with three terms, viz.: "solids not fat," fat and water, and so the tabulation strictly considered, appears to show that such an allowance has been made, in which case the composition of the original milk has been arrived at with wonderful correctness, but I am rather inclined to think that the percentages given are the results of the usual analytical method of procedure, without any correction for lactic acid, &c., and that a speculation has been made as to what the composition was originally. Under either circumstances, I submit it would only have been fair of the Somerset House chemists to have added to "we do not feel justified in pronouncing the milk to be adulterated with water," but owing to the decomposition, there is some uncertainty about the matter. I shall be glad to hear comments upon these cases, because I hold they have an important bearing with all Public Analysts, since if prosecutions cannot be sustained against vendors of such milks as these, the quality of our milk must go back to the old state, and milk examination be practically useless.

I give a tabulation of the first 20 milks examined under my appointment for South Staffordshire, and of the next 20 after some heavy fines had been imposed, showing a marked difference. I also show the composition of 20 submitted from December 6th, 1875, to January 6th, 1876, and also of 4 submitted the same day as these in question, and of 5 received two days after. All these figures refer to milks purchased by the inspectors for analysis and taken *seriatim*, they therefore, show the character of the milk retailed in the district—

MILKS.

1873, Dec. 15. 1st 20 under S.S. appt.				1874, January 19. 2nd 20 after some heavy fines.					
S. n. F.	Fat.	Ash.		S. n. F.	Fat.	Ash.			
8-94	...	3-34	...	75	8-19	...	2-35	...	64
8-22	...	1-95	...	51	9-93	...	62	...	71
10-60	...	3-12	...	68	8-97	...	2-81	...	56
9-95	...	2-35	...	65	9-50	...	2-26	...	61
10-66	...	2-29	...	80	9-12	...	3-16	...	67
4-81	...	1-67	...	41	9-18	...	3-77	...	64
6-83	...	1-66	...	50	9-89	...	2-50	...	68
10-18	...	2-38	...	67	9-03	...	1-07	...	62
10-41	...	69	...	76	9-28	...	2-06	...	63
7-67	...	2-84	...	49	7-99	...	37	...	67
6-87	...	2-00	...	57	10-37	...	1-92	...	70
8-95	...	2-30	..	67	9-22	...	2-22	...	71
9-22	...	2-98	...	61	10-42	...	2-58	...	82
5-43	...	2-48	...	45	10-15	...	1-53	...	68
9-21	...	2-07	...	59	10-35	...	2-62	...	76
6-34	...	2-30	...	44	9-64	...	2-77	...	77
7-96	...	2-91	...	53	8-96	...	2-79	...	71
8-48	...	1-70	...	65	10-63	...	2-04	...	70
9-17	...	3-36	...	63	9-49	...	2-62	...	66
9-18	...	4-78	...	67	9-86	...	3-05	...	73
169-08	...	49-17			190-17	...	45-11		
Average 8 45	...	2-45			Average 9-50	...	2-25		

20 Samples of Milk submitted from
Dec. 6, 1875, to Jan. 6, 1876.

S. n. F.	Fat.	
9-43	...	3-19
10-29	...	3-80
9-61	...	4-20
9-36	...	3-54
9-09	...	1-33
9-66	...	2-56
9-56	...	3-49
9-61	...	3-21
9-19	...	2-80
8-92	...	1-95
8-86	...	3-13
9-63	...	2-78
7-86	...	3-27
9-60	...	4-29
9-09	...	3-31
8-47	...	3-27
9-33	...	5-02
9-26	...	3-68
9-27	...	3-31
9-08	...	5-72
185-17		67-85
Average 9-25		3-39

6 Milks submitted on the
10th February, 1876.

S. n. F.	Fat.	
9-60	...	2-99
9-72	...	2-99
*7-96	...	2-57
9-00	...	3-58
9-37	...	2-77
*8-15	...	3-50

5 Milks submitted
12th February, 1876.

S. n. F.	Fat.	
9-41	...	3-24
9-55	...	2-35
9-35	...	2-88
9-85	...	3-14
9-29	...	2-98

*The Two Samples in question.

Mr. Wanklyn (who had just taken the Chair) said that the Society had most strenuously opposed the clause of the Food and Drugs Act, which sanctioned permissive reference of disputed cases to Somerset House, and its forecast had been fully realized in this case. Permissive reference had become in practice the administration of the Act by the Somerset House officials, who were now unwittingly encouraging milk dealers to water milk to the extent of 10 or 20 per cent. Under those circumstances it became the duty of the Society to act with decision, and he proposed the following resolution:—

“That in the opinion of this meeting of the Society of Public Analysts, Mr. E. W. T. Jones F.C.S., was, by the figures of his analyses of the two samples of milk marked respectively 40 C, and 43 C, justified in certifying that those samples contained an admixture of added water. Further this meeting is of opinion that the results of the chemical analyses of the before mentioned samples (40 C and 43 C), made by the chemists employed by the Inland Revenue department, justify the conclusion arrived at by Mr. Jones.”

This resolution was carried unanimously.

CRYSTALLIZED SULPHIDE OF MERCURY.

M. MEHU, communicates to the *Journal de Pharmacie et de Chimie*, some properties of sulphide of mercury, which will no doubt be of interest to practical chemists, from these experiments it appears that sulphide of mercury is insoluble, both in sodic hydrate and in mono-sulphide of sodium, but soluble in a mixture of the two, from this solution it is precipitated by acids, and by large dilution with water, and even sulphide of hydrogen, by saturating the free alkali, has a like effect. The following are the best preparations to get a clear solution: 1 eq. mono-sulphide of sodium, 1 eq. sodic hydrate 1½ eq. sulphide of mercury, or the following: crystallized mono-sulphide of sodium 1 pt. solution of sodic hydrate 1.33 sp. gr., 2 pts., sulphide of mercury, 1 pt.; care must be taken not to have any poly-sulphides present, which would cause sulphur to crystallize out; the above solution when exposed to the air in a basin covered only with blotting paper, absorbs carbonic anhydride from the air, and deposits colourless crystals of carbonate of soda containing some sulphide of sodium, and 5 per cent. of sulphide of mercury, when exposed to the air for weeks the crystals get very dark in colour, and then contain hexagonal crystals of sulphide of mercury, the slower the process the finer and more regular are the crystals, they resemble quartz, and are of the colour of cinnabar. The author further states, that he has never succeeded in obtaining crystals of the much spoken of double salts of sulphide of mercury and soda, however, he does not deny their existence. The greenish substance which frequently forms on the surface of the fluid, is chiefly composed of finely divided sulphide of iron.

L. d K.

THE DETECTION OF COLOURING MATTER IN WINE.

VAN GELDER, in a notice to the *Pharmaceut* No. 36, states, that having tried Lammatine's process for the detection of foreign colouring matter in wine, he found it answer very well in the case of logwood and cochinile, but not for aniline. This process which was originally described in the May number of the *Journal de Pharmacie et Chimie*, simply consists in shaking 100 parts of the wine with 100 parts of coarsely powdered peroxide of manganese, for a quarter of an hour, and then filtering through a double filter, if the wine is pure a colourless filtrate will result.

L. d K.

ON THE HYPOPHOSPHITES.

Le Journal de Pharmacie et Chimie, for June, contains a paper of some length, on the character and impurities of the hypo-phosphites, by M. Patromillard, in which the author points out that owing to carelessness in their manufacture, the two most important hypophosphites, namely, those of lime and soda, are frequently contaminated to a considerable extent, the former with phosphates, phosphides, and barium, the latter with phosphates, sulphates, and barium, the phosphates which are produced by oxidation of the hypophosphites during evaporation, are rarely absent from the lime salt, and are the cause of the turbidity usually produced on dissolving it in water. It is obvious that some of the above impurities, especially the phosphides and barium, may considerably modify the action of these important medicines, and should the amount of impurity be excessive, their poisonous properties might render them extremely dangerous.

H. D'A. P.

MODIFICATION OF DUFLOS' METHOD FOR THE SEPARATION OF IODINE.

By C. RICE.

New Remedies for April.

DUFLOS' process depends upon the fact that ferric chloride in contact with metallic iodides or hydriodic acid liberates iodine, thus: $\text{Fe}_2\text{Cl}_6 + 2 \text{HI} = 2 \text{Fe Cl}_2 + 2 \text{H Cl} + 2 \text{I}$. The iodide is usually put into a distillatory apparatus, and the iodine passing over is received into a solution of iodide of potassium. The author's modification is to assist the evolution of the iodine vapours by a current of carbonic anhydride.

A. W. B.

CORRESPONDENCE.

TO THE EDITOR OF THE ANALYST.

SIR,—Having been obliged to leave immediately after the reading of Dr. Hill's paper on Milk of Sulphur at the last meeting of the Society of Public Analysts, I was unable to make any remarks on the subject, I shall therefore feel obliged if you will give me space for a few words.

I shall say little on the question of whether or not sulphate of lime increases or diminishes the effects of sulphur. Much must depend on whether it gets into solution in the stomach. If it does so, I believe the effects of sulphate of lime in solution in producing congestion of the liver are two well known to need comment, if it does not, the best that can be said for introducing a large quantity of an inert and gritty powder into the stomach and bowels is, that it *may* do no harm. As analysts we have nothing to do with this, the whole question for us being, is milk of sulphur a mixture of sulphur and sulphate of lime, or is it synonymous with precipitated sulphur. If we go by the only Pharmacopœia in which directions are given for making milk of sulphur, we must come to the conclusion that it may be either the one or the other, unless we conclude that the compilers of the work were not aware that sulphuric acid would precipitate lime, which I think much more probable, than that they should mean two things by the same word. This probability is increased by the fact, that in the next Pharmacopœia, that of 1746, the use of sulphuric acid disappears, but unfortunately, so does the name lac sulphuris.

It is also unfortunate that in the Pharmacopœia of 1836, precipitated sulphur disappears and only sublimed remains. In that work there is a table of *Nomina Priora*, and *Nomina Nova*, and had the names *lac sulph* and *sulphur precip* appeared in it, the question would have been settled. In 1851, sulphur precip is again introduced, but only in the *materia medica*, we are therefore, to a great extent, obliged to inquire if custom has so restricted the name of milk of sulphur to the impure article, as to justify its sale, when milk of sulphur is asked for. I would remark on this, that Mr. R. Phillips in his translation of the P. L., 1851, say "Dilute sulphuric acid is often employed in the preparation of sulphur precip. and it is then largely *contaminated* with sulphate of lime." He does not say, or hint, that it is then called or sold as *lac sulphuris*, but speaks of it only as contaminated sulphur precip. I attach great weight to anything said by Mr. Phillips, because he combined in his own person, the highest scientific attainments with a knowledge of a druggist's business, having been brought up by the late Mr. W. Allen, of Plough Court, and having himself kept a Pharmaceutical Chemist's shop in the Poultry for a good many years, before he devoted himself more exclusively to scientific chemistry, he was also employed by the College of Physicians in compiling the chemical part of the Pharmacopœia, and in 1836, published, by authority of that body, the Latin Pharmacopœia along with his translation, which gives a sort of authority to anything contained in the work. Brand also, in his Manual of Pharmacy, makes similar remarks on precipitated sulphur, but does not hint that the contaminated article may be sold as milk of sulphur.

To come to more modern custom, I may mention, that I have sent in my districts for milk of sulphur and precipitated sulphur, and up to the present time, I have always received the pure article. It is also important, as showing how completely the names are considered synonymous by those who ought to know trade custom, that Messrs. Hodgkinson, and Preston, in their price list, speak of "*lac sulphuris pure, B.P.*" although the name *lac sulphuris* does not occur in the B. P. at all, but only its synonym "*sulphur precip.*" I have been informed by druggists that they order quite indiscriminately, either *lac sulph.* or *sulph. precip.* and in either case are usually asked if they want pure or that containing sulphate of lime. I presume that when precipitated sulphur is asked for, there can be no doubt that a dealer supplying the impure article renders himself liable to prosecution under the sale of Foods and Drugs Act, but I would ask, are those who wish it to be authoritatively stated that milk of sulphur means sulphur, plus sulphate of lime, prepared to prosecute anyone who sells pure sulphur precip. under that name? Yet if the distinction really exist, such an one would certainly be supplying an article which is "not of the nature and quality of the article demanded." I cannot but think that the most violent apostle of adulteration, would hardly be prepared for this. One other point I will mention, namely, that I have never heard of the impure article being retailed at a lower price than the pure, and if 2d. per oz. give a fair profit on an article costing 8d. per lb., what can be said of those who charge the same price for one which costs but 5d. per lb. I can only, in conclusion, express a hope that an authoritative decision will soon be given one way or the other, and if the case be well argued, I cannot but believe that the contaminated article will soon disappear, as it would have done long ago, had it not been profitable as well as pretty looking.—I remain, yours faithfully,

CHARLES HEISCH, F.C.S.

Public Analyst for the Districts of Lewisham and Hampstead.

MILK STANDARDS.

[TO THE EDITOR OF THE "ANALYST."]

SIR,—In your last number is a report of a paper on milk standards, read by Dr. Hill, before the Society of Public Analysts, in which he falls foul on myself, Dr. Redwood, Voelcker, and Messrs. Bell, Bannister, and Lewin, the chemists at Somerset House, in reference to the late milk prosecution at Coventry.

Now leaving the above-named chemists to defend themselves, I beg to state that Dr. Hill told the magistrates he had had six cows milked in his presence, in the month of June, and having taken the average of the fat of the six milks, he had come to the conclusion that if there was less than 3 per cent. of fat in a milk, the cream had been abstracted, and as he found but 2·47 in the suspected milk, he was of opinion that cream had been taken from it.

I, on the other hand as chemist for the defence, told the magistrates that there can be no standard of fat, unless the age of the calf, the time of the year, and the nature of the food are taken into consideration, in proof of which I produced my analysis book, in which I shewed analyses of undoubtedly genuine milk, in which I found less fat than what I found in the suspected milk, which was "fat 2·6."

One of the magistrate then asked me if I had ever seen the cows milked, whose milk I had afterwards analysed, I said I had not, but that all my samples had been "legally certified."

An adjournment was then agreed upon to give time to have the milk examined at Somerset House, and as the magistrates seemed to attach great importance to the chemist seeing the cows milked before his own eyes, I, on the following Saturday, March the 25th, met the farmer at the Coventry Station, who drove me in his trap to the farm, about four miles off.

I remember it was a bitterly cold day, and the country looked bare and desolate, there being hardly any grass to be seen, we arrived at the farm about 4 p.m., and found that the cows had just been driven home to be milked.

Four of the cows were then milked before me, and I took samples of each of the milks, which I put into four bottles, these I brought home for examination, and here give the results.

No. 1.—Water	...	...	...	88·84	No. 2.—Water	...	...	...	88·4
Butter	...	...	...	1·83	Butter	...	...	...	3·6
Caseine and Sugar of Milk	...	...	...	9·33	Caseine and Sugar of Milk	...	...	...	8·0
				<u>100·00</u>					<u>100·0</u>
No. 3.—Water	...	...	...	89·07	No. 4.—Water	...	...	...	86·70
Butter	...	...	...	1·59	Butter	...	...	...	3·44
Caseine and Sugar of Milk	...	...	...	9·34	Caseine and Sugar of Milk	...	...	...	9·86
				<u>100·00</u>					<u>100·00</u>
No. 1.—Butter	...	...	...	1·83					
No. 2.—Butter	...	...	...	3·60					
No. 3.—Butter	...	...	...	1·59					
No. 4.—Butter	...	...	...	3·44					

Divide by 4 10·46

Average of the four Butters ... 2·61—2

It will be seen by the above, that the average of the Butters is 2·61, and as I found 2·6 in the suspected milk which came from the same farm, I could have no difficulty in coming to the conclusion that the cream had not been abstracted from the milk, and the magistrates were of my opinion, for they dismissed the summons with costs against the Coventry Corporation, and as Dr. Hill, in his certificate, had charged the unfortunate farmer with "fraud," they gave him a written certificate that he left the Court without a stain on his character.—Yours, &c.,

Birmingham, June 17th.

ALFRED BIRD, F.C.S.

Mr. Bird omits to state whether the cows which he saw milked were milked "dry," and what time had elapsed between their being last milked, and the milking which he witnessed.

These points are important.

PROSECUTIONS UNDER THE "SALE OF FOOD AND DRUGS ACT."

WANDSWORTH.—John Bain, of the Balham Co-operative Stores, Cavendish-road, Clapham-park, was summoned for selling, to the prejudice of the purchaser, arrowroot which was adulterated with tapioca.—Mr. Corsellis, clerk of the Wandsworth Board of Works, attended in support of the summons, and produced a certificate from Dr. Muter, the analyst, stating that the sample was adulterated with 50 per cent. of tapioca.—The Inspector appointed under the Act said tapioca was sold at fourpence per lb. He paid 1s. for half a pound of arrowroot.—Mr. Ingham remarked that the defendant made sixpence profit upon every half pound of arrowroot.—An application was here made by the secretary of the society which sold the arrowroot to the Co-operative Stores for an adjournment, as he doubted the correctness of Dr. Muter's analysis. The arrowroot was sold in the same state as it was imported from St. Vincent, and there was not a case known of adulterated arrowroot having been sent.—The summons was then adjourned for the sample of arrowroot to be analysed at the laboratory, Somerset House, as directed by the Act.

POLICE COURT, BELFAST.—*Selling Adulterated Buttermilk.*—George Burns was summoned for selling adulterated buttermilk on the 15th ult.—John Moore, the employer of the defendant, appeared, and said he was prepared to pay any fine that might be imposed.—Mr. M'Lean, jun., prosecuted.—Robert Steed, inspector of provisions, was examined, and said that on the date in question he bought a sample of buttermilk from George Burns. He divided it into three parts; he gave one to Burns, took the second to Dr. Hodges, the borough analyst, and now produced the third in court.—Mr. M'Lean read Dr. Hodges' Certificate, which stated that the sample contained 6½ per cent. of solids, and the quantity of water more than was found in genuine buttermilk was 23 per cent. Mr. M'Lean said his Worship had power to inflict as high a penalty as £20 for this offence. In London lately as high a penalty as £10 had been inflicted for adulteration.—Mr. Orme fined the defendant in £5 and costs.

At the Bradford Borough Police Court, Joseph Nuttall was charged with selling milk which had been adulterated with 10 per cent. of water.—The Town clerk prosecuted. He said that the Act provided that when a charge was brought home to the vendor of selling an adulterated article, the bench might allow him to go if he should produce a warranty that the article he sold was represented by the person from whom he himself bought it to be good and genuine. When Nuttall was spoken to on the subject of the charge, he claimed the benefit of a warranty, which he held from a person named John Hanson who supplied him with the milk. The warranty ran in this form:—"I, John Hanson, agree to supply Joseph Nuttall, of 33, North Wing, Bradford, with genuine pure milk." This was a continuing agreement, and under it Nuttall said he had bought the milk. He (the Town Clerk) had had a good deal of trouble to find a case of this kind, and bring it in a complete form before the bench, but he was in a position in this case to accommodate either Nuttall or Hanson. If Mr. Nuttall wished to bear the responsibility of the sale, he was before the court; if he sought to escape under the guarantee then he would bring Mr. Hanson before them.—Mr. Brooker, inspector of nuisances, proved the purchase of the milk, and also produced two certificates of analyses which he had received from Nuttall, as obtained by him in reference to Hanson's milk. One was dated May 31st last year, and stated that the sample had been deprived of a great proportion of its cream; and the other was dated 24th February last, and stated that the sample submitted was adulterated with 10 to 15 per cent. of water. He also produced the agreement between Hanson and Nuttall, which was dated March 1st, 1876, and which provided that the former should supply genuine pure milk to the latter at the rate of 9d. per gallon in summer, and 10d. a gallon in winter, delivered clear. Nuttall told him that he bought the milk under that guarantee, and that it was sold in the same condition as he received it. Nuttall also wished him to go to the Midland station and see the milk taken out of the can as it arrived there. Witness did so, took out a sample, and had obtained a certificate of the analysis of it, on which other proceedings will be taken.—Nuttall, in his defence, said he sold the milk as he had received it, and he relied on the guarantee for its purity.—The magistrates suspended their judgment until the case against Hanson was heard.

John Hanson, farmer, Salterfirth, near Colne was then charged with giving a false warranty, in writing to Joseph Nuttall, in respect of the milk. Nuttall was called as a witness to prove the agreement. He said it was signed only about a month ago, though it was dated March 1st.—Mr. Rimmington and Mr. Booker having given evidence, Mr. Hutchinson addressed the court for the defence. He contended that the Act did not contemplate the giving of a guarantee for an article which was not in existence. The warranty produced was for a year, and referred to milk which was not in existence. What was contemplated by the Act was a warranty for an article in existence.—The Town Clerk: Then he must have a warranty for every can of milk.—The magistrates said they had entirely agreed the warranty was a good one.—Mr. Hutchinson also contended that there was no certainty that the milk was adulterated with water, as milk in its normal condition contained about 88 per cent of water. He called a brother of the defendant who swore that the milk was sent to Bradford in the same condition as it left the cows, but the can (which was supplied by the defendant Hanson) was unlocked.—In reply to a question, Nuttall stated that he had shown Hanson the certificate of analysis he obtained in February last, and after that time the milk improved.—The magistrates fined Hanson £10 and costs, or two months' imprisonment, and the case against Nuttall was dismissed.

THE ANALYST.

THE COMPOSITION AND ANALYSIS OF BUTTER FAT.

By A. DUPRÉ, Ph.D. F.R.S., Lecturer on Chemistry at the Westminster Hospital.

Read before the Society of Public Analysts, June 14th, 1876.

UP to the year 1874 butter fat was regarded as consisting, like other fats, of a mixture of tri-stearate, palmitate, oleate, &c., &c., and with only a trace, 2 per cent. at most, of butyrine. On the strength of this assumption no attempts were made to distinguish butter-fat chemically from other fats, as it was felt that a maximum difference of 2 per cent. gave far too small a margin for safe conclusions to be drawn.

In July, 1874, however, Messrs. Hehner & Angell published a small pamphlet in which they showed that butter-fat yielded only about 86 per cent. of fatty acids insoluble in water, whereas, on the above assumption, it should yield, like most other animal fats, about 95 per cent. Here, then, was a difference, apparently, at once constant and of sufficient magnitude, to be available for the detection of adulteration of butter-fat, with at least such fats as are more commonly used for this purpose. The value of this alleged fact, for the purpose of detecting adulteration, depends chiefly on the constancy of the alleged proportion of insoluble fatty acids, and is independent of the nature of the substance making up the remainder. Nevertheless, it is of advantage to know the nature of this remainder, if for no other reason than to demonstrate why the insoluble acids should be as low as alleged. Messrs. Hehner and Angell accordingly made some attempts to supply this deficiency, and came to the conclusion that it consisted, besides, of course, the necessary glycerine residue, of fatty acids soluble in water, butyric acid chiefly. The method by means of which they endeavoured to show this was, however, open to objection and their explanation was therefore not generally accepted.

In the summer of 1875, I in consequence undertook a series of experiments, in order, if possible, to clear up this point, which seemed to me of considerable interest. The work was frequently interrupted and therefore progressed but slowly. At our meeting in January, 1876, I gave, however, a short description of some of these experiments, which seemed to me to demonstrate that butter-fat really did contain a considerable proportion of fatty acids, soluble in water, as Messrs. Hehner and Angell had alleged. The experiments, it may be recollected, consisting in heating butter-fat either with water alone, or with water and a known amount of alkali in closed tubes, to a temperature of 500° F. In the first case the fat splits up into soluble and insoluble fatty acids and into glycerine, in the second case the soap produced may be decomposed by means of a known amount of acid, the insoluble fatty acids collected as usual, while the soluble fatty acids are estimated in the filtrate by standard alkali. None of the experiments then recorded were, however, quite satisfactory, as owing to constant leakage of the tubes, some loss had taken place in each case. Since then I have overcome this difficulty and now beg to lay the results of these later experiments before you.

Heating with water only. About 5 grammes of the dry filtered butter fat were enclosed in a silver tube, with about 80 cub. cent. of water, and heated to a temperature of from 500 to 550° F for a period of 4 to 5 hours. After cooling, the tube was opened and the contents washed into a beaker, or latterly a flask, as recommended by Dr. Muter, and the insoluble fatty acids thoroughly washed, dried, and weighed without removing them from the flask or beaker. The silver tube was washed out with ether, and the

amount of fatty acids thus obtained, added to that found as above. The aqueous filtrate containing the soluble fatty acids and glycerine, was neutralized with barium carbonate, boiled, filtered and evaporated, at first on a water bath, finally in vacuo over oil of vitriol. The residue obtained was then weighed and the glycerine present extracted with alcohol, or expelled by prolonged heating to a temperature of 130° C, and the rest again weighed, the loss being taken as glycerine. Finally the residual barium salt was converted into sulphate, from which the amount of soluble acids present could be calculated. Neither of these processes is, however, quite satisfactory; in the first some barium salt is dissolved by the alcohol, in the second the glycerine cannot be all expelled without danger of decomposing some of the barium salt. (Owing to this I have not as yet been able to estimate the exact equivalent of the soluble acids present, but I believe that it is very near to that of pure butyric acid. I am now engaged in some experiments to settle this point more conclusively). In some of the experiments I therefore weighed the mixed residue of glycerine and barium salts, added sulphuric acid, evaporated, ignited and weighed again. On the assumption that the soluble acid present is butyric acid, we are then able to calculate both the acid and the glycerine contained in the residue. The general results of the experiments I have already stated, viz. :—that they show the presence of a notable proportion of soluble fatty acids. I may, however, give one experiment in full.

Dry filtered butter fat taken	...	...	...	...	4·800 grammes.
Insoluble fatty acids obtained	...	...	...	...	4·202 "
Mixed glycerine and barium salt	...	...	...	...	1·059 "
Sulphate of barium	...	...	...	...	0·3395 "

This gives the composition of the fat as follows :—

Insoluble fatty acids	...	...	...	...	87·54
Soluble " " "	...	...	...	...	5·33
Glycerine " " "	...	...	...	...	12·62

This still leaves a deficiency, due in part, I have no doubt, to an under estimation of the insoluble fatty acids, owing to difficulties of manipulation, in part to the fact that the soluble acid is not, as assumed, pure butyric acid. In three other experiments, each made with a different sample of butter, I obtained soluble fatty acids 5·3, 6·4 and 5·8 per cent. mean of the four 5·70 per cent., and glycerine 10·86, 11·5 and 11·8 per cent. mean of the four experiments 11·69 per cent.

Heating with standard aqueous alkali. The same amount of butter fat as previously given was heated with 25 cub. cent. of normal soda solution, generally with the addition of some water, in the closed tube as before, to a temperature of 500° F. for four hours. The resulting soap was decomposed by 25 cub. cent. standard acid, slightly stronger than the alkali used, and the insoluble fatty acids washed, dried and weighed as usual. In the filtrate the acidity was estimated by a deci-normal soda solution, and after subtracting the excess of acid added the rest was calculated as butyric acid. Some of the results obtained were very good, but as I found that unless the soda solution used for saponification was very much stronger than that given above, which, of course, is very objectionable on other grounds, nothing was gained by substituting soda solution for pure water, except, perhaps, that the experiments could now be performed in an iron instead of in a silver tube. In either case I had to heat to at least 500° F., for not less than four hours to ensure decomposition. I therefore abandoned this method also, but will give two experiments performed in this manner.

Twenty-five cub. cent. of the standard acid added to 25 cub. cent. of the standard soda required 3.8 cub. cent. deci-normal soda to produce exact regularity.

	1st Exp.	2nd Exp.*
Butter fat taken	4.041 grammes.	3.599 grammes.
Insoluble acids obtained	3.519 "	3.166 "
Cubic cent. deci-normal soda used	28.5	25.8

From this we have—

Insoluble fatty acids	87.08	87.06
Soluble " "	5.37	5.38

Finally I have adopted the following method which, I believe, leaves nothing to be desired on the score, either of facility of execution or of accuracy. About 5 grammes of the dry filtered butter fat are weighed into a small strong flask. (I always use one of the small assay flasks), 25 cub. cent. of a normal alcoholic soda solution are added, the flask is closed by means of a well fitting caoutchouc stopper, firmly secured by a piece of canvass and string, and heated in a water bath for about one hour. I think a much shorter time would be sufficient, but hitherto I have always heated for one hour. When cool, the flask is opened, the contents, which are semi-solid, carefully liquified by heat and washed into a flask with hot water. This flask is now heated for some time on a water bath to expel the alcohol, some more hot water is added and 25 cub. cent. of diluted sulphuric acid, somewhat stronger than the alkali used, are run in. The contents are now allowed to cool and the acid aqueous solution below the cake of fatty acids is passed through a filter. The fatty acids in the flask are washed by hot water in the manner recommended by Dr. Muter, *i.e.*, each time allowed to cool; all the washings are passed through a filter. I use no cambric, but pass everything through paper. With care scarcely any of the fatty acid will find its way into the filter. At first I used to dry the fatty acids in the flask and on the filter paper separately, making use of a counterpoised filter. I found, however, that the fatty acids evaporate from the filter paper even at a temperature of 105° C., and I now, after the washing with water is completed and the flask drained, wash any fatty acid that may be on the filter into the flask, by means of a mixture of alcohol and ether, boil off the alcohol and ether, on a water bath, and finally dry the fatty acids in the flask at a temperature of 105° C. The drying can be done readily if the melted fat is now and then shaken briskly, so as to subdivide the water as much as possible. In this way the acids, when once in the flask, are not taken out until their weight has been taken, thus reducing the risk of loss to a minimum. Meanwhile the acidity of the aqueous filtrate and washings is estimated by deci-normal soda solution. Subtracting from the amount required the proportion necessary to neutralize the excess of acid added in decomposing the soap, the rest represents the soluble fatty acids contained in the butter taken, and on the assumption of its being butyric acid, we can, of course, calculate the amount of this acid present. When once the equivalent of the soluble acids present in butter is fairly determined, this, of course, will have to be substituted for that of butyric acid. The results thus obtained are, I believe, very accurate, and the process is very simple in execution. I have satisfied myself by repeated experiments that the alkalinity of the alcoholic soda solution by itself is not altered by the process. At one time I had hoped that the process might be conducted in open flasks, but the following experiments will show that a loss of soluble acid is thus occasioned,

* This was a different sample of Butter.

which renders it necessary to use a closed flask. When once the decomposition of the fat is complete, the alcohol may be boiled off without loss. This boiling off of the alcohol is not, I believe, absolutely necessary, for, if we add a sufficient amount of water before adding the sulphuric acid, the fatty acids separated are practically insoluble in the very diluted spirit. As, however, the boiling off is, as far as I can see at present, no disadvantage, it may be as well to do it.

Five portions of the same sample of dry filtered butter fat were treated each with 25 cub. cent. alcoholic soda solution; the first three, contained in open flasks, were heated on a water bath for a $\frac{1}{4}$ hour, $\frac{1}{2}$ hour, and 1 hour respectively, the last two were heated in closed flasks for 1 hour in a water bath. In one of the latter experiments, No. 4, the alcohol was allowed to remain; in the other, No. 5, the alcohol was boiled off previous to the addition of the acid. The following are the results:—

Experiment 1— $\frac{1}{4}$ hours heating, soluble acid found	...	...	...	5.38 per cent.
" 2— $\frac{1}{2}$ " " " " " "	...	...	...	4.90 "
" 3—1 " " " " " "	...	...	...	4.86 "
" 4—1 " " " " " "	...	...	...	5.49 "
" 5—1 " " " " " "	...	...	...	5.50 "

The series clearly shows that prolonged heating in an open flask occasions a serious loss of soluble acid. It may perhaps be useful to give one of the above experiments in full. I will give No. 5.

25 cub. cent. of the acid added to 25 cub. cent. of the alcoholic soda required, 29.1 per cent. deci-normal soda solution to produce perfect neutrality.

Dry butter fat taken	...	...	...	4.380 grammes
Insoluble acids obtained	...	...	...	3.885 "
Deci-nomeal soda required	...	...	...	56.5 cub. cent.

56.5—29.1 leave 27.4 deci-normal soda neutralized by the soluble fatty acids present.

From this we obtain:—

Insoluble acids	...	...	...	88.69 per cent.
Soluble acids	...	...	...	5.50 "

The same butter fat had previously been examined, in the usual manner, for insoluble fatty acids only, when 88.56 per cent. had been found.

As a further illustration of the process I will give the analysis of the butter used in the above experiments, and those of the six last samples of butter received in my district, and will add for comparison the specific gravity of the melted fat taken at a temperature of 100° F. compared to water at the same temperature.

	Sp. Gr. at 100° F.	Insoluble Fatty Acid.	Soluble Fatty Acid.
My own butter	912.4	88.69	5.50
District butter, No. 1	912.3	87.83	5.40
" " " 2	912.6	87.61	5.73
" " " 3	913.1	87.31	5.66
" " " 4	913.0	87.40	5.51
" " " 5	912.3	88.10	5.25
" " " 6	912.3	88.03	4.92

Calculating the amount of glycerine residue in each of the above cases, and adding it to the sum of acids found, we do not in any case come up to 100. This is, as before observed, no doubt due in part to the fact that the soluble fatty acid is calculated as butyric acid, whereas some higher acids are also present, in part, however, also to the fact that butter fat, as obtained by simple drying and filtering, does not consist of pure glycerides.

The results given in the foregoing show, I think conclusively, that butter fat really does contain from 5 to 6 per cent. of soluble fatty acids. It will be seen that the fat, whether decomposed with water only at a temperature of 500° F., or with diluted alkali at the same temperature, or with alcoholic soda in an open flask at a temperature not exceeding 176° F., or, finally, with alcoholic soda in a closed flask at a temperature of 212° F. yields substantially the same products. The amount of glycerine found also agrees with this assumption, although but little stress can be laid upon that, as the glycerine cannot be estimated with sufficient accuracy. I am inclined to put more stress on the fact that the amount of glycerine residue calculated, added to the amount of acid found, falls short of 100. In what exact state of combination this soluble acid is contained in butter fat must be decided by future experiments.

In conclusion, a few words in regard to a process (the spec. gr. of the fat taken at 100 F.) first employed by Mr. Bell, and since then strongly recommended by Dr. Muter, who even thinks, going in this somewhat beyond Mr. Bell, that a reputed sample of butter may safely be passed over as good if it shows a spec. gr. above 911. Now, I am sorry to say, I cannot endorse this last statement. I believe that the spec. gr. of the fat is, as one of several factors, of great value in judging of the genuineness of a given sample of butter, but it cannot be safely taken as the sole guide. Within the last week or so, I took the spec. gr. of a sample of mutton dripping, obtained about nine months ago out of my own kitchen, and since kept in my laboratory, and found it to be 917.3. The spec. gr. was taken several times, and otherwise checked, and there can be no doubt of its correctness. On my mentioning this fact to Mr. Bell, he suggested to me that the dripping had probably been strongly heated. I accordingly procured a fresh sample of mutton dripping from my kitchen, and this time found the spec. gr. to be 904.8, when, however, this same sample was heated in a flat porcelain dish, for some time to a temp. of about 300 C., the spec. gr. was raised to 914.4, thus confirming Mr. Bell's suspicion so far. I think it very probable that prolonged exposure to the action of the air, even at ordinary temperature, may have a similar effect. This clearly shows, that taken by itself, spec. gr. cannot be absolutely relied on as showing the genuineness of a sample of reputed butter. On the other hand, I think it will be found that whenever a sample of reputed butter shows a spec. gr. below 911 it may safely be pronounced adulterated. I must express my strong conviction that, as far as I can see at present, no single property of butter fat, taken by itself, is of absolute value as a guide for judging of the genuineness of a given sample of butter, and I would, therefore, advise every one to submit each sample that comes before him to as many tests as possible before he pronounces an opinion.

Dr. Muter had listened to Dr. Dupré's paper very attentively, as it showed an advance in butter analysis to the extent of saponifying in a closed tube, and apart from that, it confirmed his, (Dr. Muter's,) process for the estimation of both soluble and insoluble acids, and of the standards he had laid down. The history of the modern system of butter analysis, was as follows:—In the years 1870-71, he, (Dr. Muter,) began to examine butter, which he did by saponification, first with alcoholic potash, and afterwards with lime and distillation of the whole ley with tartaric acid, so as to estimate the soluble acids. Want of time prevented him from fully publishing his results, and subsequently Messrs. Angell & Hehner saponified with potash decomposed with acid, and estimated

the insoluble acids, published their results, and fixed a standard, this standard Dr. Muter considered too low, and therefore published his process for taking both the soluble and insoluble acids, pointing out the importance of washing in a flask instead of on a filter, giving as a standard for calculation of

Soluble Acids	...	...	...	...	6.0
Insoluble Acids	...	...	...	...	88.0
			Total	...	<u>94.0</u>

As representing a fair low class butter, looking as he now did at Dr. Dupré's results done on early summer butter, Dr. Muter was pleased to see therein a complete confirmation of the safety of his insoluble standard. In his paper he had given the barium method of estimating the soluble acids as being, although the most tedious, yet the most accurate, but in the discussion he had mentioned two alternative ways of working, viz., (1) The use of standard alcoholic potash for saponification, and subsequently standard sulphuric acid and (2) The evaporation and ignition of the solution after exact neutralization with standard acid, and the estimation of the alkalinity of the ash and calculation to butyric acid. He saw that Dr. Dupré, had been all along adopting the first of these methods, and he confessed that in practice he himself worked by it to save time, having first carefully standardized his solutions by the barium process. He, however, considered that it was essentially a dangerous method, except in the most practised hands. It was a necessity to save bulk to use a normal solution of potash each C.C. of which represents .056 KHO., so that even the slightest unsteadiness of hand and one drop too much put in, there is at once an appreciable excess of potash which when calculated to per centage of butyric acid gives an enormous error. As the tendency is in this direction, the soluble acids thus estimated come as a rule too low, and he (Dr. Muter) thus viewed Dr. Dupré's results as he rarely appeared to get the total up to 94, without which the speaker considered that no analysis of butter was perfect. He was much gratified with Dr. Dupre's approval of his flask washing, which he was certain would commend itself to highly competent men like Dr. Dupre, for its simplicity and accuracy. Dr. Muter, also from practical experience, upheld the fact that by long boiling in an open vessel, butyric ether is formed and lost during saponification, and although he had not yet gone so far as actually saponifying in a perfectly closed flask, he had, in practice, reduced the boiling to a minimum and partially closed the flask, and had, no doubt, of the value of Dr. Dupré's absolute closing principle.

As to Mr. Bell's specific gravity process he entirely differed from Dr. Dupré, and held that (especially when expressed in "actual density," as modified by himself) it was a very useful process indeed for indicating what butters were worth the trouble of analysis. Mr. Bell's results were, he understood, based on a long course of experiments, as also were his own in confirmation, and he unhesitatingly stated that there was no fat which had a gravity so great as butter. He especially took exception to the case of mutton dripping given, both as regards its gravity and acids, and was certain it could not have been pure. He had again and again examined dripping prepared by his own hands direct from the animal fat, and had found it to have a gravity of about 903 to 904, according to Mr. Bell's system, and that it never, under any circumstances, showed less than 95 of insoluble acids. The lightest fat in the market was the so called "margarine," which had a gravity of 901 to 901.5, and showed when quite fresh 93 per cent, and

when stale and after prolonged melting (the artificially added volatile portion having become dissipated) it yields 95 per cent. This gravity of 901 (= .903 actual density) is strikingly characteristic of the French artificial butter of which he had lately had occasion to examine many samples for members of the butter trade. He did not consider that this one experiment on dripping taken from a kitchen, and which might have really contained an admixture of butter, should weigh for a moment against the results obtained by Mr. Bell and confirmed by himself on undoubtedly pure samples.

Mr. Allen quite agreed with a previous speaker as to the primary importance of the determination of the soluble fatty acid. In confirmation of Dr. Muter's statement that he had been working for some years on the examination of butter by the estimation of the volatile acids, he might remind the Society that in an article contributed some four years since to the *Food Journal*, by Dr. Muter, the author distinctly stated that he was then working on and hoped to perfect a method of determining the butyric acid in butter. Dr. Duprés anomalous result of 92.46 (?) per cent. of insoluble fatty acids in dripping, Mr. Allen thought, might possibly be due to the employment of butter by the cook.

Addendum. Since the foregoing paper was written, I have effected the saponification, decomposition of the soap, and the washing and drying of the fatty acids, at ordinary temperature, thus still further reducing the risk of breaking up the higher into lower acids. The saponification is readily effected by using a sufficiency of alcoholic soda. Between four and five grams. of the dry butter fat were shaken up, for several minutes, with 100 cub. cent. of normal alcoholic soda. The butter soon dissolves, but after a time the solution gelatinizes to a clear transparent jelly. (The temperature of the laboratory at the time of these experiments ranged between 22 and 25°.) This jelly is now allowed to stand over night, during which time the smell of butyric ether, very strong at first, entirely disappears. In one of the experiments the alcohol was allowed to evaporate spontaneously, before the acid was added, in the other (made with a different sample of butter), the soap was dissolved in about half-litre of water, and at once decomposed by the addition of hydrochloric acid. The fatty acids, which separated in white curdy masses, were thoroughly washed on a filter, with cold water, about 4 litres, dried in vacuo over oil of vitriol and weighed. The following are the results:—

1st Exp.	Butter fat taken	4.545 grammes,	insoluble fatty acids obtained	3.888 grammes.
2nd "	" "	4.982 "	" "	4.299 "
		Percentage of insoluble fatty acids found 1st Exp. 85.5 per cent.		
	Ditto	" "	" "	2nd Exp. 86.3 "

Butter fat, therefore, yields the same proportion of insoluble fatty acids, whether saponified with or without the aid of heat.

For the sake of completeness, I give the analyses of the samples of mutton dripping referred to in the paper.

	Spec. Gravity at 100° F.	Insoluble fatty acids.	Soluble fatty acids.
1st Sample	917.3	92.43	1.69
2nd Sample, before heating	904.8	95.44	0.09
2rd Sample, after heating	914.4	93.64	0.78

It has been suggested, that the addition of alcohol or ether to the fatty acids, and the subsequent drying, might give either too high a result by the formation of non volatile ethers, or too low a result by the production of volatile ethers. I find, however, that such is not the case. The fatty acids, when alcohol or ether have been added,

certainly require a longer time of heating before the weight becomes constant, than is necessary when no such addition has been made, the ultimate amount found is, however, the same in either case.

A report on "Butter Analysis," by Mr. J. Bell, dated May 31st, 1876, has just been presented to the House of Commons, which contains some useful details, and I hope to return to it at some future time. Meanwhile, I would take this earliest opportunity to refer to two points in this report. Firstly, Mr. Bell is under a great misapprehension in supposing that Messrs. Hehner and Angell's process ever fell practically into abeyance. On the contrary, it was at once taken up by a number of Public Analysts, and at the time of the report was, I believe, adopted by every Public Analyst, who had at all worked on the subject of butter. As evidence of the interest taken in this question, I need only refer to Dr. Muter's paper, published with the discussion in the *Analyst* for March; and my short note read at the meeting of Public Analysts, in January. Secondly, I should like to ask Mr. Bell, if the per centages of fixed fatty acids given in Table III., and from which it is inferred that this per centage increases with the age of the butter, are in each case the results of two or more concordant analyses, or represent a single analysis only? If the latter is the case, the table is I fear of little or no practical value, since the results are then, in four at least out of the six cases given, within the limits of experimental error. A. D.

A TEST FOR THE PRESENCE OF WOOD OIL IN COPAIVA BALSAM.

THE ethereal oil of *Dipterocarpus* Balsam, otherwise known as Gurgun Balsam or wood oil, according to Flückiger, takes a splendid violet colour, when dissolved in about 20 parts of bisulphide of carbon and a drop of a cooled mixture of equal parts of sulphuric and nitric acids added. Fish liver oil and oil of valerian also give a violet colour, but it is transient whilst the colour with wood oil is permanent for some hours. In order to exclude fish oil, a few drops of the liquid may be distilled over and the test applied.

A. W. B.

A NEW SOCIETY.

ON the 13th instant there was gathered at St. James' Hall, a select company presided over by the Duke of Northumberland, their object being the formation of a "Sanitary Institute of Great Britain."

We cannot but commend the objects of such a society, and they are multiform, including the improvement of the water supply; the treatment of sewage; the prevention of the emission of noxious vapours by manufacturers; the prevention of the pollution of rivers, &c., &c.

After the opening address of the noble Duke, Mr. Gardner read a paper "On the necessity for further sanitary legislation, with special reference to Mr. Sclater Booth's Pollution of Rivers Bill."

In the full discussion which followed the reading of this paper, Messrs. Towle, Beal, Wood, Bartlett, and other gentlemen took part.

Eventually an influential preliminary Committee was formed, with instructions to report as to the further steps it is desirable to take, to an adjourned Meeting to be held in October.

We wish this society every success, and may mention for the information of such of our readers as may feel interested in the objects it is intended to promote, that the offices are at 11, Spring Gardens, and that the Secretary is Mr. W. T. Marchant.

ON MERCURIC IODATE; ITS PREPARATION AND REACTIONS.

By CHARLES A. CAMERON, M.D., F.R.C.S.,

Professor of Chemistry and Hygiene, R.C.S.I., Medical Officer of Health, and Analyst for Dublin, &c.

Read before the Society of Public Analysts, June 14th, 1876.

SOMETIME ago, I introduced ferric iodate as a therapeutic substitute for the unstable ferrous iodide, having found from the results of some experiments conducted at the Lock Hospital, Dublin, that the medicinal properties of both compounds were nearly identical. Having had occasion whilst engaged in these experiments to prepare some iodates, I found that the descriptions of some of these compounds given in the larger treatises on chemistry, were both meagre and inaccurate. In the present paper, I propose to describe new methods of preparing mercuric iodate, and to detail several interesting reactions which I observed in connection with this substance.

The only chemists who appear to have studied mercuric iodate are Rammelsberg and Pleischl: they state that it can only be prepared by digesting recently precipitated mercuric oxide with iodic acid; and that neither iodic acid nor alkaline iodates precipitate mercuric salts. This is an erroneous statement, for though iodic acid fails to precipitate with mercuric chloride, it throws down precipitates from other salts of dyad mercury.

Iodic acid added to a hot solution of oxycyanide of mercury in the ratio indicated by the equation: — $\text{Hg. Cy}_2 + \text{Hg.O} + 2\text{HIO}_3 = \text{Hg } 2\text{IO}_3 + \text{Hg. Cy}_2 + \text{H}_2\text{O}$ —gave a white amorphous precipitate, almost insoluble, which was with difficulty attacked by nitric acid, but which readily dissolved in hydrochloric acid. Exactly similar precipitates were obtained by mixing iodic acid and iodate of potassium with nitrate, and acetate of dyad mercury.

The white precipitate thus procured was dissolved in excess of pure potassium iodide solution, and on being acidulated yielded iodine corresponding to 46.32 per cent. in the form of iodic anhydride, the proportion required by theory in mercuric iodate being 46.18 per cent.; the precipitate was completely volatilised by heat, and in other respects comported itself like Rammelsberg and Pleischl's iodate.

Mercuric iodate is, I find, soluble in solutions of alkaline chlorides, bromides, iodides, cyanides and cyanates, of disodic hyposulphite, and of chlorides of zinc and manganese when dilute. Hydrochloric acid, even when highly diluted dissolves it: but when it is mixed with hydrobromic acid, bromine is set free, and it liberates iodine from hydriodic acid; in both cases the mercury salt is dissolved.

Mercuric iodate is insoluble in soda, potash, ammonia, hydric disodic phosphate, borax, corrosive sublimate, and alkaline iodates, chlorates, bromates, and sulphites, and in acetic, fluoric, and silicofluoric acids. It is with difficulty attacked by strong nitric acid. Mercuric bromate reacts with hydrobromic and hydriodic acids in the same way as mercuric iodate, but it is not soluble in alkaline chlorides, bromides, &c., which, however, decompose it.

Mercuric iodate, dissolved in ammonium chloride solution, yields with ammonia a white precipitate, insoluble in excess of the latter, and solution of the iodate in disodic hyposulphite, gives with hydrochloric acid a red precipitate, soluble in excess of the acid. The nature of these precipitates has yet to be ascertained.

To a solution of potassium chloride, mercuric iodate was added until it ceased to be taken up. The solution was filtered and evaporated. The crystals which first made their appearance contained the merest trace of mercury, and yielded on analysis 58.78 per cent. of iodine, the amount required by theory, assuming the crystals to be potassium iodate, being 59.34 per cent. in the form of iodic acid. These crystals, therefore, consisted of slightly impure potassium iodate.

To a solution of ammonium chloride, mercuric iodate was added in the proportion of two molecules of the former to one of the latter. The solution was filtered from excess of mercuric iodate, evaporated, and the substances therein contained crystallized out in four fractions.

Fraction 1. A relatively large amount of the substance separated in this fraction, and proved on analysis to be almost absolutely pure ammonium iodate.

Fraction 2 was identical with Fraction 1.

Fraction 3 contained a trace of mercury and consisted of slightly impure ammonium iodate.

Fraction 4 consisted of a mixture of mercuric and ammonium iodates.

The mother liquor gave with potash a yellow precipitate, not soluble in cold dilute nitric and hydrochloric acids, but soluble in them by the aid of heat.

Mercuric iodate dissolves in three molecules of ammonium chloride, sodium chloride, and potassium bromide, in the cold, and in two if the solution be boiling. Four molecules of potassium iodide, dissolve one molecule of Mercuric iodate.

When mercuric iodate is dissolved in say 4 molecules of iodide of potassium, and the solution evaporated, potassium iodate separates, leaving in solution the crystallizable double salt, $\text{HgI}_2 + 2\text{KI}$. A great many double salts of mercuric chloride with alkaline chlorides, bromides, &c., may be formed in this way.

A mixture of mercuric iodide, potassium chlorate, and water, heated to 170°C ., in a sealed tube, undergoes no change, but at about 200°C ., and especially with excess of chlorate, the brilliant scarlet color of the mixture soon vanishes. The tube, on being cooled, will be found filled with tufts of colorless crystals, completely soluble; on evaporating the solution of the contents of the tube, potassium iodate separates, leaving in solution mercuric chloride.

It is a rule, that two soluble compounds will decompose each other, when by an interchange of their constituents, an insoluble substance can be formed. The production of a precipitate under such conditions may, however, be prevented, by the formation of a soluble double salt, composed of an insoluble (*per se*) salt, combined with a soluble one. For example, solution of mercuric chloride fails to produce a precipitate when added to an excess of solution of potassium iodide, because the mercuric iodide formed in the solution, and insoluble in water, forms with potassium iodide the soluble salt, $2\text{KI} + \text{Hg.I}_2$. The behaviour of mercuric iodate with soluble iodides, bromides, &c., is, however, quite different from that of the iodide of mercury; the latter dissolves in solutions of certain iodides, &c., but the double salts thereby formed are readily procurable by the evaporation of their solutions. On the other hand, mercuric iodate dissolves in solution of, say, ammonium chloride, but when the solution is evaporated it is neither the insoluble mercuric iodate, nor a double salt of mercuric iodate with ammonium chloride, which appears, but merely ammonium iodate.

As mercuric iodate would undoubtedly in the stomach become converted into mercuric chloride, this iodate cannot be employed for medicinal purposes.

In the present paper I have not exhausted the subject of mercuric iodate and its reactions, but I hope soon to lay before the Society the results of further experiments with this and other iodates, on which I am at present engaged.

REVIEWS OF BOOKS, &c.

DISCURSIVE CHEMICAL NOTES IN RHYME.*

By the Author of the "Chemical Review."

CHEMISTRY and Poetry are not generally considered to be natural allies. The Scientist, as a rule, looks upon the poet as a mere trifler, and regards him with a feeling of pity tinged with contempt.

On the other hand the poet has a certain fear of the Scientist—a man who weighs and measures and calculates everything to a fraction— and, admitting his usefulness, does not desire his acquaintance.

In the little book before us, however, we have Chemistry done into rhyme and very fair rhyme.

The Chemistry is good, but the verse is better. It abounds in playful badinage and we feel sure that neither of the eminent chemists referred to in the following lines will feel offended by this very good humoured attack:—

“Anomalies are common: Abel will
Doubtless be handed to posterity,
For teaching men the readiest way to kill.
A kindly man who would not harm a fly,
With peaceful face, and voice as soft as silk,
While fire-eating Wanklyn writes on milk!

“One studies missiles and torpedoes grim;
The other works on tea and chocolate,
And tranquil water is a friend to him,
Of which, I think, we've had enough of late.
The man of peace extols the means of slaughter;
The fighting man is full of milk and water!”

The Byronic style is of course apparent, and though we should be extremely sorry to be supposed for a moment to compare Professor Abel, to a Greek pirate, we must say:—

“A kindly man who would not harm a fly,
With peaceful face and voice as soft as silk,”

Irresistibly reminds us of

“The mildest mannered man,
That ever scuttled ship or cut a throat.”

We commend this little *brochure* to our readers. They may find it both instructive and amusing; and if not the former, certainly the latter.

* VAN VOORST, Paternoster Row.

ERGOT OF RYE.

BY PROFESSOR DRAGENDORFF.

Pharmaceut Journal (No. 312, p. 1001, 1876).

PROFESSOR Dragendorff, in connection with Herr Stud Padwissotsky, has been engaged in the chemical examination of Ergot, and believes he has isolated the active principle.

1. Coming specially under consideration as an active constituent of ergot is (a) *Scleromucin*, a slimy substance which goes into solution upon extraction of the ergot with water, and which is again precipitated by 40 to 45 per cent. alcohol. It is colloidal, after being once dried it is with difficulty soluble in water, and it holds with the greatest energy constituents from which it might not have been freed.

It contains nitrogen, but gives no albuminoid reaction, nor any reaction of an alkaloidal or glucosidal body. It gave to analysis:—

8.26	per cent.	Water.
26.8	„	Ash.
29.0	„	Carbon.
6.44	„	Hydrogen.
6.41	„	Nitrogen.

(b). A substance Dragendorff calls *Sclerotic acid*. This is a feebly acid substance, easily soluble in water and dilute and moderately concentrated alcohol. It passes in association with other constituents of the Ergot extract into the diffusate, when the extract is submitted to dialysis, but after its separation in a pure state it is like scleromucin colloidal. It is precipitated by 85 to 90 per cent. alcohol together with lime, potash, soda, silica and manganese, but after maceration with hydrochloric acid the greater part of the ash constituents can be separated by a fresh precipitation with absolute alcohol. The sample analysed contained only 3 to 4 per cent. of ash and gave—

40.0	per cent.	Carbon.
5.2	„	Hydrogen.
4.2	„	Nitrogen.
50.6	„	Oxygen.

Sclerotic acid forms with lime a compound that is not decomposed by carbonic acid, and which upon combustion leaves 19 to 20 per cent. of calcium carbonate.

Its reactions, both qualitative and quantitative, are similar to those of scleromucin. The subcutaneous injection of 0.02 to 0.04 grams brings frogs gradually into a state of perfect palsy, accompanied by a peculiar swelling, that may last six or seven days. Professor Dragendorff particularly insists upon the peculiar fitness of *sclerotic acid* * for therapeutic use, from its easy solubility in water and from the fact that it occasions no kind of disturbance in the cellular tissue if injected under the skin, and he further states that Professor Von Holst, has used it in midwifery practice for a year and a half, injecting it under the skin in doses of from .04 to .05 grams.

2. The red colouring matter, professor Dragendorff names *Sclererythrin*, he suspects that it is a derivative from anthraquinone, standing in near relation to chrysophanic acid and alizarine. *Sclererythrin* is insoluble in water; but easily soluble in dilute and strong alcohol, ether, chloriform, dilute solutions of caustic potash, ammonia, &c., its solutions in alkalis are of a beautiful murexid colour, and when these are decomposed by an acid and shaken up with ether, the *sclererythrin* is taken up by the ether. Alcoholic solution

* It may be obtained from Dr. F. Witte Rostock, Mecklenburg, Germany.

of sclererythrin gives with aluminium sulphate, and with zinc chloride a splendid red mixture; with salts of calcium, barium, and many of the heavy metals it gives a blue precipitate. The amount of sclererythrin is very small, not more than $\frac{1}{10}$ or $\frac{1}{30}$ of a part per thousand.

3. With sclererythrin is obtained a small quantity of another colouring matter, which, because it dissolves in concentrated sulphuric acid, with the production of a handsome blue violet colour, the author has named *Scleroiodin*, its analyses gave—

5.5	per cent.	Hydrogen.
64.88	„	Carbon.
3.87	„	Nitrogen.
25.50	„	Oxygen.

Scleroiodin is not soluble in alcohol, ether, chloroform, or water, it dissolves in potash solution with the production of a splendid violet colour; from this solution it is again precipitated by acetic acid. It is present in ergot in the proportion of about one to one thousand.

4. From ergot powder treated with aqueous solution of tartaric acid, after the two colouring matters have been separated by alcohol by treatment with ether, two crystalline substances can be obtained, both of which are without physiological action upon frogs, the one is in needle shaped colourless crystals, almost insoluble in alcohol and water, with difficulty soluble in ether, but dissolving in caustic ammonia and potash solutions, it has probably the composition $C_{10} H_{10} O_4$, and the author names it *Scleroerystallin*, the other crystalline substance has been named *Scleroscanthin*, and appears to be an hydrated compound of Sclererythrin, into which it can be converted by heating with chloroform. Sclererythrin can also be artificially brought back to scleroxanthin, the formula of the latter is probably $2C_{10} H_{10} O_4 + 3H_2 O$.

The author also states he has isolated a yellow amorphous substance and a brown resinous substance, neither of which appeared to have any physiological action upon frogs.

He has also isolated Wenzel's alkaloids (ergotine and ceboline), but found them almost inactive. Taurets crystinin was also prepared but found not to be a pure substance containing sclererythrin, to which perhaps its action on frogs is to be attributed.

A. W. B.

NOTE ON THE OCCASIONAL OCCURRENCE OF CANE SUGAR IN PORT AND SHERRY WINE, SUPPLIED TO IRISH WORKHOUSES.

BY CHARLES A. CAMERON, M.D., F.R.C.S.

HAVING occasion to examine very frequently wines supplied to the Infirmaries attached to Workhouses, I have on several occasions met with Cane Sugar in specimens of Port and Sherry, sent in by contractors to those Institutions; in one instance I found that the so-called Port Wine supplied, contained the enormous amount of 12 per cent. of solid matters, of which nearly one-half consisted of Cane Sugar. As Cane Sugar added to Wine soon becomes converted into invert sugar, I have no doubt that nearly the whole of the Sugar in this wine was originally Cane Sugar. The Wines which are known as "Hambro," contain a large amount of alcohol, a small amount of solid matters, and a relatively much smaller proportion of acid and of mineral matters than are usually met with in genuine wines. In the fictitious wines manufactured at Hamburgh, and probably elsewhere, Cane Sugar may be detected for a much longer time than when it is added to genuine wines, such for example as sparkling Champagne and Moselle. This is owing to the small amount of free acid contained in the spurious wines. I have never found Cane Sugar in claret, nor do I believe that it is to be found in the wines imported from Spain and Portugal.

The best way to determine the amount of sucrose in wines, is by the polariscope, Mr. Wigner, who has great experience in sugar analysis, recommends for this purpose Duboscq's. Those who do not use the saccharimeter will find the volumetrical copper method sufficiently accurate; ten minutes' boiling with the dilute acid will be sufficient to convert the cane into invert sugar, and the matters usually present in wines will not sensibly interfere with the accuracy of the results.

PROSECUTIONS UNDER THE SALE OF FOOD AND DRUGS' ACT.

A SPECIAL Petty Sessions was held at Duntser to hear a case in which Mr. William Burnell, grocer, &c., of Wootton Courtney, was charged by the inspector of weights and measures with selling as pure one ounce of pepper which was adulterated. Mr. Cooper, wholesale druggist and chemist, of Exeter, who supplied the defendant with the article in question, appeared and contended that it was not adulterated. Mr. Durham proved purchasing the pepper at the shop of the defendant and taking it to the county analyst, Mr. W. W. Stoddart, of Bristol, who returned a certificate stating that it was adulterated with 10 per cent. of starch. Mr. W. Stoddart stated that he analysed the pepper in question, and found that it contained at least 10 per cent. of starch from the flour of peas or beans. He produced the starch extracted from 30 grains of pepper. He had since received a sample of pepper direct from the defendant for analysis, and found that it also contained the same percentage of starch. In answer to Mr. Cooper, witness said that the glass produced also contained pure pepper-starch. For the defence, Mr. Burnett stated that he added nothing whatever to the pepper, and that he sent a sample of it, by Mr. Cooper's request, to Professor Attfield, of London. John Middlewick, miller, of Exeter, proved receiving two sacks of peppercorns. He did not add anything whatever to the pepper, but replaced it in the bags. The Stones were kept for other uses. Before the stones the last things ground were beans. A small quantity of the bean-flour might have remained on the stones and so got mixed with a slight portion of the pepper. Mr. J. Attfield, professor of practical chemistry to the Pharmaceutical society, stated that on the 30th May last he received a sample of pepper by post from the defendant. He analysed it, and found no pea-meal, pea-starch or bean-starch in it. He was well acquainted with the operation of drug-grinding, and the previous witness's statement that some bean-meal might get mixed with the pepper was correct. From the description which had been given by the miller of the process which he adopted in grinding he was of opinion that a small portion of the ground pepper would contain bean-meal. He explained the finding of starch by Mr. Stoddart and not by himself by the suggestion that the portion sold to the inspector was a portion containing the bean-meal. The complete admixture of a little bean-meal with the whole bulk of pepper ground would be extremely unlikely. The bench were of opinion that the provision under section 6 of the Act of 1875, to the effect that no conviction could take place when an act of food or drug was mixed with extraneous matter in the process of preparation or collection, could not shield the defendant. There was no doubt that the starch was in the pepper, but they thought it was not wilfully put there; still its presence was not unavoidable. The fine would be merely 6d. and costs, and they expressed an opinion that the case had been conducted in a very straightforward manner.

The following charges for selling adulterated tea came before the magistrates at the Petty Sessions held at Newport, Isle of Wight.—Miss Winefred Long, grocer, of Calbourne. David Davis's evidence was to the effect that he went to the defendant's shop and purchased a quarter of a pound of tea at 2s. per lb. He forwarded a portion of it to Dr. Hassall, the public analyst, whose certificate he now produced. The result of the analysis disclosed that the sample was one of "adulterated black tea" containing the following foreign ingredients:—Mineral matter 11·13 per cent., including small stones 5·60 per cent.; lie tea 2·63 per cent. Adulterated with stores and lie tea. The lie tea was made up of dust of tea-leaves, sand, and starch; it is most likely derived from the caper tea in the sample. Mr. Blake called Mr. Maurice Dear, who stated that he had been in business at Cowes 50 years. Defendant was a customer of theirs; the tea in question was sold by them to her. The chairman said they must, as the law stood, convict the defendant, but they would not inflict a heavy penalty. Fined 5s., and £1 9s. costs.

Mr. Benjamin Wheeler, grocer, of Shanklin. Police-sergeant Chapton deposed visiting defendant's shop and asking for a quarter of pound of gunpowder tea. Defendant said he had none, but he had some young hyson. Witness consented to take a quarter of a pound of that. He sent the whole for analysis to Dr. Hassall, whose certificate he now put in. This document stated—"This is a sample of young hyson tea containing mineral matter 6·5 per cent., prussian blue and China clay a small quantity. Observations: This tea is strongly painted or coloured with Prussian blue and China clay." Defendant said he would submit this sample to any experienced tea dealer in Newport; it was the purest green tea he could procure; he sold it just as it came to him. The chairman remarked that this Act was framed to protect the public from Adulteration, and those in the trade like the defendant should take steps to secure themselves. Fined 5s., and £1. 10s. costs.

THE ANALYST.

BUTTER ANALYSIS IN SCOTLAND.

FROM the Report of a Scotch prosecution for selling adulterated butter, which we print in another column, it would appear that butter analysis is but little understood at the Andersonian University. Some years ago the then Professor of Chemistry came to grief on an analysis of butter, and now his successor, Dr. Dittmar has failed even more lamentably, in conjunction with Dr. Stevenson Macadam, of Edinburgh. As we believe neither of these gentlemen holds the position of a Public Analyst, we shall be spared the usual outcry about the imbecility or incompetence of Public Analysts. Drs. Macadam and Dittmar are reported to have stated that they had examined the sample in question both by Bell's and Muter's processes, and also by the "old system," and finding the butter good according to the latter, which they thought was the most reliable one, they pronounced it pure. We have no doubt that all adulterators will hail with delight this return to "old systems," but, that two gentlemen with some knowledge of Chemistry, should have been found deliberately to prefer old and utterly worthless methods is more than we should have thought possible. Everyone with the slightest knowledge of the subject must have known that, up to the last few years, there was no system according to which butter fat could safely be distinguished from other animal fats, and, as a matter of fact, no chemist, who had any regard for his reputation, ventured to affirm the contrary. During the last two years, however, thanks mainly to the initiative taken by Messrs. Hehner and Angell, the subject of butter has been much worked at, and its analysis is now as well understood and as certain, as any other process in the whole range of food analysis. We do not blame Drs. Macadam and Dittmar for being ignorant of this, as the subject probably lies outside their usual pursuits, but we do blame them for being ignorant of their ignorance, and for venturing to give evidence in a court of law on a subject with which they were so imperfectly acquainted. Taking the evidence of both sides there cannot be the slightest doubt that the sample in question consisted mainly of fat other than butter. We trust that this case may serve as a warning to the Analysts of Scotland, and that when next we have to report a case of butter adulteration we may find that an intelligent knowledge of the processes for the analysis of butter is possessed by the Chemists engaged, whether they are employed for the prosecution or the defence.

ON THE DETECTION AND QUANTITATIVE DETERMINATION OF FREE SULPHURIC AND HYDROCHLORIC ACIDS IN VINEGAR, LIME AND LEMON JUICES, AND SIMILAR LIQUIDS.

By OTTO HEHNER.

ALTHOUGH a large number of methods for the detection and determination of free mineral acids in vinegar have been proposed, yet there is none, as far as I am aware, which could be considered to fulfil all the requirements expected from such a method. These requirements are, first, that a simple quantitative test should at once answer the question, whether a given sample of vinegar contains free mineral acids or not, so that, the result being negative, no quantitative determination need be resorted to; second, that the method for determining the amount of free mineral acid present should be exact within a few hundredths of a per centage; and third, that no substance or re-agent should be required which is not within reach of every chemist, and which is not to be found in the laboratory of any Public Analyst.

The older qualitative tests as proposed by Normandy, Muspratt, and other chemists, were mostly based upon the charring action of sulphuric acid upon paper or other organic substances. Thus we read, "Sulphuric acid may be detected by writing with a quill upon white paper and drying it strongly before the fire, when the paper will become charred," but, fortunately, the author adds, "if the quantity of sulphuric acid exceed two per cent." (Muspratt.) Another writer recommends that a drop of the suspected vinegar should be placed upon paper and dried before the fire, when a black stain will be produced, and a third, to heat a solution of cane sugar nearly to boiling, and then to add a small quantity of the liquid containing the sulphuric acid, when the charring of the sugar will at once point out the presence of mineral acid. These absurd and worse than useless methods seem to have been in general use, as they are to be found in most books dealing with the subject, which were written fifteen or twenty years ago.

But, besides the above methods, there are several worthy of attention. Thus it is directed to evaporate a measured quantity of the vinegar on the waterbath and to extract the syrupy liquid with spirits of wine, when the sulphates will be left in the residue on account of their insolubility in alcohol, while the sulphuric acid will be found in the alcoholic solution. But I have not unfrequently found an appreciable quantity of sulphate to pass into solution, even where no trace of free sulphuric acid could be present.

Another plan is to determine the total amount of sulphuric acid, both free and combined, gravimetrically by means of chloride of barium, and to evaporate and incinerate another portion of the vinegar, thus driving off the free sulphuric acid, and to determine in the residue left the amount of the combined sulphuric acid, the difference between the two determinations being calculated as free sulphuric acid. This method however is quite incapable of giving accurate results, as free sulphuric acid, so pertinaciously clings to the ash, that even with the acid of carbonate of ammonium, it cannot be completely got rid of without some loss by volatilisation of the sulphate of soda invariably present. In addition, it will be seen, this method requires two tedious gravimetric estimations, in order to find out whether free sulphuric acid is present or not, and as even in the purest vinegar, which has never been contaminated with free mineral acid, the results before and after incineration are never exactly identical, it cannot be relied upon when small quantities of sulphuric acid are to be determined.

Mr. Thresh, in a late volume of the *Pharmaceutical Journal*, described a method similar in principle. He estimates the amount of chlorine before and after incineration of the vinegar, the difference being equivalent to the quantity of sulphuric acid added, but although this method is capable of giving more accurate results than the method just described, yet the same objection applies to it, namely, that two quantitative determinations are needed, to obtain a qualitative result.

There have lately been published two other methods, one based upon the solubility of oxalate of lime in mineral acids, it being insoluble in acetic acid, and the other upon the change of colour which methylaniline violet undergoes, on the addition of mineral acids, it being unaffected by vegetable acids. Both these methods, however, are nearly useless, the former, because the solubility of the oxalate of lime depends upon a great variety of circumstances, and the latter because the quantity of mineral acid usually present in proportion to the acetic acid, is by far too small to allow of a direct accurate determination. Both methods may however be useful, if the quantity of mineral acid present is very large.

As vinegar consists, except in the case of its being distilled, not merely of acetic acid and water, but always contains potash and soda salts of organic acids, as the tartrate or acetate, and chloride of sodium, it is obvious that sulphuric or hydrochloric acids, if added in small quantity, can no longer be considered to exist *as such* in vinegar, but that they decompose an equivalent quantity of acetate or tartrate. Whenever there is any undecomposed acetate or tartrate present in vinegar, no trace of any mineral acid can be present in the free state. As the organic salts of the alkalies are converted by incineration into the corresponding carbonates, it can safely be asserted. *Whenever the ash of a vinegar exhibits an alkaline re-action, free mineral acid cannot be present in the vinegar.* Mineral acid may have been *added*, but it then has become neutralised by the decomposition of the acetates or tartrates. We have thus the simplest possible qualitative test for free mineral acids in vinegar.

But whenever the ash is neutral, free mineral acid is most likely present. The quantity of this may be ascertained with the utmost accuracy by following the same principle. If we add to a measured quantity of the suspected vinegar, a known and exactly measured volume of decinormal soda solution, somewhat more than would be necessary to neutralise the total amount of free mineral acid present, evaporate and incinerate, the alkalinity of the ash gives the measure of the quantity of the free sulphuric or hydrochloric acid. Supposing we add 20c.c. of standard alkali to a vinegar, and find after incineration, by titration with standard acid, an alkalinity corresponding only to 5c.c., then 15c.c. of the soda solution have been neutralised by the mineral acid in the vinegar.

As the point of neutralisation can be far easier ascertained, litmus being used as an indicator, by titrating from red to blue, than from blue to red, and as the latter plan offers several other advantages, it is advisable to operate as follows:—A measured quantity, say 50 cc. of the vinegar to be examined, is mixed with 25 cc. of decinormal soda solution (capable of neutralizing 0.200 per cent. of SO_3). The liquid is evaporated on the waterbath in a platinum basin, the residue is dried to prevent spitting in the air, or on the sand-bath at about 110°C , and is then carefully incinerated at the lowest possible temperature. The ash need not be burned white. 25cc. of a decinormal sulphuric acid solution, corresponding exactly to the soda solution, are now added to the ash, the liquid is heated to expel all carbonic acid, and is then filtered into a small beaker. The filter is washed with hot water, tincture of litmus is added to the filtrate, the acidity of which is ascertained by means of the decinormal soda solution. *The volume of soda necessary for neutralisation directly gives the proportion of free mineral acid present in the vinegar*, 100 cc. of the standard solution, corresponding to 0.49 grammes of H_2SO_4 .

It may happen, when more than 0.200 per cent. of free mineral acid is present, that the 25 cc. of decinormal solution added to the vinegar are insufficient to neutralise all free mineral acid: in that case 25 cc. of decinormal soda would be required to neutralise the filtrate. A fresh experiment, with the addition of a larger quantity of soda solution, say 35 or 40 cc. to the vinegar must then be made.

An error of one cc. of decinormal soda solution, would cause with 50 cc. of vinegar an error only in the amount of free mineral acid of 0.0098 per cent., calculated as H_2SO_4 , but practically results of far greater accuracy can be obtained, as the following experiments show. I will remark, that they are taken without selection, but were made with scrupulous care.

A vinegar was prepared by diluting pure acetic acid, to a strength of 5.475 per cent. and by adding about one per cent. of cane-sugar, to represent the organic residue present in all non-distilled vinegar. To 4 portions of this liquid as much decinormal sulphuric acid was added, as corresponded to 0.2, 0.1, 0.05, and 0.025 per cent. respectively, and which I will call, I., II., III., and IV. To 50 cc. of I., I added 30 to 50 cc. of II., III. & IV. each, 25 cc. of decinormal soda solution. The liquids were evaporated in a platinum basin, and incinerated at the lowest possible temperature, the basin not being allowed to become heated to redness.

To the carbonaceous residue in I. 30 cc. of deci. H_2SO_4 were added, the liquid was boiled and filtered; the filtrate needed 25.07 cc. of deci. soda for neutralization, equal to 0.10028 gram. SO_3 or 0.20056 per cent., instead of 0.2000 per cent. Error, + 0.00056 per cent.

To Ash II., 25 cc. of deci. acid were added; the filtrate required 12.79 cc. of deci. soda, equal to 0.05116 gram. SO_3 , or 0.1022 per cent., instead of 0.100. Error, + 0.0022 per cent.

Ash III., was likewise treated with 25 cc. of deci. acid, the filtrate requiring for neutralisation 6.30 cc. of acid, corresponding to 0.0252 gram. SO_3 , or 0.0504 per cent. instead of 0.0500 per cent. Error, 0.0004 per cent.

To Ash IV., 25 cc. of deci. acid were added; 3.8 cc. of deci. soda were required for neutralisation, corresponding to 0.0152 gram. SO_3 , or 0.0304 per cent., instead of 0.0250 per cent. Error, + 0.0054 per cent.

It will be seen that in no case is the error greater than 0.0054 per cent., and this only when the total quantity of free sulphuric acid present was as small as 0.025 per cent.

As vinegar mostly contains some chloride of sodium, which would be converted by the action of free sulphuric acid into free hydrochloric acid, and sulphate of soda, and as hydrochloric acid might be directly used as an adulterant, a similar series of experiments as that described above was undertaken, the vinegar being admixed with hydrochloric acid to the extent of 0.2, 0.1, 0.05, and 0.025 per cent. To 50 cc. of each of these adulterated vinegars, 25 cc. of decinormal soda solution was added, and the quantities determined as in the previous series. The following are the results:—

- I. Used 24.14 cc. of deci. soda, equal to 0.08814 gram. H Cl, or 0.1763 per cent. instead of 0.200 per cent. Error, + 0.0237 per cent.
- II. Used 14.03 cc. of deci. soda, equal to 0.0512 gram. H Cl, or 0.1040 per cent., instead of 0.100 per cent. Error, + 0.0040 per cent.
- III. Required 7.93 cc. of deci. soda, equal to 0.02894 gram. H Cl, or 0.05789 per cent., instead of 0.050. Error, + 0.0079 per cent.
- IV. Used 5.63 cc. of deci. soda solution, corresponding to 0.0205 gram. H Cl, or 0.0410 per cent., instead of 0.025. Error, 0.016 per cent.

Thus it is shown, that although the error of estimation in the case of free hydrochloric acid is greater than with free sulphuric acid, the results are still highly favourable and accurate, the difference between theory and experiment not exceeding 0.02 per cent. The experiments quoted, show that the amount of free mineral acids may be determined with far greater accuracy alkalimetrically, than by any other method.

The same method may be applied to lime and lemon juices, wherein I have repeatedly come across large quantities of sulphuric acid.

With a view to establish the correctness of the conclusion, that an alkaline reaction of the ash of the vinegar is the best proof of its freedom from uncombined mineral acid, the following experiments were undertaken. They may perhaps appear somewhat superfluous, but I quote them, as again demonstrating the extreme accuracy of the method.

A pure distilled vinegar was mixed with a solution of acetate of soda, and it was found, that 100 cc. were capable of saturating 0.1065 gram. SO_3 , corresponding to 26.62 cc. of decinormal sulphuric acid.

To 50 cc. of this artificial vinegar, 12.5 cc. of deci-normal sulphuric acid were added, the liquid was evaporated and the residue was charred at a low temperature. The ash was all but neutral, but slightly alkaline, showing the absence, as was expected of free sulphuric acid in the vinegar. The alkalinity of the ash was found to be equivalent to 0.0085 gram. of SO_3 . Theoretically there ought to have been an alkalinity corresponding to 0.0065 gram. of SO_3 .

To 50 cc. of the same vinegar 6.25 cc. deci-normal sulphuric acid were added. The alkalinity of the ash corresponded to 0.0643 per cent. of SO_3 , instead of 0.0565 per cent.

To another 50 cc. of the same solution, 3.13 cc. of deci-normal acid were added. The alkalinity of the ash corresponded to 0.0776 per cent. of SO_3 , theoretically 0.081 per cent.

The final conclusion to be drawn from these results is obvious. The alkalinity of an ash is diminished in exact proportion to the amount of mineral acid added to the vinegar; alkaline reaction is the surest and safest criterion, that free mineral acid is absent from the vinegar.

THE FRAUDULENT COLOURATION OF WINES,

By A. GAUTIER,

Bull. Soc. Chim., [2] xxv. 435-44 483-498, and 530-538.

THE increasing practice of adding artificial colouring matters to wines, led the author to undertake a series of experiments, having for object the discovery of a method by which each of these adulterants might be recognised by characteristic reactions, even in the deep red wine themselves when the amount of the fraudulent colouration did not exceed 12 to 20 per cent. of the total colouration of the liquid. In many instances the processes to be described led successfully to the detection of a mixture of two or three colouring matters added to wines. The experiments were repeated with authenticated genuine samples of wines.

COLOURING MATTERS USED IN THE ADULTERATION OF WINES.

The colouring matters which are used, sometimes to freshen or increase the natural colour of red wines, sometimes to colour white wines, at the present time are—

1. *Hollyhock Althea rosea*, variety *nigra*, petals.—They give an extract of a fine deep wine—violet colour.

2. *Elderberries* (*sucambucos niger*), the juice of which becomes wine red by fermentation or by the action of acids, much used in north and central France, Portugal, and Spain. Its tone is heightened with tartaric acid, but more frequently with alum. Sometimes the berries of the dwarf elder (*sucambucos ebulus*) are employed. The juices of both these Elders are purgative in moderate doses.
3. *Privet Berries* (*Ligustrum vulgare*) impart a crimson tint when recently added, or after fermentation, but if the juice is fermented the colour is that of an old red wine. Not much employed in France.
4. *Portugal Berries* (*Phytolacca decandra*).—Their use is now almost abandoned, because the juice contains a drastic purgative.
5. *Whortle Berries*.—Chiefly used in Paris, or in Switzerland to colour white wines, but not in the wine growing districts.
6. Decoction of beet root; seldom used alone, it being generally employed to mask the tints of cochineal, and of fuchsine.
7. *Logwood*.—There are several varieties, one of which gives reactions closely resembling Brazil wood. Chiefly used in Paris for common wines. When added to new wines it imparts to them an appearance of age.
8. *Brazil Wood* (alcoholic extract of).—Used for same purposes as logwood, but not employed in the producing districts.
9. *Cochineal*, (carmine, carmine lake, ammoniacal carmine).—Very largely employed, chiefly in central France to raise the tone of wines, which are in turn themselves frequently used to adulterate the wines of Burgundy and Bordeaux. It is usually sold in thick solution in ammonia, or in cakes made by wetting the cochineal with ammonia and then pressing it.
10. *Fuchsine, aniline reds and violets*, not unfrequently contaminated with arsenic, are used in large quantities either alone or mixed with various other yellow or red substances to diminish the brilliancy of their tint.
11. *Grenat*.—A bye product in the manufacture of Fuchsine, (a few years ago valueless, but now sold at a remunerative price in consequence of its use for the adulteration of wines.) It consists of a mixture of mauve aniline, crsotoluidine, fuchsine, and an undetermined body called brown grenat.
12. *Indigo-carmine* or ceruleine, in paste, added to common wines deepens their colour, and renders them purple or violet. Tolerably largely used in Central France.
13. A few substances are sold under fantastic names, such as "colourine," "caramel," "colouring fluid," &c., consisting of fuchsine residues, mixed with beetroot extract, carmine, &c., &c.

The order of the importance of the colouring matters most frequently employed, is as follows:—1. Fuchsine. 2. Cochineal. 3. Hollyhock. 4. Elder. 5. Indigo.

The greater part of the colouring matters communicate a rose, red, or rich violet tint to the wines, which frequently is fugitive, and in the wines thus tinted the foreign colouring matters soon separate and carry with them a portion of the natural colouring matters; this is specially noticeable when cochineal, indigo, or fuchsine are the adulterants.

REACTIONS CHARACTERISTIC OF THE NATURAL COLOURS OF WINES.

There are slight variations in the reactions with the products of different vines, and particularly with the age of the wine. The following apply to wines of Central France, more especially of Bourgogne, and of the Gironde, examined as they are usually sold, about five to eighteen months after the vintage, when they are said to be *made*, but not *aged*.

*Carbonates of Soda.**—A very dilute solution of di-sodium carbonate affords a means of recognizing certain adulterations. Thus elder (wall wort), dwarf elder, privet and hollyhock change to green or grey blue; whortle berry, Portugal berry, and beetroot retain their colour; among those which change to green with the neutral carbonate of soda, hollyhock undergoes the same change with bicarbonate while both elders are unchanged, 5 c.c. of a 1-200 solution of di-sodium carbonate, added to 1 c.c. of natural wine afford a greenish-grey, green, or bluish-green colour, depending upon the age and variety of wine. In certain sorts, a winey or lilac tint remains; *teinturier* affords a deep bluish-green tint, which becomes chestnut brown on heating.

All the following reactions were performed on the wines clarified by a process to be shown further on; or else diluted with five to ten times their volume of water, so that the colours were reduced to a mere rosy tint.

The changes of colour should be observed about two minutes after the addition of the re-agents.

Sodium Bicarbonate, charged with carbonic acid—(Eight per cent. by weight solution). Equal volumes of wine, and of this re-agent afford a slightly cloudy iron-grey liquid, with tint of bottle green. *Teinturier* becomes deep green; *aramon* rose winey brown; *aramon* with *petit Bouschet* lilac changing at 100° to the colour of extract of tea.

Borax.—Saturated solution at 15°. One volume of wine with two volumes of this re-agent becomes bluish-grey, or that colour with greenish tinge (*pinot* 16 months old; *carignane* 5 months); greenish (*carignane*) or greyish-blue with feeble violet tinge (*carignane*, 18 months old); or entirely wine-lilac, (*aramon* alone, or with *petit Bouschet*.) The colours should be viewed by transmitted light reflected from a white surface; they last unchanged for several hours.

Ammonia.—Ten volumes of ordinary ammonia with 90 of water. The deeply coloured wines of Central France, mixed with an equal volume of dilute ammonia, change to greenish grey, bottle green, greenish-yellow, or grey greenish blue. With *aramon* (of which the colouring matter differs most from that of the generality of wines,) or with mixtures containing it, the change is to buff, or decoction of tea with trace of lilac. With new wines the colour is more decidedly green, but changes subsequently to brown; with those over a year old the colour is that of a dead leaf, if the wine is very dark coloured (like Roussillon), and the grape had become perfectly ripened, a single drop of a stronger ammonia causes a blue colouration or precipitate; then the colour changes as before mentioned to greenish or brown.

Sulphide of Ammonium.—8 c.c. of ordinary ammonium sulphide, with 10 c.c. of ammonia, made up to 1 litre, with water. Equal volumes of the wine, and the re-agent are mixed and filtered. The filtrate is greenish with pure wines, but bluish or violet-lilac with those adulterated. The re-action is not satisfactory.

* In the preparation of the re-agents, the directions given must be followed strictly to the letter in order to avoid errors otherwise inevitable.

Baryta Water.—Saturated solution. Equal volumes of this reagent and clarified or diluted wine afford on filtration an olive green, or dirty greenish yellow filtrate, sherry coloured with *teinturier*, old brandy coloured with *aramon* of 18 months. This filtrate becomes rose on acidification with acetic acid, except with *teinturier*, which remains buff, and *aramon* which becomes clear yellowish green. It becomes red-brown, or yellow-brown with logwood, or Brazil wood.

Subacetate of lead.—2 c.c. of wine with 1 c.c. of solution of subacetate of lead, of 15° B give a coloured precipitate from which no indication of the nature of the colouring matter can be obtained. When filtered the filtrate is colourless with wine, and most vegetable colouring matters; but rose or lilac with Brazil wood; pale rose with fuchsine.

Sulphurous acid.—It has been stated by various authors that any wine, the colouring matter of which was not destroyed by this re-agent might be considered to be adulterated, but in fact, whereas many vegetable colouring matters are so destroyed, that of wine remains unaffected even after 24 hours.

Nascent Hydrogen (by the action of hydrochloric acid on zinc), affords no satisfactory reaction.

Barium Peroxide.—3 c.c. of clarified or diluted wine acidified with five drops of a 5 per cent. solution of tartaric acid, and treated with 0.1 grammes of barium peroxide is nearly discoloured in 24 hours. With elder (both varieties) fuchsine, Brazil wood, logwood, beetroot, and cochineal, the colour remains for a very much longer time.

REACTIONS FOR DISTINGUISHING MIXTURES OF WINE AND COLOURING MATTERS.

The first portion of this section is devoted to a review of the various methods that have been suggested for detecting the foreign colouring matters in wines. Having examined them all, the author avers that they are valueless. Among them are the process of Fauré (who suggested the precipitation of the natural colouring matter in wine, with tannin, and examining the filtrate therefrom for the artificial ones,) and of Dr. Facon (decolourisation of the wine by manganese peroxide.)

A tolerably successful method is to put into the suspected wine skeins of silk or wool variously mordanted with such mordants as alum with cream of tartar, oxychloride of tin, and acetate of alumina. Certain differentiating characteristics were thus obtained, but the method cannot be generalized; yet by mordanting scoured silk with tartaric acid, fixing the colour and drying it at 100°, after having acted upon it with various reagents, such as ammonia, lime-water, chlorides of zinc, iron, calcium, salts of copper and tin, some new re-actions were observed, which are characteristic of certain colouring matters.

[To be continued.]

C.H.P.

THE LATEST CHEMICAL DISCOVERY.

THE *Chemical News*, of the 18th inst., startles us with the wonderful announcement that "an establishment has been opened in Belgium for extracting *the wool from grease*, (we think this chemical curiosity justifies the italics, which are our own), and that the "yield" of wool "is understood to be large." We regret that the exact details of the process are not given as they would doubtless be interesting, but possibly the method resembles in some degree that used for the extraction of sunbeams from cucumbers.

The marvels of Science certainly appear to be illimitable.

REVIEWS OF BOOKS, &c.

THE ANALYST'S ANNUAL NOTE BOOK, 1875, EDITED BY S. W. RICH.*

THIS little manual contains in a portable form a number of collected articles on the analysis of a variety of substances, and, while it may be of use for reference to chemists in general, it will be found of most value to those who have not the time or the opportunity for consulting Chemical Journals as they are published.

It is, of course, only a compilation of papers which have already been published, but it contains much valuable information on the analysis of such substances as bread, butter, milk, tea, citric acid, water, wine, &c.

While appreciating the discriminating care with which Mr. Rich has made his selection, we cannot but express our regret that his regard for the ethics of journalism has not suggested to him the propriety of stating in each case the source to which he is indebted for the article he publishes, and also of indicating in which instances (if in any) an article is reproduced in its entirety, and in which it is merely an arbitrary abstract.

We will explain what we mean by an example or two.

More than six pages are devoted to a paper by professor Wanklyn, on the "Detection of Alum in Bread."

No intimation is given that this is merely an abstract, and no acknowledgment is made of the fact that these six pages are "cribbed" from the published volume of "The Proceedings of the Society of Public Analysts." We must refer those who wish to read the whole of the paper to that volume.

Precisely the same remark applies to a paper. "On taking the melting point of Butter, by Dr. Tripe, which is taken from the same source without any acknowledgment, and cut down at the will of the compiler.

A very valuable paper on Butter Analysis by Mr. Angell, is treated in the same way—emasculated, and inserted with no acknowledgment of the source from which it is taken.

A paper by Mr. W. C. Young, on the Volumetric estimation of Chlorides in the presence of Alkaline Phosphates, is treated with the same unfairness, as also is a paper by Dr. Redwood, on "The Analysis of Milk," one by Dr. Stevenson, on "The decomposition of Milk," one by Mr. Allen, on "The Adulteration of Tartaric and Citric Acids," as well as Mr. Wigner's exhaustive paper on "Tea," and Dr. Dupré's valuable essay on "The Natural Constituents of Wine."

The only thing that can be said in palliation of this wholesale system of appropriation, is that our compiler has been fairly unfair all round.

To amateur chemists and those only desiring to obtain a smattering of the subjects treated of, this book will be useful.

To the numerous chemists who possess the "Proceedings of The Society of Public Analysts," it will appear to a great extent a *rechauffé* of that work, and to those chemists who, not having already read the papers in question, have a wish to study them with a view to actual manipulation, we need hardly point out the wisdom of their possessing themselves of the papers in their entirety, with the discussions which in most cases ensued.

We wish this little compilation all the success it deserves; but we would suggest to Mr. Rich, that he would be no loser, and his readers would be gainers, if in his next issue he were to frankly acknowledge to what sources he is indebted for his articles, and, where they are abstractions, if he would mention the fact, and state by whom they have been abstracted. Chemists would then know what value to attach to the abstractions as faithfully representing the views of the respective authors.

CORRESPONDENCE.

TO THE EDITOR OF THE "ANALYST."

SIR,—Will you allow me space for a few words in answer to some of the remarks made during the discussion on my paper on Butter Fat, read before the Society of Public Analysts, on June 14th, and which appears in the last number of "The Analyst."

I believe every one is now convinced that a high specific gravity, taken by itself, is no proof of the purity of any given sample of butter.

I entirely dissent from Dr. Muter's historical sketch. What may or may not have been done in the privacy of laboratories we know not. We must, therefore, confine ourselves to published records. Here we have firstly Messrs. Hehner and Angell's pamphlet on butter, which is undoubtedly the foundation of our present butter analyses, secondly my note confirming the main features of Messrs. Hehner and Angell's work, read before the Society of Public Analysts in January, 1876. Thirdly, Dr. Muter's papers read March 15th, 1876, which, like my own previous note, is essentially nothing more than a confirmation of Messrs. Hehner and Angell's statement; and lastly my paper of June 14th. The experimental demonstration of the fact that butter fat really does contain a notable proportion of soluble fatty acids is the main point; the methods by means of which this is ascertained have but of secondary importance. Next I look upon Dr. Muter's method for the estimation of the soluble fatty acids as greatly inferior to either of the three described in my paper, and also as more complicated than the one finally adopted. It will be recollected that Dr. Muter arrives at the proportion of soluble acids by means of three distinct estimations, each differing from the others in principle. First, the total free acid is estimated in $\frac{1}{5}$ of the bulk by standard alkali. Secondly, the total amount of sulphuric acid is estimated in $\frac{1}{10}$ of the bulk by precipitation with barium chloride. Thirdly, the total combined sulphuric acid is determined in $\frac{1}{10}$ of the bulk, by evaporation and final ignition of the residue, which residue is taken as potassium sulphate. Assuming that no mistake is made in the various measurements, the following may, I think, be looked upon as reasonable experimental errors. First, variations in the amount of alkali necessary to neutralize the 200 cub. cents. will not be less than 0.1 cub. cent., equal to 0.5 cub. cent. on the litre, corresponding with the alkali used by Dr. Muter, to 0.026 grams butyric acid. Secondly, any one strictly following Dr. Muter's directions, will have worked well if he comes within 1 per cent. of the total amount of sulphuric acid present, equivalent (taking the one experiment given in full by Dr. Muter as basis) to 0.088 grams butyric acid. Thirdly, few will come to within 1 per cent. of the true amount of combined sulphuric acid present by following Dr. Muter's directions, in which no allowance is made for any impurity in the potassium hydrate employed, which is never absolutely pure, and, worse still, no account is taken of the fact that on ignition of the dry residue obtained by evaporation, much carbon is separated which has to be burnt off and reduces some sulphate to sulphide. Now 1 per cent. on the combined sulphuric acid is equivalent to 0.07 grammes of butyric acid. The sum of these errors, which I am sure have not been exaggerated, is 0.184 grams of butyric acid, equal to 1.814 per cent. on the 10 grammes butter fat taken.

What now is the probable error to which the process of titration is liable? In this the total amount of soluble acid is estimated by means of a process which involves the measurement of 25 cub. cent. normal soda, of 25 cub. cent. of acid,

slightly above the normal, and the volumetric estimation of the excess of acid present in the mixture by means of deci-normal soda. Any one of average skill will be able to do this and come always within 0.2 of decinormal soda, but let us assume that the variation amounts to 0.5 cub. cent.*

0.5 cub. cent. deci-normal soda are equivalent to 0.044 grammes of butyric acid, which, on 5 grammes, correspond to 0.88, or say 0.1 per cent., which may be taken as the maximum error to which, in moderately skilful hands, this method is liable, for the process of saponification &c., &c., does not increase the error of titration. If two successive estimations of soluble acid in a sample of butter differ by more than this, the error is due, I am convinced, not to a mistake in the estimation of the soluble acid actually present in the washings, but to the fact that more soluble acid has been washed out in the one case than in the other.

It may fairly be asked how, if the method employed by Dr. Muter is so faulty, I explain the marvellous correspondence between the duplicate analyses of the same butter fat given in Dr. Muter's paper. I can only answer, I cannot explain it, unless it be accidental, for even at its best Dr. Muter's process is necessarily less accurate than the process of titration, as it involves three estimations (instead of one), each of which is liable to error, which, whatever it may be, has to be multiplied by 5 or 10. I look upon the fact mentioned by Dr. Muter, viz.: that the sum of acids (calculating the soluble acid as butyric acid) in my analyses rarely comes up to 94 per cent., whereas in his case it comes up to nearly 95, in spite of the fact that he saponified in an open vessel and thus lost about $\frac{1}{2}$ per cent. of soluble acid, as a strong proof that my process is more correct than his.

In conclusion I would remark that I began my experiments on the saponification with standard alkali in the Autumn of 1875, that in my communication to the Society of Public Analysts, in January of this year, I stated that I had made experiments in that direction, and was then engaged in similar experiments, which I hoped would be more accurate than the former, as well as more easy of execution. This meeting took place two months before the reading of Dr. Muter's paper. The method is, in fact, nothing more than an application of Berthelot's well known process for the titration of ethers, with which I have worked for ten years or more.

Yours, &c.,

A. DUPRÉ.

MILK OF SULPHUR.

TO THE EDITOR OF THE "ANALYST."

SIR,—Referring to Dr. Hill's "Paper" on Milk of Sulphur, which he read before the Society of Public Analysts, as reported in your last number, I gather from it, that Dr. Hill's contention is, that when he wants to buy the sulphur precipitatum of the British Pharmacopœia of 1867, he, as a medical man, is at liberty to ask for it, either by the name of precipitated sulphur, or by the name of milk of sulphur.

In reply to this, I desire to point out that though the two names in former Pharmacopœias may have synonymously applied to the precipitate thrown down by sulphuric acid, and to that thrown down by hydrochloric acid, the British Pharmacopœia of 1867 plainly and clearly shews that the hydrochloric acid preparation *alone* shall be called by the name of precipitated sulphur.

* 0.5 cub. cent. of deci-normal soda is equal to 0.05 cub. cent. normal soda, which is about 1 drop, and according to Dr. Muter, would when calculated to per centage of butyric acid give an enormous error.

Dr. Hill therefore, as a medical man, is not at liberty to embarrass the retailer by asking for milk of sulphur, if he wants precipitated sulphur, and there can be no question that he is pharmaceutically reprimanded if he does so, in proof of which I give the following extract from the preface of the British Pharmacopœia of 1867.

"By the Medical Act of 1858, section 54, it is enacted that the General Council shall cause to be published under their direction a book containing a list of medicines and compounds. And by a subsequent Act, the 25th and 26th Vic., cap. 91, recites that different pharmacopœias having been published in England, Scotland, and Ireland, the pharmacopœia to be published is intended to supersede the above mentioned pharmacopœias. The present work, therefore, is produced in compliance with and under the sanction and authority of these Acts of Parliament, and is intended to afford to the medical profession, and those engaged in the preparation of medicines throughout the British Empire, one uniform standard and guide, whereby the nature and composition of substances to be used in medicine may be ascertained and determined.

It will be seen by the above "extract," that all former Pharmacopœias, including of course the names of all drugs, and all processes for the compounding of medicines, have been superseded, and that the ONE CODEX for the making, dispensing, and prescribing of medicines is the British Pharmacopœia of 1867, in order that prescribers and dispensers may mutually understand each other.

A grave responsibility therefore rested upon Dr. Hill, in flatly disobeying his pharmacopœia when he told his man to ask for precipitated sulphur by a name which is not in that work, and he, is the wrong doer, and not the unfortunate retailer, who, when he was asked for milk of sulphur, sold milk of sulphur.

Dr. Hill seems to exult, that when his man went round to the chemists' shops to ask for milk of sulphur, out of thirteen purchases, ten of the retailers gave for it the precipitated sulphur, thrown down by hydrochloric acid, and the wonder is, the whole thirteen did not sell that preparation after receiving a certain circular, of which the following is a copy.

SPECIAL NOTICE.

"As the Borough Analyst is obtaining samples of milk of sulphur from chemists and druggists in Birmingham and district, it is desirable to save annoyance that only the pure precipitated sulphur should be supplied."

This curious circular was sent to all the chemists by an influential firm, and it appeared to me in plain English to mean, "When the Borough Analyst's man asks for an article, take his money, but to save annoyance, give him something else!"

Yours, &c.,

BIRMINGHAM,

ALFRED BIRD, F.C.S.

July 26th, 1876.

(The above letter reached us too late for publication in our last issue, but the subject being of interest to Chemists in general, we insert it now.)

VOLUMETRIC DETERMINATION OF PHENOL.

By W. F. KOPPESCHAAR.

Zeitschr. : F. Anal. Chemie. III., 1876.

ON the addition of an aqueous solution of bromine to liquids containing Phenol, a precipitate is thrown down, consisting of Tribromophenol. According to Landolt, this precipitation is still perceptible in a solution containing, 1 part of Phenol in 43,700 parts of water; and accordingly this substance possesses a high degree of insolubility. Experiments have proved, that the action of Bromine upon Phenol takes place according to the formula $C_6 H_6 O + 6 Br. = C_6 H_3 Br_3 O + 3 H Br.$ But on account of the difficulty of collecting, washing, and drying this precipitate, a direct gravimetric determination of the phenol cannot thus be accomplished, the tribromophenol being very voluminous and volatile at 100° C.

But according to the numerous experiments of the author, Phenol may be determined with great accuracy, volumetrically, by ascertaining indirectly the quantity of Bromine which combines with a known quantity of the substance to be examined. He prepares an aqueous solution of bromine, and determines its strength by titrating, by means of hyposulphite of soda, the iodine separated from iodide of potassium, by a measured volume of the bromine solution.

A clear solution of the sample to be analysed, is prepared by dissolving 4 grammes in 1000 cc. of water, the liquid being filtered, if necessary 25 cc. of this solution are put into a stoppered bottle, capable of holding 500 cc. A measured volume of the bromine solution, containing more bromine than is necessary to effect the reaction is added, and the liquid is allowed to rest for about a quarter of an hour. Iodide of potassium is now added, and the iodine is determined as usual by means of hyposulphite of soda. Thus the necessary data are obtained to calculate the percentage of C_6H_6O in the sample.

As it is both inconvenient and somewhat inaccurate to operate with Bromine water, a slight loss by evaporation being hardly avoidable, the author made a series of observations, employing the mixture of bromide and bromate of potassium, obtained by saturating caustic potash with bromine, and liberating from this mixture the bromine by means of hydrochloric acid. Thus the bromine acts in a nascent state. The results obtained in this manner are highly satisfactory. This latter modification is especially recommended when many samples of Phenol have to be examined.

O. H.

OFFENCES UNDER THE SALE OF FOOD AND DRUGS ACT.

ADULTERATED BUTTER IN GLASGOW.—Mr. M'Kinnon, Provision dealer, was charged under the Food and Drugs' Act, with having sold a pound of adulterated butter. The assistant sanitary inspector stated that he obtained the butter from M'Kinnon's shop, and that it had been analysed by Dr. Clark, one of the city analysts, who found that it was adulterated with extraneous fat to the extent of two-thirds of its weight. Dr. Clark, city analyst, stated that he made his analysis by Bell's and Muter's method, which he believed were correct. Dr. Stevenson Macadam, Edinburgh, stated that he had made an analysis of a sample of the butter by Muter's mode and by the old system of testing. By the former the butter appeared to be adulterated, and according to the old system it was quite sound. He believed the old system was the correct one, and that the butter was quite good. Dr. Dittmar, Professor of Chemistry in the Andersonian University, gave similar evidence as the result of the two processes of analysis. He did not think Muter's system was the correct one, and was of opinion that the butter was quite sound. A portion of the sample was ordered to be sent to Somerset House, and on the adjourned hearing judgment was given. The Somerset House Analysis was as follows, water 14.33 per cent., curd and impurities 0.48 per cent., salt 3.81 per cent., and fats 81.41 per cent. The analysts add that they are of opinion that the sample is made up almost exclusively of a fat which is not that of butter, and which has apparently been worked up with a little milk. The defendant was fined two guineas, and the cost of the Somerset House Analysis.

ALUM IN BREAD.—At the Wednesbury Police-court, John Hartill, was summoned for selling adulterated bread. Mr. Jones, the County analyst, stated that upon analysing the bread he found that alum had been used to enable defendant to use damaged flour, and to make a presentable loaf, and to prevent further decomposition of the gluten and other substances in the flour. Mr. Sheldon, in defence of the accused, said that his client was extremely sorry for what had occurred, and would take care that the offence was not repeated. The Stipendiary said that if defendant repeated the offence he would be liable to be sent to the assizes or the sessions. The defendant was fined £25 and costs.

MILK ADULTERATION.—William Mason, of Homerton, was summoned for selling adulterated milk. The inspector sent it to the parish analyst, and put in the certificate from that gentleman to the effect that the milk was adulterated with 20 per cent. of water. The defendant made a novel defence, viz., that he had during the hot weather to put ice into the milk to preserve it. Mr. Barstow said he could not take that excuse. Ice was well known to be congealed water. It was no excuse to a butcher if he sold stinking meat. He ordered the defendant to pay a fine of £5 and 2s. costs.

At the Brentford Petty Sessions, two dairymen, named Harris Thompson and Chas. Stanley, appeared to answer to adjourned summonses for unlawfully selling milk adulterated with water. In Thompson's case the milk in question, on being analysed by Dr. Redwood, was found to consist of 82 parts milk and 18 parts water. After further evidence the defendant was fined £7 including costs, the justices intimating that they were determined if possible to put a stop to such practices. The case of the other defendant was very similar, and after hearing the evidence, including that of Dr. Redwood, the justices, after consultation, imposed a fine of £5 including costs.

On May 26th, at Chesterfield County Police Court, Arthur Slater, druggist, of New Whittington, was summoned under section 6 of the Sale of Food and Drugs Act, for selling a which was not of the nature, substance, and quality demanded by the purchaser.

Lieutenant-Colonel Shortt, inspector for North Derbyshire, said that on May 9th he instructed his assistant to take a prescription to the defendant's shop and have it made up. At the same time he told him to ask for two ounces of "precipitated sulphur." He wrote down the name of the article in the assistant's note book so that there might be no mistake. He subsequently went into the shop and told the defendant that he intended to take them to the county analyst, Mr. A. H. Allen, of Sheffield. He offered to divide them into three parts, and this offer the defendant accepted. There was no label on the sulphur. He said "You sell this as 'precipitated sulphur' I suppose," and the defendant replied in the affirmative. He submitted the articles to the analyst, and subsequently received a certificate (produced) which stated that the sample did not consist of precipitated sulphur, but of orange sulphuretted antimony, which was a very active remedy, and if taken in quantity by mistake for precipitated sulphur would have had a dangerous and probably fatal effect.

Job Bayes, assistant-inspector, stated that he asked the defendant for "precipitated sulphur" as he had been instructed, and the defendant said, "Precipitated sulphur of antimony, I suppose you mean?" He replied, "I don't know; I was told to ask 'precipitated sulphur.'" He was certain he did not mention antimony; he had never heard of such a preparation. He read what Colonel Shortt had written for him.

In defence it was contended that the two preparations were totally dissimilar, and the defendant who had been a dispensing chemist for thirty years could not have made such a mistake, but the purchaser must have asked for the antimonial preparation.

Mr. Gabriel, surgeon, gave evidence in favour of the defendant, who, he said, dispensed many prescriptions for him, and he had always found him accurate. No druggist could make the ignorant mistake alleged. The magistrates considered the case proved, and inflicted a fine of £2 10s. and costs.

WESTMINSTER.—*Penalty for refusing to serve a Food Inspector.*—Edward Hunt, cheesemonger, of 200, Vauxhall bridge-road, was summoned for refusing to supply one of the sanitary inspectors of the Board of Works for the Westminster district, a certain article of food, to wit, butter.—It appeared from the evidence of Mr. Hughes that, in his official capacity, he went to the shop of the defendant, and was served with half a pound of butter at sixteen pence per pound. He told the defendant that he had purchased the butter for the purpose of analysis, whereupon the defendant snatched it from him, and said he could not afford to sell it at the price. Witness had purchased butter before at this shop at the same price, and found it genuine.—Defendant said there was a doubt on his part whether it was genuine or not and he had since discovered that it was genuine.—Mr. Arnold fined him £5, giving the alternative of a month's imprisonment.

GREENWICH.—George Francis Silcott and Calvin Dennis Smith, tradesmen, carrying on business as grocers, appeared to summonses at the instance of the vestry authorities at Rotherithe, charging them with selling butter as an article of food, which, on analysis by Dr. Muter, was proved to have been adulterated to the extent of 25 per cent of foreign substance, but which was not injurious to health. The charges were proved by the inspector, the butter in question being purchased at the rate of 1s. 2d. per lb. Mr. Pook, who appeared for Smith, produced invoices received in payment of the butter, and said it was retailed as it was bought. The defendant Silcott made a like defence. Mr. Patteson told the defendants that they should obtain warranties as to the genuineness of the butter they purchased from the vendors, and fined them 20s. and 2s. costs. The defendants said that such warranties, when asked for, were refused.

At the West Bromwich Police Court, on Saturday, before the Hon. A. G. Calthorpe, Major Williams, Mr. J. A. Kenrick, and Dr. Underhill, the charges against Mr. Gough and Mr. Leighton, milkdealers, of West Bromwich, for an alleged adulteration of milk, were again heard. The cases had been twice adjourned, on the first occasion for the samples of milk to be tested by the officials of the Inland Revenue Department, Somerset House, London, and on the second occasion for the chemical analysts from London to attend and be cross examined in respect of their certificates. The Government analysts, in their certificates, admitted that the samples were in an advanced state of decomposition, but made allowance for that in their results, which, in one case, showed that there were 8.14 per cent. of solids, not fat, 3.50 per cent of fat, and 88.36 per cent. of water. The analysts, in their report of this case, concluded as follows: "When the necessary allowance for the solids not fat lost by the decomposition of the milk has been made, the amount is lower than is present in samples of milk of first quality, but not less than is frequently found in genuine milk of low quality. The quantity of fat represents a milk of first quality, and exceeds the proportion found in many genuine milks. This, in our opinion, is an important part in judging as to the character of the sample. Under these circumstances, we do not feel justified in pronouncing the milk adulterated with water." In the other case, the chemists were unable to express a definite opinion as to whether the milk was adulterated with water. The certificates were signed by three of the Government analysts.—Mr. Young now appeared for the prosecution, which had been taken out at the instance of Mr. Horder, inspector under the Adulteration of Food Act, who was present, together with Mr. Jones, the county analyst, who had certified that the milk was adulterated. Both cases were dismissed.

THE ANALYST.

BUTTER ANALYSIS IN SCOTLAND.

WE have received a copy of the "Glasgow Herald," of the 9th inst., in which there appears a letter from Dr. Dittmar, attacking this journal for an alleged inaccuracy in a report in its last issue of a recent, notorious butter case, and for a short article on the subject.

If we have really mis-reported Dr. Dittmar, we very willingly apologise for the inadvertence, and shall be happy to print any correction of our report which Dr. Dittmar may choose to send us.

We believe we are pretty well served in the matter of information, but we are free to confess, that for police court reports, we have to depend in a great measure upon local newspapers.

In the present case we selected from a number of reports the one which appeared to us the clearest and fairest, and reports almost identical in terms had appeared in the "Times," as well as in several scientific journals.

Dr. Dittmar writes as though we had some personal feeling against him, and insinuates that we should probably refuse to insert any communication from him.

In this we know that he does us an injustice, and we think he greatly exaggerates the point at issue, which after all simply comes to this:—

We reported that Dr. Dittmar had affirmed that finding certain actual results from the analysis of a sample of butter, he was of opinion that the same was genuine.

As we understand his letter, what he reported (or meant to report,) was, that though the results were capable of being put into figures, (which figures were closely accordant with those yielded by the analysis of "Butterine," but wholly incompatible with the idea of the substance being genuine butter;) he was unable to come to any definite conclusion as to whether or not the sample was pure.

We put it to Dr. Dittmar, whether if a man holds himself out to analyse butter, he should not after submitting the sample to a careful examination be able to form some conclusion as to its genuineness.

If a chemist is unable to draw any deduction from the figures of his analysis, it appears to us that whatever may be his eminence in other walks of science, he would do wisely to eschew the analysis of butter.

SOCIETY OF PUBLIC ANALYSTS.

THE country meeting of the Society was held at Bath Street, Glasgow, on Tuesday, the 12th inst., Mr. Wanklyn in the chair.

The minutes of the last General Meeting were read by Dr. Clark (who acted as local Secretary), and confirmed. Dr. Cameron referred to the report of a case of adulteration of butter, which appeared in the last number of the "Analyst," and which was said to be inaccurate, so far as it concerned Dr. Dittmar, and to an article which also appeared, headed "Butter Analysis in Scotland." After some discussion it was suggested that Dr. Dittmar should be advised to write to the "Analyst" and explain the matter.

The following papers were then read, a discussion in most cases ensuing:

On Enamelled Cooking Vessels, by R. R. Tatlock, F.R.S.E., F.C.S.

Note on the Solution of difficult Soluble Substances, by A. H. Allen, F.C.S.

On the Composition of Gases Evolved in White Lead Stacks during the Corrosion of Metallic Lead, by G. W. Wigner, F.C.S., and R. H. Harland, F.C.S.

Messrs. Wallace, Tatlock, and Clark were thanked for kindly granting the use of their hall for the purposes of the meeting, and a special vote of thanks was accorded to Dr. Clark for his services as Secretary on the occasion.

ON ENAMELLED COOKING VESSELS.

Read before a Meeting of the Society of Public Analysts at Glasgow, August 12th, 1876,

By R. R. TATLOCK, F.R.S.E., F.C.S.

It will be readily conceded that if it is requisite to have our food and drink pure and genuine, it is almost equally desirable that the vessels in which they are prepared for use, should be of such a character as to ensure that they will not be subject to any contamination, or have imparted to them any quality which would render them injurious, or even objectionable.

The Food and Drugs' Act, 1875, does not make any provision for dealing with the sale of dishes, or vessels, which, on account of the nature of the materials from which they are manufactured, must in many instances inevitably introduce poisonous or hurtful ingredients, into the food or drink, which may be prepared or contained in them; and it is questionable, whether officials appointed under the Act, would consider it any part of their duty to interfere with the sale of these.

It is therefore all the more necessary that attention should be called to the question, in order that, if possible, moral influence as well as future legislation should be brought to bear upon it.

Brass vessels for boiling fruit, in making preserves; and also "preserved meat" tins, the coating metal of which is partly composed of lead, have again and again been pointed out as examples of the articles referred to, but it is exclusively with enamelled cooking vessels that this communication has to do.

The nature of "Enamel," or at least of the white, porcelainous kind most commonly met with on cast iron cooking vessels, admits of great variety as regards the ingredients it contains, and their proportions, upon both of which the properties and character of the enamel depend.

Thus, we may have poisonous ingredients, such as Lead or Arsenic, present in comparatively large quantity, without the risk of having even a trace of either of these metals imparted to any food cooked, provided sufficient silica has been employed in the composition to make a glass not readily acted upon by common salt, vegetable acids or other ordinary dietetic substances. But if, on the other hand, a deficiency of silica be used, the same proportions of lead and arsenic will give an enamel the use of which would be attended with great risk, on account of the easy action upon it of many of the substances employed in the preparation of food.

That enamels, in practice, differ largely in composition as well as in properties, will be seen from the following analyses and experiments, which refer to three samples of white opaque enamel taken from three cast iron cooking pots as sold for use, made by three different manufacturers.

	1.	2.	3.
	Per Cent.	Per Cent.	Per Cent.
Silica	61.00	42.40	42.00
Alumina	8.00	2.88	6.06
Oxide of Iron	1.10	2.04	4.04
Lime	3.02	.16	.78
Magnesia .....	.28	.10	.21
Oxide of Lead	Absent	25.89	18.48
Potash	5.61	7.99	6.46
Soda	20.67	14.67	19.25
Phosphoric Acid	Trace	Trace	Trace
Arsenious Acid .....	.02	.42	1.02
Carbonic Acid .....	.30	Absent	Absent
Boracic Acid	Absent	3.45	1.70
	<u>100.00</u>	<u>100.00</u>	<u>100.00</u>
Bases	38.68	53.73	56.28

The most superficial study of these Analyses will shew that Nos. 2 and 3, although differing considerably in composition, are of the same class, both being quite different from the No 1 in the following respects:—

1. The ratio of the total amount of bases simply added together, (without taking into account the difference in their combining proportions) to the silica is as 1 to 1·58 in No. 1; 1 to ·79 in No. 2; and 1 to ·76 in No. 3, so that in the first-named sample the ratio of the silica to the bases is twice as great as in the other two.

2. Lead is absent in No. 1, while the other two contain it in very large proportion.

3. No. 1 contains only 1-20 part of the amount of arsenic present in No. 2, and 1-50 of that contained in No. 3.

At first sight it seems rather startling that a fatal dose of arsenic should be contained in one ounce of the enamel of a vessel intended for cooking purposes, but this fact alone would not be of so much consequence were it not for the basic character of the enamel, rendering it easily acted upon by ordinary dietetic substances, and even by water.

It is impossible, however, to determine, from the composition alone of any enamel, whether it will, in the ordinary circumstances in which the vessel is used, give out any of the poisonous ingredients which it may contain, and it, therefore, becomes necessary to ascertain this point by direct experiment. With this object the pot prepared with the No. 3 enamel was subjected to the following tests:—

1. A one per cent. solution of citric acid was boiled in the pot for a few minutes. The fluid was then cooled and tested for lead by sulphuretted hydrogen. A dense black precipitate was at once obtained, which settled immediately; and on concentrating a further portion of the fluid, and testing for arsenic the presence of that metal was distinctly established.

2. A quantity of water containing about 3 per cent. of common salt in solution was boiled in the same pot for a few minutes, and the solution cooled and tested with solution of sulphuretted hydrogen.

A black precipitate of sulphide of lead was at once obtained.

A further portion of the fluid was concentrated and tested for arsenic, but none could be found.

3. A quantity of gooseberry jam was boiled for a short time in the same vessel, and the result tested for lead in the same way. The re-action was sufficiently distinct, but the presence of arsenic was not satisfactorily proved. A blank experiment shewed that the jam did not contain a trace of lead originally.

There was no difference in the appearance of these enamels, which could be of the slightest service in enabling any one to distinguish between them, so that nothing short of a chemical examination could determine whether they were objectionable or otherwise.

It may be worth noticing, however, that when the basic enamel is boiled with citric acid solution of 1 per cent. strength; its surface loses its glassy appearance and becomes quite dull, while a perfect enamel is unaffected.

It will be, of course, at once seen that the object of the manufacturer in the employment of arsenic, is to obtain a milk white porcelainous enamel, and that by the use of lead, the materials can be fused at a much lower temperature, but it is evident from the analysis of the No. 1 enamel, that both of these ingredients *can* be dispensed

with, that sample being quite white, and yet containing only a comparatively minute quantity of arsenic, which on account of the siliceous character of the composition, is not acted upon by ordinary agents. The makers of the objectionable article are therefore all the less entitled to consideration. They must be well aware that they are introducing into cooking vessels, of even small dimensions, many fatal doses of arsenic, but they possibly are under the impression, through ignorance of the properties of the ingredients they are working with, that the arsenic is volatilised in the process of melting on the enamel.

The action of salt and other substances upon these objectionable varieties of enamel is not the only means by which poisonous matter may be introduced into food. It may also take place by the cracking and subsequent breaking off of the enamel, and it is not difficult to see that this might readily take place in such a way that the substance would be in a highly comminuted state, and consequently would escape observation.

It is undoubtedly very desirable to have iron cooking vessels enamelled, but if utensils thus prepared are not to be a source of injury to health, one of two ways must be followed:—Either the poisonous ingredients must be entirely left out of the compositions, or these must be of such a character that they will not be acted upon by ordinary ingredients in the circumstances under which the vessels will be subjected to use.

In a brief discussion which ensued: Dr. Clark, stated that several of the manufacturers of enamelled pots were experimenting with the view of producing an enamel perfectly free from lead and arsenic, and he had no doubt that if the attention of the public was called to the presence of poisonous substances in the enamel of pots, manufacturers would immediately alter the composition of their enamels, and keep out the hurtful ingredients.

Mr. Tatlock, stated, that he had purchased, within the last two days, two enamelled pots, one of which seemed free from objection and remained unaffected by a 1 per cent. solution of citric acid, while the other was acted upon to such an extent, that an enormous quantity of lead was dissolved out with ease.

CORRESPONDENCE.

BUTTER ANALYSIS.

TO THE EDITOR OF THE "ANALYST."

SIR,—I have no time to enter into a controversy on this subject, and even if I had, I think it is our duty not to squabble about small points of priority, but to work together in an amicable spirit, and finally to adopt whatever modification in the mode of estimating the fatty acids which may prove the most workable in our hands. The great point is the origination of the idea, and if Dr. Dupré will refer to the *Food Journal* for 1870, pages 586-7, he will there find that I was at that date engaged in studying the analysis of butter, and duly announced my process to be the estimation of amount of the fatty acids, which I stated would be found to be the only reliable method. This much in self defence, and the rest I leave to time and experience in the hands of my *confrères*.

Yours &c.,

JOHN MUTER.

WE have received from Mr. Sidney W. Rich a letter criticising our criticism of his "Analysts' Annual Note Book."

We should have been glad to have inserted Mr. Rich's letter if space had allowed of it. At the same time we beg to assure Mr. Rich that we had no intention of treating him unfairly, and do not think we are open to the charge of having done so.

It cannot, however, be disputed that a great part of his matter is taken, without acknowledgment, from the "Proceedings of the Society of Public Analysts." Whether from the bound volume or as they appeared weekly is not material.

ON THE COMPOSITION OF THE GASES EVOLVED IN WHITE LEAD STACKS DURING THE CORROSION OF METALLIC LEAD.

By G. W. WIGNER, F.C.S., & R. H. HARLAND, F.C.S.

Read before the Society of Public Analysts, at Glasgow, August 12th, 1876.

THE ordinary process of manufacturing white lead by what is called the Dutch method is familiar to all chemists, but, as far as we are aware, no investigation has ever been made into the composition of the gases contained in the stacks during the process of corrosion. Such an investigation is, nevertheless, important, because it is these gases which "corrode" the metallic lead, and form the white lead, and the presence of an unusual proportion of any gas may alter the composition of the compound produced.

In order to render the technical terms intelligible it may be necessary to call attention to the ordinary mode in which stacks are constructed. The stack is enclosed by four walls, generally approximating to a square, having one opening, called the door, from floor to roof. This opening is closed, as the stack is built, by boards fitting loosely together. The walls are sometimes lined as the stack is built by "margins" some six to twelve inch thick of tan, which are kept in place by loose fitting boards.

In "building" the stack a number of successive layers are added, which are somewhat as follows: First, three feet of tan; second, earthen pots filled with diluted crude acetic acid; third, the lead to be corroded, cast into "crates" or "plates," and stacked loosely to a thickness of perhaps nine inches; 4th, a flooring of boards supported either on large pots or on suitable wooden supports. This flooring is generally double, so as to prevent small pieces of tan from falling through the crevices between the boards. These four layers constitute what is called a "heat," and the stack itself is composed of eight to twelve of these "heats," each subsequent heat differing only from the first in having a much thinner bed of tan, say 1 foot instead of 3 feet. The top heat is covered over with a layer of spent tan, to retain the warmth.

When the stacks are built, the tan (which usually contains about half its weight of water,) from its necessary turning over and exposure to the air, has a comparatively low temperature, which, although it varies greatly, may probably be averaged at 100° F. When the stacks are finished and really at work the temperature will rise much higher, sometimes even to 180° F.

The proportion of actual acetic acid used is generally less than one per cent. of the metallic lead, and it is obvious that this cannot act to any sensible extent as a source of carbonic acid. This gas must, therefore, be produced almost, if not entirely, from the oxidation of the carbonaceous matter contained in the tan. The action of the acetic acid probably converts the lead into one of the sub-acetates, and the carbonic acid decomposes this salt, forming a carbonate of lead.

As it is clear that the tan has to produce the carbonic acid gas, we will consider the quantity of this gas necessary. In a stack 15 feet square, and consisting of ten heats, about 35 tons of lead would be stacked, and at a fair estimate, one-half of this would be corroded, (say 17½ tons.) This will produce about 22 tons of white lead. The proportion of carbonic acid present in this white lead, will vary in extreme cases from 10½ to 16 per cent., but the average may be assumed to be 12½ per cent. 22 tons = 49,280 lbs., 12½ per cent. of which is 6,160 lbs. of carbonic acid required, assuming that no waste takes place. This requires the combustion of 1,680 lbs. of carbon. The bulk of this carbonic

acid will be about 53,000 cubic feet, at a temperature of 60° F. The same bulk of oxygen, will, therefore, be required for the production of the carbonic acid, but as atmospheric air contains less than 21 per cent. of oxygen, and as we cannot reckon that, under ordinary circumstances, more than one-third of this can be brought into combination with carbon, at the temperature existing in the stacks, this 53,000 cubic feet will only represent 7 per cent. of the total atmospheric air requisite. The total quantity of air required will, therefore, be 757,000 cubic feet, even allowing for 7 per cent. of oxygen being utilized. This is, therefore, the minimum quantity needed, and the results of the analyses which we will give will show that this minimum is probably only a fraction of the quantity actually necessary.

Such a stack as we have described will probably take twelve weeks to work. Twelve weeks=120,960 minutes. The minimum quantity of air necessary is, therefore, only between 6 and 7 cubic feet per minute, or say the entire change of the air in the stack every six hours.

Even allowing that these figures represent, as is probably the case, only about one-fourth of the actual quantity of air passing into the stack, the fact, that under these circumstances, the air in the stack would only be changed once in about 1½ hours, and would, therefore, have an upward movement at the rate of about 3 inches per *minute*, will probably be sufficient to account for the smallness of the air passages through the flooring boards, which have been found sufficient in practice to pass air from one heat to another.

This explanation does not, however, seem to us sufficient to account for the imperfect mode in which air is at present admitted into the stack itself, namely, through the chinks in the boards forming the door. It appears obvious that all this air should enter through the bottom, *i.e.*, the thick stratum of tan, and thence after being partially heated, and carbonated pass upwards, receiving fresh supplies of carbonic acid at each heat. In practice however, there is equal facility for the entrance of air at each heat, and this air is not compelled to pass through any tan, (except the margins,) before it reaches the white lead, and its effect is consequently diminished. It seems clear that a due admission of atmospheric air below the bottom tan, combined with complete exclusion of in-currents at any higher point, would produce a more effectual and uniform corrosion than is at present obtained.

Having thus considered the general points in the process employed at the present time, we will pass to the actual results obtained in the analysis of a large number of samples of gases taken while the stacks were at work.

The mode in which these gases have been collected is as follows:—We have had an iron tube constructed for the purpose of driving or screwing through the door into the interior of the stack. This tube is about 6 feet long, made of 1 inch gas pipe turned smooth outside, at one end it is plugged by a pointed steel plug, drilled with a large number of holes about ⅓-inch in diameter, to admit the gas. At this end of the tube for a length of about 2 feet, a spiral of very thick iron wire, forming a screw of about 1 inch pitch is brazed on to the exterior of the tube; the other end is fitted with a double ended lever wrench, so as to enable the tube to be turned round. The mode of using this tube is as follows:—A hole about 1-inch in diameter is bored in the door, the point of the tube is inserted, and the lever wrench turned round, the screw immediately seizes on the wood, and the tube is forced forward into the stack, when the screw loses

its hold on the wood, it retains enough hold on the tan to force its way in, and there is seldom any difficulty in getting the tube five feet into the stack. If the point should come into contact with a "pot," the force is almost always sufficient either to dislodge or break the latter.

When the pipe is screwed in far enough, a registering thermometer is pushed in to the end, a small bent copper tube $\frac{1}{4}$ -in. diam. is then screwed on to the outer end of the iron tube, and the sample can then be taken.

We prefer to collect the gas in one of the collecting tubes, a description of which by G. W. Wigner appears in the "Proceedings of the Society of Public Analysts," page 97, as by that means we avoid the trouble of sealing glass tubes, and also enable the gas to be more readily transferred to the laboratory tube for analysis. One of the India-rubber tubes on this collecting tube is slipped securely on to the bent copper tube already mentioned, and the other end is connected to a small Tate's air-pump fitted on a stand, and air equal to about twenty times the capacity of the entire tubes is exhausted. The screw clamps are then closed, the collecting tube containing the air detached, and the registering thermometer withdrawn to ascertain the temperature.

The samples of air have all been analysed either by the McLeod apparatus, or by an improved form of it devised by Mr. Wigner. In every sample, determinations of carbonic acid and oxygen have been made, and in many cases carbonic oxide and acetic acid have been tested for.

As to the general characteristics of the samples, we may premise that we have analysed some hundreds of different specimens taken at all ages of and from many different positions in, the stacks, and we think we have therefore sufficient *data* on which to base a sound opinion.

All the samples were found to be saturated with vapour; this was of course to be expected from the presence of so much water in the tan, and diluted acetic acid. On drawing this moist air into the collecting tube condensation invariably took place, and we have tested this condensed water for acetic acid, but only one sample in the whole series has *shown* the least traces of it. We think that in this case the point of the iron tube had been forced into an acid pot, and a few drops of the liquor drawn over. It is therefore clear, that no sensible amount of acetic acid vapour can be discovered in the air of the stack. On another occasion we used an aspirator, and drew about two cubic feet of gas from a stack, in small bubbles through a wash bottle, but even in this way it was impossible to say that acetic acid vapour was present.

Nevertheless in some instances we have distinctly noticed the odour of acetic acid, as distinguished from the peculiar smell which the stacks always have.

It was thought possible that some of the carbonaceous matter might oxidise into carbonic oxide, instead of carbonic acid, and a considerable number of samples were tested for this gas, but only in one case was any found.

The sample in question was drawn from the second heat of a stack which had been thirteen weeks at work. The temperature had fallen very low, viz., to 106° , and the stack was consequently working very slowly. The proportion of carbonic oxide was 47 per cent. Other samples taken from the same place two or three days before, and two or three days later were tested, and did not show any carbonic oxide, and samples from other parts of the stack gave the same negative result. We cannot venture any opinion as to the cause of this exceptional sample, but can only say that we believe the analytical results to be correct.

The percentage of carbonic acid gas present was found to vary to an excessive extent. The maximum and minimum found in our analyses, being respectively 27·27 per cent., and "traces only."

These are beyond the ordinary variations, which usually range between ·50 and 4·50 per cent.

Up to the present time we have been unable to discover any rule governing *these* variations.

They are evidently not dependent in any way on the age of the stack, for we have had samples of 5 weeks old giving ·60 per cent. CO₂, 1·16 per cent. CO₂, and 1·76 per cent., respectively, and of 9 weeks old giving ·22 per cent., ·67 per cent., and 2·92 per cent., and of 13 weeks old giving "none," ·75 per cent., and 1·33 per cent. respectively. Neither does the proportion appear to bear any definite relation to the temperature, for we have had a temperature of about 150° associated with the entire absence of carbonic acid, and with the presence of 1·10 per cent. and 1·67 per cent. respectively, while with a low temperature of about 110°, we have had ·07 per cent., ·50 per cent., and 3·39 per cent. respectively.

The only approach to a rule appears to be, that when a stack is entirely worked off, *i.e.*, when the temperature has fallen to say 105°, and the production of white lead has virtually ceased, it is rare to find more than about half a per cent. of carbonic acid present.

It would certainly be an advantage to the workpeople employed, if this portion could be removed prior to stripping. Some experiments made with this object, by opening a large aperture at the bottom of the door, and removing the cover of tan at the top, have been attended with partial success, and if proper arrangements were made it appears as if such an arrangement would prove advantageous to the product, as well as beneficial to the health of the people employed.

The percentage of oxygen present in the samples is also very variable, but here, despite many discrepancies, there is some approach to a law governing the quantities found.

This rule appears to be as follows: At the time of stacking, the air included in the stack is of course atmospheric, which, considering the character of the factory, may probably be assumed to contain 20·7 per cent. of oxygen. As the stack starts work this proportion diminishes, and after two weeks will probably average about 17 per cent; after 5 or 6 weeks' more work the proportion will be lower still, the average being probably between 13 and 15 per cent, exceptional samples falling as low as 6½ per cent. This is unquestionably the period of greatest activity in the stack. After this the proportion greatly, but irregularly, increases, and at 11 weeks will average about 17 per cent. It still increases until the stack is practically worked off, when it will range from about 19·5 to 20·6 per cent.

From this fact we find that it is possible to deduce one certain rule, namely, if a stack has been some few weeks at work, and the temperature has fallen to say 110° or 115°, and the analysis shows 19·5 to 20·0 per cent. oxygen, with not more than ·75 per cent. carbonic acid, all work in the stack is practically finished, and it is better to strip it at once rather than wait, (even though the time is not up) for the comparatively trivial amount of corrosion which may be still going on.

We will now pass from the general view of the question and give some specific illustrations of the results obtained. A stack, which we will call No. 1, was sampled when it had been nine weeks at work, and the results were:—

	2nd Heat.	6th Heat.
Carbonic Acid ...	.00 per cent.	.22 per cent
Oxygen ...	14.92	17.05
Temperature ...	154°	156°

It was again sampled two weeks later, the spouts through which the air escaped at the top having been meanwhile partially closed. The results were:—

	2nd Heat.	6th Heat.
Carbonic Acid ...	.50 per cent.	.50 per cent.
Oxygen ...	17.46	17.46
Temperature ...	109°	109°

It will be observed that the temperature was 45° lower. The carbonic acid had increased, and the two samples, which previously differed greatly, were now identical in every respect. This last fact, we are inclined to think, indicates some slight displacement in the boards of the stack, so as to allow a more perfect circulation of the air from heat to heat.

No. 6 heat was sampled one week later. The results were:—

	6th Heat.
Carbonic acid ...	.95 per cent.
Oxygen ...	13.25
Temperature ...	152°

These figures are remarkably discordant from the previous results. They clearly show that the stack had "started work" again. Possibly this might be due to a sudden influx of fresh atmospheric air, due to the cause suggested above, but this is only a supposition.

In consequence of this anomalous result the stack was again sampled two days later at the same heat. The results were:—

	6th Heat
Carbonic acid ...	.17 per cent.
Oxygen ...	17.92

These results are fairly concordant with the results of last sample but one.

After 9 days more, *i.e.* 13 weeks and 4 days altogether, the results were:—

	No. 2 Heat.	No. 6 Heat.
Carbonic acid ...	.08 per cent.	Traces per cent.
Oxygen ...	19.45	16.13
Temperature ...	93°	120°

These last analyses clearly show that No. 2 heat had entirely stopped from useful work, but that No. 6 was still probably doing good work. The stack was allowed to stand three or four days longer and then stripped.

The produce of the stack was good in quality and quantity.

A stack which we will call No. 2, was furnished with two spouts for carrying off the gases. When the stack was built these spouts were covered. The gas was sampled after four weeks' work. The results were:—

	2nd Heat.	6th Heat.	7th Heat.
Carbonic acid ...	.97 per cent.	.81 per cent.	.60 per cent.
Oxygen ...	17.56	17.44	14.53
Temperature ...	110°		184°

The covers were then removed from the spouts, and after twelve days more the results were:—

	2nd Heat.	6th Heat.	7th Heat.
Carbonic acid ...	.67 per cent.	.88 per cent.	.56 per cent.
Oxygen ...	17.86	16.78	16.01

The stack worked eight days longer, say seven weeks in all, the results then were:—

	2nd Heat.	7th Heat.
Carbonic acid ...	.96 per cent.	.71 per cent.
Oxygen ...	18.49	13.60
Temperature ...	80°	166°

Some cause had evidently stopped the work of the lower heats. The temperature 80° and the high oxygen 18·49 per cent. clearly show this, while the upper heats were working vigorously. Yet the proper "time" of the stack was little more than half over.

A sample of No. 2 heat, twelve days later, *i.e.* nearly nine weeks from start, confirmed this result. It showed:—

Carbonic acid	...	...	...	...	2nd Heat.	Traces	per cent.
Oxygen	...	...	...	...	19·85	82°	
Temperature	...	...	...	...

This analysis proved that very little action was taking place, and the second heat was again analysed fourteen days later on, or nearly eleven weeks from start. The results were:—

Carbonic acid	...	..	...	...	2nd Heat.	·39	per cent.
Oxygen	...	...	...	...	17·89	112°	
Temperature	...	...	...	...

These figures clearly prove that this heat was at work again, and that the cause (which was probably due to an irregularity in the supply of air) which had produced the original stoppage had been removed. We were unable to sample this stack again, but when it was stripped the two bottom heats, which had given such anomalous results, gave *poor corrosions and inferior white lead*, while the upper heats were all extremely good.

These results certainly point to the desirability of some ready mode of adjusting the inlet of atmospheric air instead of allowing it to take its course through any chinks or crevices which may, and in fact are, produced by the irregular settlement of the stack.

Having given these two examples of the consecutive samples taken from a given stack, we will now give in a tabular form, the averaged results of about 100 analyses, arranged in order of the age of the stacks at the time the samples were taken.

These results are selected from the total number which we have obtained as being the most typical, or in other words as representing most nearly the maximum, minimum, and average results, obtained from stacks which were working in ordinary course, and not under any unusual conditions.

AVERAGE RESULTS.

Series.	Age in Days.	Carbonic Acid.	Oxygen.	Maximum and Minimum of Oxygen.	No. of Samples averaged.
1	1 to 10	·51	19·04	19·64 ... 18·73	3
2	11 ,, 20	1·64	17·60	20·22 ... 11·35	11
3	21 ,, 30	3·40	18·79	20·07 ... 16·36	7
4	31 ,, 40	·59	17·12	20·47 .. 12·64	4
5	41 ,, 50	4·29	13·01	20·61 ... 7·12	12
6	51 ,, 60	1·49	14·70	20·23 ... 6·57	9
7	61 ,, 70	1·10	15·55	19·77 ... 5·91	13
8	71 ,, 80	·65	15·74	20·03 ... 6·53	12
9	81 ,, 90	·76	17·49	20·24 ... 15·22	15
10	91 ,, 100	·46	19·13	20·57 ... 16·30	15

One other point appears worthy of consideration in connection with this subject. The results which we have given tend to show the necessity of properly regulating the admission of air to white lead stacks, and also confirms the old opinion that the temperature of the stack has a most important effect on the produce. The cooling effect of a considerable current of cold air, may under some circumstances, be so detrimental as

to more than counter-balance the good effected by the formation of carbonic acid, or in other words it may be desirable in some cases to heat the ingoing air. We are not at present prepared to enter at all fully into the discussion of this question, but we will merely point out a few of the facts.

We have already shown that in our ideal stack, at least 1680 lbs. of carbon must be consumed to produce the necessary carbonic acid. This carbon would in its combustion produce 24,450,000 units of heats, *i.e.*, raise 24,450,000 lbs. of water, 1° F. We have assumed that in round numbers 3,000,000 cubic feet of air, say 230,000 lb. must pass through the stack. The specific heat of air being .2374, and the increase of temperature necessary, being assumed to average 60° to 160°, we shall require 5,478,000 heat units to heat this air. The stack will contain, according to our estimate, 35 tons of lead, and perhaps 35 tons more of tan, pots and boards. At a fair estimate we cannot assume more than 500,000 units of heat for heating these.

We have now about 18,500,000 units available for the evaporation of the water in the tan, and in the diluted acetic acid, and for replacing the losses occurring by the escape of heat from the spouts, &c.

If these latter losses are reduced as they ought to be to a minimum, we certainly ought to have surplus heat enough to enable us when it is required to let more air pass through the stack and so increase the oxidizing action, and the corrosion. If air is admitted in this way, it is essential that it be done with discretion, and in such a manner as to avoid unduly lowering the temperature of the stack.

During these experiments we have upon several occasions analysed the air of the factory from which the samples were procured; three samples taken from the top of the tan, covering the top heat have shown the following results:—

	No. 1.	No. 2.	No. 3.
Carbonic acid ...	0.00 per cent.	.29 per cent.	.78 per cent.
Oxygen ...	19.83 "	19.59 "	18.25 "

Three more samples taken from the confined passages closely adjoining the mouths of the stacks showed.

	No. 1.	No. 2.	No. 3.
Carbonic acid ...	0.00 per cent.	0.00 per cent.	0.08 per cent.
Oxygen ...	20.46 "	20.35 "	20.18 "

These last three are probably typical of the worst air which the workpeople would be compelled to inhale. In conclusion we would point out that white lead makers may evidently gain much information from the periodical examination of the gas in the stacks, and that the careful collation, and examination of these results may enable improvements to be made in the process of white lead manufacture.

We have intentionally avoided any reference to the analyses of the white lead produced in these stacks, as this paper is already, we fear, too long.

In reply to Mr. Allen: Mr. Harland, stated that the carbonic oxide found in one particular sample was determined by absorption with solution of cuprous chloride, after the oxygen had been taken up by means of pyrogallate of soda. Mr. Wanklyn, suggested, that the carbonic oxide had been formed by the action of the pyrogallate of soda, as some researches tended to show that carbonic oxide was produced when oxygen was absorbed by this substance in the proportion in which it existed in atmospheric air.

Mr. Harland, replied, that about 100 samples of the air from different stacks had been tested for carbonic oxide, each in exactly the same way, and under similar conditions, and that the slightest trace of absorption by the cuprous chloride (if amounting to only .5 mm.), could be detected.

In every case, however, with the exception of the one instanced, the gas measured exactly the same, after cuprous chloride, as it did after treatment with pyrogallate of soda.

ON THE FRAUDULENT COLOURATION OF WINES.

By A. GAUTIER.

Bull. Soc. Chim., [2] xxv. 435-44; 483-498, and 530-538.*(Continued.)*

THE following Table (A) has been prepared, in order to show the action of re-agents upon the substances employed for the fraudulent colouration of wines, both when the substances in question were in a pure state, and when mixed with pure wines, in such proportion, that of the total intensity of the colour of each mixture, about one-fifth was due to the foreign colouring substance. In all cases, before commencing the tests, the samples were shaken for some minutes, with one-tenth their volume of white-of-egg, albumin; (which had been previously diluted with one-and-a-half times its bulk of water), and then filtered, whereby the filtrate was rendered comparatively richer in the adulterating substances, shown in Table A.

In order to make these reactions practically useful, much care has been given to the relative constancy and value of each, and as a result, a systematic method of research has been arranged and is shown in Table B.

Even with every precaution in the process of examination, cases may arise in which some uncertainty may exist. In such cases, further examination by other reactions must follow. The mention of one and the same substance may for that reason occur in various places in Table B.

PRELIMINARY PREPARATION OF THE SAMPLE.

The wine to be examined is mixed with one-tenth its volume of white-of-egg, previously diluted with one-and-a-half times its bulk of water, well shaken, and after standing for half-an-hour, filtered. If the wine is very poor in tannates, a few drops of a fresh aqueous solution of tannin should be added previous to the agitation with albumin.

The filtrate is treated with dilute sodium bicarbonate until its re-action is *very* feebly acid. All the re-actions of Table B, must be made on this liquid, except those for indigo, which are executed upon the albuminous precipitate.

TABLE B.

SYSTEMATIC PROCESS TO BE FOLLOWED FOR THE DETECTION OF THE NATURE OF FOREIGN COLOURING MATTERS ADDED TO WINES.

A. Having placed aside the filtrate from the albuminous precipitate, the precipitate is washed until the washings are almost colourless.

Two cases may present themselves :

(a). The precipitate after washing, remains wine-coloured, lilac, or maroon, *natural wine, or may be adulterated with the greater part of the substances usually employed.* Pass on to C.

(b). The precipitate is of a very deep wine colour, violet blue, or bluish, *wines from the deepest coloured grapes; or wines coloured with indigo.* Proceed to B.

B. The precipitate is washed with water, then with alcohol of 25 per cent., a part is then removed and boiled with alcohol of 85 per cent.

(a). The filtrate is *rose, or wine-coloured.* A portion of the precipitate is removed from the filter, suspended in water, and carefully saturated with dilute potassium carbonate. The colour changes to brown or blackish brown *natural wines, or may be adulterated with substances other than indigo.* Pass to C.

(b). The filtrate is *blue.* A portion of the precipitate suspended in water and treated with dilute potassium carbonate affords a deep blue liquid, which changes to yellow by an excess of the reagent. **Various preparations of indigo. INDIGO.**

TABLE A.

	A.	B.	C.	D.	E.	F.	G.	H.	K.	L.	M.	N.	O.	P.
Nature of the Liquid examined.	To 1 c.c. of the unclarified wine, add 3 to 5 c.c. of a 1-200 solution of sodium carbonate, according to the acidity and intensity of colour.	Heat the preceding to boiling.	To 2 c.c. of clarified wine add 1.5 to 2 c.c. of an 8 per cent. solution of sodium bicarbonate charged with carbonic acid. Examine the colour after 2 minutes.	To 2 c.c. of clarified wine add 3 c.c. of dilute ammonia (1 of ammonia to 10 of water); then dilute with 5 c.c. of water.	2 c.c. of clarified wine are treated with 2 c.c. of saturated baryta-water, and filtered after 15 minutes. Colour of the filtrate.	The filtrate E is acidulated with acetic acid.	To 2 c.c. of clarified wine add 3 to 4 c.c. of saturated solution of borax, depending upon the depth of the colour of the wine.	To 4 c.c. of clarified wine add 1 c.c. of a 10 per cent. solution of alum. and 1 c.c. of a 10 per cent. solution of sodium carbonate. Colour of the lake.	Colour of the filtrate from H.	To 2 c.c. of clarified wine add 1 c.c. of subacetate of lead, of 15° B. Shake. Filter. Colour of precipitate.	Colour of filtrate from L	To 1 c.c. of clarified wine add 1 c.c. of aluminium acetate of 2° B. Colour of liquid.	To 1 c.c. of clarified wine add 4 drops of potassium aluminate (obtained by adding alum to a solution of alumina in potash.) Filter the mixture.	To 0.1 gram of barium biniodide add 5 drops of a 5 per cent. solution of tartaric acid, and then 3 c.c. of clarified wine. Examine the colour 18 hours afterwards.
PURE WINE.	Colouration bluish-green; grey, slightly greenish, according to the wine. With aramon, lilac.	The liquid becomes yellow; has a tendency to become decolourised. Any trace of lilac present, disappears.	Deep gray, with a little green, or sometimes violet.	Greenish grey-blue or greenish grey, faintly lilac.	Dirty yellow, with a little green.	Liquid faintly roseate; in certain cases nearly colourless.	Liquid grey-blue or greenish; flax blossom; sometimes a trace or more of lilac.	Lake bluish green; or greenish.	Clear bottle-green, almost colourless with certain rare varieties.	Ashey blue-green, rarely apple-green, or yellowish green.	Decolourised.	Wine lilac. Aramon is nearly decolourised.	Lilac, faintly rose, tendency to de-colourise.	Liquid, scarcely rose-tinted; a trace (or none) of orange deposit in contact with the biniodide.
PURE BRAZIL WOOD.	Red currant.	"	Red currant.	Red currant.	"	"	Red currant.	"	"	Brown lilac.	If an excess of lead-salt is added and the fluid heated: Red currant.	Preserves its original colour.	"	"
Brazil wood, 1 part Wine 4 "	Brown-lilac, or brown tinged with maroon.	Wine colour.	Wine-lilac.	Lilac, soiled with grey, or maroon.	Red-brown.	Colour of onion-skin, or nearly colourless yellow.	Wine lilac.	Lilac lake, running into rose or brick-red.	Geey, with a little maroon.	Precipitate ashey-blue, tinged with yellow or brick-red.	Decolourised, or very slightly reddish.	Old-wine red, or roseate	Colour of onion-skin, or slightly rose.	Liquid yellow, without rose colour even in 10 hours. Large orange deposit in contact with the biniodide.
PURE LOGWOOD.	Red-purple, or, violet.	"	Rose wine-colour.	Violet lilac. The violet tends to disappear with an excess of reagent, and to return on heating.	"	"	Rose wine-colour.	Lake violet-blue.	"	Somewhat violet.	Colourless: or but slightly lilac.	Becomes violet-blue.	Precipitate-lilac or somewhat violet.	"
Logwood, 1 part Wine 4 "	Same colourations as pure wine.	Lilac, or wine violet.	Greenish deep grey	Greenish-grey.	Dirty greenish yellow.	Scarcely roseate.	Grey-blue (flax blossom) slightly tinged with maroon.	Lake bluish green tinged with violet, becoming more violet by drying in the air.	Clear bottle-green.	Blue, rather more violet than with wine only.	Decolourised, or but very slightly yellow.	Violet or lilac.	Rose, tinged with violet.	Like the preceding mixture.
PURE COCHINEAL.	Lilac.	"	Lilac.	Violet-lilac.	"	"	Lilac.	Lake, rose.	Liquid always rose, more or less deep.	Deep violet lilac.	Lilac, almost colourless.	Rose lilac.	Rose-lilac.	"
Cochineal, 1 part Wine 4 "	Grey flax-blossom, or grey with tinge of lilac.	The grey tinged with lilac is unchanged.	Grey, tinted with lilac or violet	Greenish-grey, or greenish-grey brown.	Dirty greenish-yellow.	Very distinctly rose.	Lilac, or bluish-grey, tinged with lilac.	Lake bluish, slightly roseate	Rose lilac.	Ashey-blue; clear green.	Decolourised.	Wine lilac.	Rose.	Liquid rose with tinge of orange-yellow in contact with biniodide.
PURE FUCHSINE.	Rose.	"	Rose.	Rose, decolourised by an excess of reagent.	"	"	Rose.	"	"	No precipitate.	Rose.	Rose.	Rose.	"
Fuchsine, 1 part Wine 4 "	Colour greenish-grey, sometimes with lilac tint.	The rose-lilac, or rose violet tint disappears.	Wine, lees roseate.	Greenish-grey, with or without tinge of rose.	Dirty yellowish green.	Distinctly rose.	Bluish-grey with lilac; sometimes the latter is very faint.	Lake bluish, or greenish slightly roseate.	Clear green.	Ashey blue; sometimes rose tinted.	Rose.	Lilac or rosy.	Rose.	Liquid scarcely rose tinted. Orange deposit in contact with biniodide.
PORTUGAL BERRIES, pure.	Violet-rose.	"	Violet-rose.	Violet-rose.	"	"	Violet-rose.	Lake, violet.	"	Violet maroon, slight; soluble in excess.	Decolourised if the lead salt is not in excess; otherwise yellow-red.	Violet rose.	"	"
Phytolacca, 1 part Wine 4 "	Dark violet, or lilac.	Yellow-grey with little maroon, which increases with the amount of Phytolacca.	True lilac.	Deep grey with a little maroon, or lilac.	Dirty greenish-yellow.	Distinctly rose.	Lilac, or grey-blue with little lilac.	Bluish-green; or greenish, slightly roseate with more phytolacca.	Lilac.	Ashey greenish-blue.	Decolourised, or only very faintly roseate.	Wine lilac, or distinctly lilac.	Bright rose.	Liquid distinctly rose: orange deposit in contact with biniodide.
HOLLYHOCK, pure.	Dark bottle-green.	Dark greenish-grey.	Bottle-green.	"	"	"	Colour of dark infusion of tea.	"	"	"	"	"	"	"
Hollyhock, 1 part Wine 4 "	Greenish, slightly blue, or greenish-grey.	Partially decolourised, slightly greenish-grey	Grey, with little green or blue.	Bottle-green, darkened with grey.	Dirty greenish-yellow	Scarcely roseate.	Greenish blue-grey.	"	"	"	"	"	"	"
BEETROOT, pure.	Rose, or yellowish red, which is persistent.	"	Rose or yellowish-red, which is persistent.	Yellow if the beet-juice was fermented; roseate if new.	"	"	Rose, or yellowish-red according to the age of the infusion.	"	"	"	"	"	"	"
Beetroot, 1 part Wine 4 "	Yellowish-grey, if the beet-juice was fermented: faint yellowish-red if fresh.	Tends to be decolourised if the beet-juice was old; yellowish-grey touched with red if fresh.	Reddish-yellow or lilac brown.	Dirty yellowish-grey, with a little maroon if the beet-juice was fresh and not fermented.	Clear yellowish.	Yellowish, or colour of onion skin, slightly rose.	Grey: a little brown-violet if the beet-juice was recent.	"	"	"	"	"	"	"
BLACK ELDER, pure	Violet-lilac changing to dark bluish grey, then to bluish-green.	"	Wine lilac.	Fine green.	"	"	Wine colour.	"	"	"	"	"	"	"
Black elder, 1 part Wine 4 "	Dark green with lilac tinge.	Dark greenish grey	Remains lilac for an instant, then rapidly changes to grey with greenish-blue.	Dirty greenish grey.	Dirty greenish-yellow.	Liquid is roseate.	Lilac; or greenish grey-blue, scarcely lilac.	"	"	"	"	"	"	"
DWARF ELDER, pure	Bottle green, darkened with grey.	"	Wine red.	Dark bottle-green.	"	"	Colour of port-wine.	"	"	"	"	"	"	"
Dwarf elder, 1 part Wine 4 "	Green with lilac tinge, or grey slightly green.	The green tends to disappear on heating.	Lilac with grey; or grey tinged with maroon.	Dark green with grey, possibly tinged with maroon.	Clear greenish-yellow.	Scarcely roseate.	Greenish grey-blue, tinged with lilac.	"	"	"	"	"	"	"
PRIVET, pure	Dark green.	"	Dark grey tinged with maroon.	Dark green.	"	"	Dirty reddish-rose.	"	"	"	"	"	"	"
Privet, 1 part Wine 4 "	Dark green, to greenish-grey.	Changes to dirty yellowish.	Greenish grey.	Bluish, greenish-blue, or greenish-grey, according to the variety of wine.	Yellowish, with a little green.	Scarcely roseate.	Greenish grey-blue, tinged with lilac.	"	"	"	"	"	"	"
WHORTLEBERRIES, pure	Wine color, more reagent changes it to grey-lilac, and grey tinged with lilac.	Becomes yellowish grey.	Remains lilac. An excess of the reagent rapidly changes it to grey, slightly red.	Maroon by transmitted light; grey bottle-green, by reflected light.	"	"	Dirty yellow, tinged with lilac.	"	"	"	"	"	"	"
Myrtle, 1 part Wine 4 "	Yellowish grey with a little lilac or rose.	Becomes deep grey.	Yellowish-grey, frequently with a little red.	Greenish-grey or yellowish-grey.	Greenish-yellow.	Faintly roseate.	Grey, with a little lilac.	"	"	"	"	"	"	"
INDIGO, pure	Blue.	"	Liquid blue, tending to become green.	Blue. Slowly decolourised.	Becomes green; then slowly decolourised.	"	Blue.	"	"	"	"	"	"	"
Indigo, 1 part Wine (not clarified) 4 "	Greenish, slightly blue	Tends to become yellow.	Bluish, or greenish blue.	Oak-leaf, green.	Dirty green grey.	Roseate.	Bluish-green.	"	"	"	"	"	"	"

NOTES TO TABLE A.

- Each wine re-acts in a slightly different manner, according to its variety, age, &c. This Table refers to wines of 5 to 15 months old, and particularly to the following:—Pinot, Carignane, Teinturier, Carbenet. Aramon gives special re-actions not shown here.
- The word *pure*, means *not mixed with wine*. The re-actions shown were obtained by acting upon solutions of the substances in water, containing 10 per cent. of alcohol, and were made of such strength that the colours corresponded in intensity with those of the wines being examined.
- Brazil wood, 1 part, wine 4 parts*, means that the intensity of the colour of the liquid examined, resulted from the mixture of the decoction of Brazil wood, and of wine in the proportions named. These proportions refer only to the intensity of the colouration, and represent but a very minute ponderable quantity of the adulterating substance.

C. Two c.c. of wine are treated with 6 to 8 c.c. of a 1-200th solution of sodium carbonate, which must be added in slight excess (1 c.c.) after the change of colour.

(a). The liquid becomes *lilac*, or *violet*, sometimes the liquid becomes only winey, or dashed with violet. *Brazil wood, cochineal, Portugal berries, fuchsine* *wines of certain sorts, fresh beetroot, logwood, both elders, whortleberries* (myrtle), *Portugal berries*. Pass to D.

(b). The liquid becomes bluish-green, sometimes with a faint lilac tint, *wine, hollyhock, privet whortleberries, logwood, Portugal berries, fuchsine*. Pass to M.

(c). The liquid becomes greenish-yellow without any blue or violet, *beetroot*, (old or fermented decoction), *whortleberries, certain rare varieties of wine*. Pass to L.

D. The liquid *C. a.* is heated to boiling.

(a). The liquid remains wine-violet, rose, or wine-lilac, or becomes a brighter lilac; *logwood, Brazil wood, cochineal, certain varieties of wine*. Pass to E.

(b). The colour disappears, or changes to a yellow, or maroon, or reddish tint, *wine, fuchsine, both elders; whortleberries, Portugal berries, fresh beetroot*. Pass to F.

E. Treat 4 c.c. of the wine with 2 c.c. of each of a 10 per cent. solution of alum, and a 10 per cent. solution of crystallised sodium carbonate. Filter.

(a). Clear yellowish-green lake (which may be bluish from mixtures of wines containing aramon), filtrate colourless, becoming very slightly yellow on warming; its own volume of aluminium acetate at 2° B almost wholly decolourises it. On acidification with acetic acid, after treatment with its own volume of barium-hydrate (saturated solution), the wine becomes clear greenish-yellow *aramon, pure or mixed*.

(b). Greenish-blue lake, or dirty yellowish-green, according to the varieties present, sometimes very slightly winey. Filtrate bright-rose, gradually decolourised on warming, though retaining a tinge of lilac; not decolourised by lime-water in the cold. COCHINEAL.

(c). Winey-violet lake, which darkens on exposure to the air. Filtrate bottle-green, or grey faintly red (if much logwood is present). The filtrate becomes green on warming. LOGWOOD.

(d). Lilac, or maroon-lilac lake. Filtrate greyish with tint of maroon. On boiling this filtrate becomes fine old wine coloured. BRAZIL WOOD.

F. Treat 4 c.c. of the wine with alum and sodium carbonate (as explained at *E*), add to the mixture two or three drops of very dilute sodium carbonate, and filter.

(a). The filtrate is lilac or winey, *Portugal-berries, fresh beetroot*. Pass to G.

(b). The filtrate is bottle-green, or reddish-green; *wine, fuchsine, black-elder, whortleberries, beetroot*. Pass to H.

G. Treat 2 c.c. of the wine with subacetate of lead solution of density 15° B. Shake. Filter.

(a). The filtrate is rose which persists even when made slightly alkaline; it slowly disappears on boiling. Lime water destroys the rose colour. PORTUGAL BERRIES.

(b). The filtrate is yellowish, or brownish-red. FRESH BEETROOT.

II. The alum-lake obtained from *F* (b) was:—

(a). Deep blue. On treating the clarified wine with a few drops of aluminium acetate solution, it becomes a decided violet, or wine violet. *Both elders*. Pass to I.

(b). Bluish-green, green, or faintly rose-tinted, *wine, whortleberries, beetroot, fuchsine*. Pass to J.

I. After the test *II* (a) treat a fresh quantity of 2 c.c. with 1.5 to 2 c.c. (according to its acidity and the depth of its colour) of an 8 per cent. solution of sodium bicarbonate charged with carbonic acid.

(a). The liquid remains lilac for a moment, then changes to greenish-grey blue. Another specimen treated with sodium carbonate (according to *C*), and heated to boiling becomes dark greenish-grey. BLACK ELDER.

(b). The liquid retains a lilac tint, or becomes grey with mixture of maroon, or dirty lilac. Another specimen treated with sodium carbonate (as at *O*) tends to discolour on heating, the green being replaced by red. DWARF ELDER.

J. Treat 5 c.c. of the clarified wine with a slight excess of ammonia, heat to boiling, and after cooling shake with 10 c.c. of ether, decant and evaporate the ether, and treat the residue left on evaporation with acetic acid.

(a). The liquid becomes red. *FUCHSINE*.

(b). The liquid does not become red; *wine, whortleberries, fresh beetroot*. Pass to *K*.

K. Another specimen is treated according to *C* with sodium carbonate.

(a). The colour darkens or becomes red on heating, *whortleberries, fresh beetroot*. Pass to *L*.

(b). The greenish or bluish-green liquid, possibly having a winey tinge, has a tendency to discolour on heating. *Natural wine*.

L. Treated with sodium bicarbonate according to the rules given at *I*.

(a). The liquid is deep grey, slightly greenish, green, sometimes green with very slight lilac tint.

The clarified wine, treated with an equal volume of saturated baryta-water, filters after standing for fifteen minutes, dirty yellow, or slightly greenish.

With an equal volume of aluminium acetate of 2° B, it gives a lilac wine colored filtrate.

With a few drops of aluminate of potash no change of colour. With sodium carbonate, employed as at *C*, the liquid tends to lose its colour on heating. With barium peroxide, used according to Table A, column P, the liquid is faintly rose tinted, with or without an orange coloured deposit on the barium peroxide. *NATURAL WINE*.

With the general characters above indicated, if with baryta-water it affords a madeira-coloured filtrate, changing to buff on acidulation with acetic acid; if with borax it becomes deep-green with bluish tinge; if with alum and sodium carbonate (as at *E*), a deep bottle-green with bluish tinge, precipitate falls, and if with aluminium acetate it remains rose-coloured with no change to violet-blue. *TEINTURINE*.

(b). The liquid is reddish-yellow or brown-lilac. By treatment with acetate of alumina the filtrate is clear lilac. With a few drops of aluminate of potash the colour becomes that of the skin of an onion, and with a larger quantity of the re-agent the colour is green, tinged with maroon. With sodium carbonate (employed as at *C*) the fluid passes to yellowish or greyish-yellow, with tinge of red. With barium peroxide, flesh-coloured liquid with considerable orange coloured deposit in contact with the peroxide. *BEETROOT, fermented or not*.

(c). The liquid is yellowish grey, with tinge of green or red. With baryta-water the filtrate is yellowish olive-green. With aluminium acetate the filtrate is bluish violet, or violet-lilac. With aluminate of potash, fresh rose, becoming yellowish-green, with an excess of re-agent. With sodium carbonate (as at *C*) the fluid becomes deep grey on heating. With barium peroxide the fluid is bleached, or remains but very slightly roseate, with a trace of orange deposit in contact with the peroxide. *WHORTLEBERRIES*.

M. The mixture of wine and alkaline carbonate (*C*) (*b*) is heated to boiling.

(a). The mixture becomes lilac-violet, or violet. *Logwood*.

(b). The mixture tends to become decolourised, or changes to yellowish green, or dark green, or maroon-green; *natural wines, whortleberries, both elders, privet, Portugal-berries, fuchsine*. Pass to *N*.

N. Treat the wine with alum, and sodium carbonate, as directed at (*E*) and filter.

(a). The colour of the filtrate is lilac. *Portugal-berries*.

(b). The filtrate changes to bottle-green, or reddish-green. *Natural wines, whortleberries, hollyhock, privet, both elders, fuchsine*. Pass to *O*.

O. Treat 2 c.c. of the clarified wine with 3 or 4 c.c. of a saturated solution of borax, according to the intensity of the colour of the wine.

(a). The liquid remains wine-lilac, or with some violet tinge. Both *elders, privet, Whortleberries*. Pass to *P*.

(b). The fluid becomes bluish-grey-flax-blossom, greenish or bluish-grey with very faint trace of lilac. *Pure wine, whortleberries, hollyhock, fuchsine*. Pass to *R*.

P. Treat a new portion of wine with sodium bi-carbonate, (as directed at *I*.)

(a). The tint, at first lilac, changes afterwards to grey, slightly brownish, or to maroon. If a new portion be treated with sodium carbonate, according to (*C*) and then heated to boiling, it becomes clearer, and loses its green tint.

The lake obtained according to (*E*) is deep blue-green. DWARF ELDER.

(*b*). The specimen remains grey, tinged with green, bottle green, or yellowish. Sometimes (black elder) it acquires a lilac tint, which almost immediately disappears, changing to a greenish-grey-blue *whortleberries*, *black elder*, *privet*. Pass to *Q*.

Q. Treat a specimen of the wine with alum and carbonate of soda (as directed at *E*). Shake the mixture, and after a few moments throw it on a filter.

(*a*). The lake remaining on the filter is deep green-blue; the filtrate is clear bottle-green. A sample treated with sodium carbonate (as at *C*) darkens and becomes grey, slightly greenish, on heating to boiling. BLACK ELDER.

(*b*). The lake is clear bluish or greenish. The filtrate is clear bottle-green. A sample treated with sodium carbonate (as at *C*), and heated to boiling, changes to dirty yellowish. PRIVET.

(*c*). The lake is ash-green faintly rose tinted. The filtrate is bottle-green, with tint of maroon. A sample treated with sodium carbonate (according to *C*) becomes deep grey on being heated to boiling. WHORTLEBERRIES.

R. Treat a specimen of the wine with ammonia and ether as directed at *J*.

(*a*). The ether being decanted and evaporated, the fluid residue becomes rose-coloured on treatment with acetic acid. FUCHSINE.

(*b*). The liquid left after the evaporation of the ether, does not become red on acidification with acetic acid, *natural wines*, *hollyhock*, *whortleberries*. Pass to *S*.

S. A sample is treated with its own bulk of a solution of aluminium acetate of 2° B.

(*a*). The colour of mixture remains winey, *natural wines*, *whortleberries*, differentiate between them, as directed at (*L a*), and (*L c*).

(*b*). The colour of the mixture becomes violet-blue, *hollyhock*, *whortleberries*. Pass to *T*.

T. A specimen is treated with alum, and sodium carbonate (as at *E*), and after a few moments filtered.

(*a*). The lake is clear green, slightly bluish, and rose tinted, filtrate is bottle green, with little maroon. With borax, (as at *O*), particularly if the sample has been concentrated, the liquid is grey with trace of lilac. Two c.c. of the liquid treated with 3 c.c. of dilute ammonia, (1 vol. of liq. ammonia with 10 vols. of water), and the mixture diluted with its own bulk of water, gives a liquid which is yellowish-grey, greenish or greenish-grey. The other characteristics (as at *L*). WHORTLEBERRIES.

(*b*). The lake is green, slightly bluish, quite free from rose, filtrate clear bottle-green. With borax the liquid is greenish blue-grey. With ammonia (as above), dark bottle-green. With aluminium acetate, (as at *S*), bluish-violet colouration. HOLLYHOCK.

Although somewhat difficult, this systematic method serves for the discovery of several colouring matters mixed in one wine, if the indications of Tables *A*, and *B*, are carefully observed, and followed. It is always desirable to determine the presence of Fuchsine, by the special re-actions given further on. By means of Table *B*, the presence of one or several of the colouring matters may be detected, but before deciding, it is as well to verify by repeating, for the substances so found the re-actions of Table *A*, on the sample; and also the more special characteristics given further on, for the identification of those substances.

SPECIAL RE-ACTIONS FOR THE DETECTION OF CERTAIN OF THE COLOURING MATTERS
MIXED WITH WINES.

Brazil Wood.—Even a very strong clarification (two or three times more albumin than mentioned at the head of Table *B*), does not wholly decolourise the adulterated

wine. It becomes yellow-buff, which on exposure to the air, gradually changes to red. If a wine that has been adulterated with Brazil wood is clarified, and then a skein of scoured silk, washed with dilute tartaric acid, be soaked in it for twenty-four hours, and then withdrawn, washed and dried at 60° to 70°, the silk will be found to be dyed lilac-maroon, or red. In pure wine, the skein remains wine-coloured or lilac.

If the dyed silk be now dipped into dilute ammonia, and heated to 100° for a moment, it becomes lilac-red, if Brazil wood was present; but deep grey with scarcely a tinge of its original colour if the wine were pure. If the ammonia be replaced by lime-water, the skein changes to ash-grey if Brazil wood were present; but to a dark, dirty-yellowish-red, if the wine were pure. Finally, if the skein be dipped into aluminium acetate, and then heated to 100°, it retains its wine-red lilac colour. This re-action differentiates Brazil wood from Logwood.

Logwood.—If the colour due to Logwood is in excess in the wine, ammonia gives it a shade of violet; if the proportion of Logwood is small, the re-actions *B*, *L*, *N*, of Table *A*, which are very delicate, should be tried.

Treated with a skein of silk, prepared in the manner described for Brazil wood, it becomes dyed lilac-red, or maroon, which dilute ammonia changes to violet-blue tinged with grey, and which by acetate of aluminium becomes bluish-violet.

Cochineal.—The lilac, or roseate tints due to the re-actions *A*, *B*, *H*, *K*, of Table *A*, are very sensitive, the last being very characteristic; the only substance likely to be confounded with it, being the phytolacca, (Portugal berries), which is differentiated by the re-action *B*. of the same Table.

A skein of scoured silk, mordanted with aluminium acetate, soaked in the clarified wine for 20 hours is dyed of a wine violet colour, analogous to that of pure wine, on being dried at 100°. The colour does not change, even at 100°, by cupric acetate (exclusion of fuchsine), but if the skein be dipped into a dilute solution of zinc chloride, heated to 100°, and then wetted with sodium carbonate, washed with water and dried, the colour becomes fine purple, whereas with pure wine, the tint would remain sombre grey-lilac.

Cochineal may be discovered by the spectroscope if present in large quantity, but if it amounts to only about 12 per cent. of the total colouration, it cannot be so detected. It rapidly separates from wines, being precipitated in the lees.

Fuchsine.—This should be sought for in all wines found to be adulterated with other substances. The re-action *J*. of Table *B*, is very sensitive. Great care must be taken to avoid loss of rosaniline from imperfect decomposition of its salts in solution, moreover, arsenic should always be sought for where the wine is found to contain any aniline. Fuchsine rapidly separates from the wines to which it has been added. A skein of silk becomes dyed rose by soaking in a wine adulterated with fuchsine and its colour passes to yellow on treatment with hydrochloric acid, but to bright red, if the wine was pure. The dyed skein treated with dilute cupric acetate, and dried at 100° becomes fine deep rose-violet if fuchsine is present, and of a lilac tinged with ash-grey if the wine is pure. This re-action is very sensitive.

Phytolacca.—(Portugal berries). The rose or lilac colourations of the re-actions *A*, *G*, and especially *C* of Table *A* are very sensitive.

Hollyhock.—(*Althea rosea*), much used. This substance imparts a peculiar flavour which in a few months becomes actually disagreeable, while the colouring matter itself rapidly precipitates.

Beetroot.—This is generally employed only to mask other adulterants. The lilac tint of re-action C of Table A, if the beetroot is fresh, and the yellowish colours due to alkalis, (re-actions D, E, and F, of Table A.) are very sensitive even with old decoctions.

Black Elder, Dwarf Elder.—The dwarf elder imparts a faintly turpentine odour to the wines. The berries of both varieties are particularly used to communicate a special colour and flavour to port wine. The *teinte de Fismes*, which is largely used at Fismes, Paris, and elsewhere, is made by digesting 250 to 500 parts of elder berries, and 30 to 60 parts of alum, with 800 to 600 parts of water, and then submitting the mixture to pressure. M. Maumené reports having discovered as much as 4 to 7 grammes of alum per litre in wines adulterated with this substance. Sometimes (though rarely) the alum is replaced by tartaric acid. Wines adulterated with elder, yield a violet-blue lake (reaction H, table A). By comparison with pure wine the difference is very marked.

A piece of flannel, or skein of silk, mordanted with aluminium acetate, heated for some time in the suspected wine, then washed, and immersed in water made faintly alkaline with ammonia, becomes green if the wine is pure, but dark brown if black elder is present. Probably the same reaction occurs with dwarf elder.

Privet.—This is very seldom used. The general reactions, particularly N and P of Table A, must be relied on.

Myrtille, (Whortleberries).—Very seldom used, and only for the commonest wines. The principal characteristics are given in L (c), Table B. In wines suspected to be adulterated with this substance, citric acid should be sought for, its presence being one of the best indications of the adulteration.

Indigo. The re-actions A (b) and B (b) of Table B, are so sensitive that they are alone sufficient to characterise indigo. Wool or silk mordanted with aluminium acetate, heated with 20-40 c.c. of the suspected wine nearly to dryness, washed and then dipped into very dilute ammonia become dirty green if the wine be pure, but blue if indigo be present.

Indigo being often used to mask the too bright colours of cochineal and fuchsine, they should always be sought for after the removal of the indigo by clarification with albumin.

Indigo very rapidly separates from wines, and it may frequently be found in the lees, even when the wine itself gives no indication of its presence.

Substances other than those mentioned are occasionally employed for the adulteration of wines; among them are archil residues, sulpho-purpuric, and sulpho-alizaric acids, and their salts, but these have only recently been introduced, and are not yet seriously employed. Except in such cases as indigo and cochineal, it is only upon a series of concordant re-actions that the presence of an artificial colouring matter should be affirmed.

PROSECUTIONS UNDER THE SALE OF FOOD AND DRUGS' ACT.

Mr. G. R. Toogood, grocer, was charged before the Stockton Borough Bench, with selling adulterated oatmeal. The case was before the Bench on a previous occasion, when it was stated that two samples of the oatmeal had been analysed by Messrs. Stead and Pattinson, of Newcastle, and found to contain $1\frac{1}{2}$ and 1 per cent. of barley only respectively. Mr. Edger, of Newcastle, had analysed it, and showed that there was 25 per cent. of barley in it. The samples had been sent to Somerset House for analysis, and it was certified that they contained 15 per cent. of barley, and 4 per cent. respectively. The Bench fined defendant 2*l.*, including costs.—Messrs. W. Webster and F. Heaton were also charged with largely adulterating oatmeal, and were fined 3*l.*, including costs.—Mr. A. Holmes was also charged with the same offence, and was fined 1*l.*, including costs.—The Co-operative Society were also charged with adulterating oatmeal with 25 per cent. of barley, and fined 1*l.* including costs.—Messrs. W. Jackson and Geo. Brown were also charged with selling oatmeal adulterated with 20 per cent. of barley, and were fined 1*l.*, including costs.

Mr. John Hopley, provision merchant, of 340, Deansgate, appeared at the City Police-Court, Manchester, charged with having sold a quantity of lard which was not of the nature, substance, and quality of the article demanded by the purchaser. Mr. Talbot said the lard was bought by Mr. Rook from the defendant, and on being analysed it was found to be adulterated with 15 per cent. of water. There had been several cases under the 6th section of the Act, principally for the adulteration of milk. Convictions had been obtained, but a point had been raised, which caused the justices to defer the present case until the return of the stipendiary magistrate. By the 25th section of the Act, it was enacted that if the defendant has a written warranty he shall be discharged from the prosecution. Mr. Cobbett would say that he had a written invoice in which the article was described as lard, and that such description being in writing would amount to a warranty under the statute. Careful reading of the Act, and subsequent reflection, led him (Mr. Talbot) to the conclusion that the Act intended there should be something more than a mere invoice; it required that there should be a guarantee in writing, distinctly setting forth the quality and description of the article in order to avoid conviction under the 25th section. The warranty of an invoice was of the very slightest character, and it ought to be more specific in order to come within the meaning of the section. If the magistrate ruled in favour of the defendant, the mere production of an invoice would render the Act a dead letter, which was a very undesirable state of things, as most business was carried on by means of invoices, and in every case the defendant could procure one very easily. In order to satisfy the Bench something more than a mere piece of paper with "lard" written upon it must be produced by the defendant. Mr. Estcourt, the city analyst, stated that on being analysed, the lard was found to be adulterated with 15 per cent. of water. There was no water naturally present in lard. Mr. Cobbett, in reply, said the defendant obtained his lard, butter, &c., from a Mr. Wm. Walker, who was a cheese factor and provision merchant in Liverpool. On July 3rd, the defendant bought from Mr. Walker, in Liverpool, amongst other things, four tins of lard for £2 15*s.* He received with them an invoice, on which was stated, "Bought from Wm. Walker, four tins of lard, &c." He asked Mr. Walker if the lard was pure, and he replied that it was. The lard was conveyed to Hopley's shop in Manchester, and was never touched after its arrival, until the purchase of a portion by Superintendent Rook. Upon those facts he (Mr. Cobbett) proposed to ask the Bench to dismiss the summons, and he did so upon these grounds: the section of the Act said "the article demanded by the purchaser." Mr. Rook asked for lard, and the defendant gave him what was to his belief lard, but which turned out to be lard and water. That, however, showed no guilty knowledge on the part of the defendant, but was rather a ground for proceedings against the vendor, Mr. Walker. The only material question was as to whether the invoice was such a warranty as was mentioned in the section. All the good authorities showed that no particular form of words was necessary for a written warranty; and though it might be said that there was no proof that the invoice had ever been seen by Mr. Walker, it had been decided that his name written or stamped on the bill-head was sufficient proof of his knowledge of its existence. The defendant was called, and bore out by his evidence Mr. Cobbett's statement. The case was adjourned.—Mr. Joseph Nuttall, provision dealer, of 213, Deansgate, was also summoned for having sold to Mr. Rook, lard adulterated with water to the extent of 15 per cent. The defendant said he bought the lard from a wholesale dealer, but he could not at the moment lay his hand on the invoice. If the case were adjourned, he would produce it. This case was also postponed for a fortnight.—Mr. Samuel Gouldburn, 141, Ridgway Street, was charged with having sold to Mr. Rook, superintendent of nuisances, milk which was "not of the nature, substance, and quality of the article demanded by him," was fined 5*l.* and costs. The milk was adulterated with water to the extent of 9 per cent.—Mr. Edward Hayes, was fined 40*s.* and costs, for having on August 15th, sold a certain article of food, to wit, mustard, which was adulterated by the addition of 15 per cent. of starchy matter.—Mr. Charles Bostock and Mr. David Sewelson, were each fined 40*s.* and costs, for selling mustard which was not of the nature, substance, and quality of the article demanded. In the case of Mr. Bostock, the mustard was adulterated by the addition of starchy matter to the extent of 15 per cent., and in the case of Mr. Sewelson, the adulteration exceeded 25 per cent.

THE ANALYST.

"THE ANALYST," AND MR. J. ALFRED WANKLYN.

It will probably be noticed by our readers, that the name of Mr. J. A. Wanklyn, which has hitherto appeared as a member of the "Committee of Publication," of this journal does not appear on the cover of the present number.

It is with extreme reluctance that we feel compelled to explain the reason for the absence of Mr. Wanklyn's name, but that gentleman has left us no alternative.

In our issue of the 31st August, we felt it our duty to comment on a certain case of prosecution for the sale of adulterated butter in Scotland.

One of the chemists engaged in the case chose to feel affronted by our strictures, and instead of writing to us direct, addressed a letter to a Glasgow paper, in which he attacked *The Analyst*, in no measured terms.

A copy of the paper containing this letter was sent to us, and on September 30th we made a short reply to the writer, (Mr. Dittmar.)

Meantime, on September 12th, a meeting of "The Society of Public Analysts," was held at Glasgow, when the matter was mentioned, and Mr. J. A. Wanklyn, suggested the passing of a vote of censure on himself, and his colleagues on the "Committee of Publication."

The absurdity of this proposition was apparent to everybody, except Mr. Wanklyn, and consequently, it found no seconder.

The incident, so far as Mr. Dittmar was concerned, terminated by a decision being arrived at, to leave the matter in Mr. Wanklyn's hands, on the understanding that he (as he happened to be Chairman at the meeting), would see that some notice was inserted in *The Analyst*, with a view of soothing the feelings of the chemist, who fancied himself aggrieved.

A meeting of the "Committee of Publication" was held shortly afterwards, and Mr. Wanklyn was summoned in ordinary course; he, nevertheless, omitted to attend, and has not in any way communicated with *The Analyst* on the subject he was deputed to attend to.

Mr. Wanklyn, however, has not been idle. He has considered it consistent with his position as a member of a Committee, openly to attack his colleagues in the columns of a contemporary paper.

To show that we do Mr. Wanklyn no injustice, we reprint a letter bearing his signature, which appeared in the *Chemical News*, of the 6th inst.

We also print a letter addressed by the Editor of this paper to the *Chemical News*, to which letter, however, the *Chemical News*, has thought fit to refuse insertion.

In that journal of the 13th inst., Dr. Muter vindicated his own position against Mr. Wanklyn's charge, and in the same paper, on October 20th, Dr. Dupré, and Mr. Heisch (in a letter bearing date, October 9th), indignantly repudiated Mr. Wanklyn's imputation, that though members of the "Publication Committee," two other gentlemen were "alone responsible for the contents of the paper."

We think that this short explanation, taken in connection with the letters we print below, will be considered a sufficient justification for the omission from the list of the "Committee of Publication," of the name of Mr. J. Alfred Wanklyn.

COPY.]

TO THE EDITOR OF THE "CHEMICAL NEWS."

SIR,—The subject of the recent attack on Professor Dittmar was brought before the notice of the Glasgow Meeting of the Public Analysts, and the attack was condemned by those present at the meeting. So decided was the expression of condemnation that a vote of censure on the Committee of Publication was even mentioned; but in place of so extreme a course (which, in my opinion, ought to have been followed) an *indirect* vote of censure was carried, the resolution being to the effect that before commentaries on adulteration-cases are inserted in *The Analyst* the chemists implicated should be communicated with.

I observe that the current number of *The Analyst* purports to give an account of the Glasgow Meeting of the Society, but does not in any way record the resolution passed at that meeting. I observe also an editorial commentary on Mr. Dittmar which is in direct opposition to the resolution passed by the meeting; and I take this opportunity of making known that the Society of Public Analysts have no real control over *The Analyst*, which is the property of Mr. Wigner and Dr. Muter, who alone are responsible for the contents of the paper.

I am, &c.,

J. ALFRED WANKLYN.

October 2, 1876.

COPY.]

TO THE EDITOR OF THE "CHEMICAL NEWS."

SIR,—Had Mr. Wanklyn paused to make a few enquiries before writing to you, he would not, I am sure, have dragged my name into this discussion, because he would have found that at the time *The Analyst* published the article and report which originally gave him offence, I was enjoying a ramble in Switzerland, and I can safely say never wasting a thought either on butter or Mr. Dittmar. In fact Mr. Wanklyn and myself have precisely the same amount of responsibility for the contents of *The Analyst* for September, viz., that we were both members of the Committee of Publication, and that we each of us neglected our obligations as such, and stayed away from the meeting, and therefore we ought to be the last to throw stones at those who did their duty by attending.

My position as one of the "registered proprietors" of the paper was simply taken to get the Society out of the difficulty that, not being corporate, they could not legally hold a copyright, and I will have much pleasure in handing over the position (involving, as it does, pecuniary responsibility) to any other member who may be public spirited enough to accept it. I trust Mr. Wanklyn will withdraw his remarks so far as I am personally concerned.

I am, &c.,

JOHN MUTER.

October 7th, 1876.

COPY.]

TO THE EDITOR OF THE "CHEMICAL NEWS."

SIR.—I have to ask for space in your columns to reply to a letter which appears over the signature of Mr. J. Alfred Wanklyn, in your issue of the 6th instant.

Mr. Wanklyn is pleased to speak of the "recent attack" made on Mr. Dittmar in *The Analyst*, which "attack," he says, was condemned by a recent meeting at Glasgow; further, that a vote of censure on the "Committee of Publication" was suggested, and, in Mr. Wanklyn's opinion, ought to have been passed.

The suggestion in question was made by Mr. Wanklyn, himself a member of the Committee he wished to censure, but it met with no support and fell to the ground.

Mr. Wanklyn complains that a certain resolution, which he states was passed, is not given in *The Analyst* report.

It need hardly be pointed out, that an ordinary report of a meeting does not, necessarily, include a copy of the actual minutes. For such information I beg to refer Mr. Wanklyn to the minute book of "The Society of Public Analysts."

To Mr. Wanklyn's assertion that a note in the last number of *The Analyst*, "is in direct opposition to the resolution passed at the meeting," I have to give an unqualified and emphatic denial.

Anybody capable of understanding plain English who reads the resolution, as quoted by Mr. Wanklyn, side by side with the article in *The Analyst*, commenting on Dr. Dittmar's published explanation, will, at once, see that the only "direct opposition" is that evidenced by the animus of Mr. Wanklyn's letter.

The concluding paragraph contains a statement which is so untrue and so clearly intended to be offensive, that it is my duty to contradict it absolutely.

Mr. Wanklyn says:—"The Society of Public Analysts has no real control over the Analyst," but that two individuals, whose names he gives, "alone are responsible for the contents of the paper."

This assertion is clear enough.

The answer shall be none the less unmistakeable.

A "Committee of Publication," consisting of six members of the council of "The Society of Public Analysts," has, from the first, been responsible for the contents of *The Analyst*, meetings of such committee have been held periodically, and I am in the position to affirm that in no case has any matter appeared in *The Analyst* which has not been previously submitted to, and approved by, the Committee.

If, when the article to which Mr. Wanklyn objects, was agreed to, Mr. Wanklyn was not there, it was, presumably, his own fault.

If he attended and voted against its insertion, and was in a minority, he should—as minorities always have to do—submit gracefully to the majority.

In any case, it would be well if, in future, Mr. Wanklyn would satisfy himself of the accuracy of his statements, before he allows them to appear in print.

Yours, &c.,

THE EDITOR OF "THE ANALYST."

October 9, 1876.

COPY.]

TO THE EDITOR OF THE "CHEMICAL NEWS."

SIR,—Referring to a letter which appears in your last number, signed by Mr. Wanklyn, we ask your permission to make a short statement, as follows:—

We beg to say that we are members of the "Committee of Publication" of *The Analyst*; that we consider we have devoted a fair amount of attention to our duties, that we have no wish to shirk our responsibility for anything that has appeared in *The Analyst*; and consequently, we are in a position to deny, as we hereby emphatically do, Mr. Wanklyn's assertion, that two other members of the "Committee of Publication" alone are responsible for the contents of the paper.

Whatever may be Mr. Wanklyn's view of the duty of any one holding office, we, for ourselves, can say that unless we felt ourselves both able and willing to perform our share of the duties of the Publication Committee of *The Analyst*, we would certainly not allow our names to be published as members of that Committee.

Yours, &c.,

CHAS. HEISCH,
A. DUPRÉ.

LONDON, Oct. 9th, 1876.

ON THE SOLUTION OF DIFFICULTLY-SOLUBLE SUBSTANCES.

*By ALFRED H. ALLEN, F.C.S.

SOME years ago, in a letter to the *Chemical News*, (Vol. XXII., p. 57), I described a mode of effecting the solution of difficultly-soluble iron ores and slags, by heating them with strong hydrochloric acid in sealed tubes, and experience having shown the method to be extremely valuable in certain cases, I have thought it worth while to bring my results before the Society in the form of a paper.

In the analysis of minerals and metallurgical products containing iron, it is often necessary to determine whether that metal exists as a ferrous or a ferric compound. Of course, this is easy, provided the substance is readily decomposed by acids, but in the case of insoluble or difficultly-soluble minerals and slags, the problem is by no means easy of solution. Protracted boiling with acid is often very inconvenient, and sometimes useless; while any process of fusion almost necessarily involves more or less oxidation of ferrous compounds.

Mr. C. E. Avery (*Chemical News*, Vol. XIX., p. 270), has proposed to decompose silicates with a mixture of a fluoride and a mineral acid, and the same method in a somewhat modified form has been described by Messrs. Wilbur & Whittlesey (*Chemical News*, Vol. XXII., p. 2). These processes have a certain value of their own, but the use of fluorine compounds is not always convenient, though of course in some cases indispensable.

It might be anticipated that acids acting under pressure in sealed tubes would effect the decomposition of many refractory minerals, which resist ordinary methods of treatment, and this view is fully borne out by experience. This mode of treatment has the great advantage that it can be continued for any desired length of time, or discontinued and recommenced at will, and that the subsequent steps of the analysis can be performed after any interval of time most convenient to the operator.

The method of procedure I have been in the habit of adopting is simply as follows: A gramme of the finely powdered mineral or slag is placed in a piece of combustion tube carefully sealed at one end. From 20 to 30 c.c. of pure fuming hydrochloric acid are poured in, and the other end of the tube drawn out and carefully sealed in the blowpipe flame. The tube when sealed, should be about eight or ten inches in length. The proportion of acid used is such as to ensure a large excess; this prevents undue weakening by saturation of the acid, and has other obvious advantages.

*Read at a Meeting of "The Society of Public Analysts," at Glasgow, Sept. 12, 1876.

The tube is now ready for heating. In many cases, the mere heat of a water-bath is amply sufficient to ensure perfect decomposition. As fuming acid is employed, there is always considerably more than one atmosphere of pressure even at 100° C., but decomposition is in many cases greatly facilitated by use of a higher temperature. A very convenient bath for the purpose is formed by a saturated solution of nitrate of sodium, which boils at 120° C. In some cases, it is desirable to obtain a still higher temperature, in which case chloride of calcium can be conveniently employed. In all cases, however, I prefer to subject the tube to a temperature not exceeding 100° C. first of all. This enables the sealing to be tested, and perhaps causes some reduction of the internal pressure, owing to partial neutralization of the acid. In many cases the temperature of 100° C., is amply sufficient to effect perfect decomposition of the sample.

This is true of blast-furnace slag, all the varieties of which are readily decomposed at 100° C. In fact, blast-furnace slag rarely requires a sealed tube at all. The slag now obtained in England from the manufacture of spiegeleisen, contains from 30 to 40 per cent. of oxide of manganese, and is decomposed with such facility that if it be added in a powdered state to hot hydrochloric acid, the mixture will be converted, almost instantly, into a transparent jelly.

“Tap-cinder” and Bessemer-converter slag are far more refractory, and require somewhat prolonged treatment at an elevated temperature.

Basalt is readily and completely decomposed when heated with fuming hydrochloric acid in a sealed tube.

Titanic iron sand, if finely powdered, suffers perfect decomposition under the same treatment.

“Ore-furnace slag” from copper-smelting, is decomposed with difficulty.

Finely powdered burnt red brick, gives up some iron to the acid, but is very imperfectly decomposed.

Chrome-iron ore suffers very little change.

Tin-stone is partially dissolved, but I have not succeeded in effecting perfect solution.

A blank experiment showed that the acid had no sensible effect on the glass of the tube, even when heated in it to about 169° C. for five hours.

In all cases it is exceedingly easy to watch the progress of the decomposition. When complete, the tube can be left alone till it is convenient to proceed with the analysis. For the determination of the ferrous oxide, it is only necessary to open the tube, wash the contents into a basin, and titrate at once with standard bichromate.

The silica rarely separates in a gelatinous state.

It has been proposed to employ a mixture of three parts by weight of concentrated sulphuric acid, and one of water, for a similar purpose. Experiment shows that this is by no means a satisfactory modification, at least for the treatment of ferruginous silicates and similar materials, the sulphate of iron separated preventing further action on the undecomposed portions of the substance. In fact, I have succeeded in effecting complete decomposition by sulphuric acid in comparatively few cases.

It is evident that treatment in sealed tubes is not at all an advantageous plan of employing sulphuric acid, for unless the temperature be dangerously high, the vapour of

the acid exerts no great tension, and thus all the advantages of working under high pressure are lost, and one might as well use an ordinary bottle or corked tube at once.

But at very high temperatures sulphuric acid is able to effect decompositions with great facility, and, at a red heat, it is one of the most convenient and powerful re-agents we possess.

Of course "red-hot sulphuric acid" is employed in the form of acid sulphate of potassium. The sodium salt is often recommended, but it will not advantageously replace the potassium compound, as it decomposes at an inconveniently low temperature, and gives off much more sulphuric anhydride.

The acid sulphate should always be fused in the platinum crucible first of all, to drive off water and free acid, the sample being subsequently added.

It is desirable to test the purity of any fresh sample of "bisulphate" before using it. A quantity of the salt sold me by one of our principal operating chemists contained a considerable quantity of *silver*, an impurity doubtless dissolved from the vessel in which the salt had been fused by the manufacturer.

By fusion with acid sulphate of potassium, nearly all the above-mentioned refractory substances can be readily decomposed. Brick-dust leaves nothing but pure white silica, and the same is true of all clays.

Instead of treating ordinary soluble iron ores with hydrochloric acid, and having the unsatisfactory item of "silicious matter" to examine further, it is far better to fuse the ore with acid sulphate at once, by which means pure white *insoluble* silica is obtained, and all the other constituents pass into solution on treating the product of the fusion with acidulated water. In presence of pyrites or ferrous compounds it is best to add a crystal of nitre when the sample is placed in the crucible. The silica obtained is sometimes ochreous if too high a temperature has been employed, but it is readily purified by treatment with hydrochloric acid after pouring off the liquid. No evaporation to dryness to render the silica insoluble is requisite.

It is a pity that a re-agent so valuable and so widely applicable as the acid sulphate of potassium is not more commonly employed.

I have made a few experiments in another direction, and although the results possess merely a negative value, this appears a convenient occasion to place them on record.

It is well known that a hot solution of phosphoric acid readily acts on glass, and it occurred to me that the decomposing power would probably be greatly enhanced if *fused* meta-phosphoric acid were employed instead of a mere *solution*. This deduction was fully borne out by experiment. A fragment of window-glass about an inch square was treated at a low red heat in a platinum crucible with glacial phosphoric acid. In an hour or so it was decomposed nearly to the centre, and the change was accompanied by some very remarkable and characteristic appearances. With powdered glass the reaction was still more perfect, and there is no doubt that fusion with phosphoric acid might be employed as a means of decomposing silicates. The difficulty consists in the subsequent treatment of the resulting meta-phosphates. In practice, this presents such difficulties, that I have been compelled to abandon the idea of making the method useful, though it is possible that there are exceptional cases in which it might be made of service. The platinum crucible used for the fusion is seriously attacked.

ON THE COMPOSITION OF DIFFERENT KINDS OF COCOA.

By CHARLES HEISCH, F.C.S.

It is well known, that different varieties of cocoa fetch very different prices; but as far as I am aware, no careful examination has been made to ascertain if these differences are caused by any difference in their composition regarded as articles of food, or if they be due solely to differences in flavour, which after all may be only matters of taste. In none of the published analysis of cocoa which I have seen, is any mention made of the kind of bean analysed, it is therefore not surprising that the results published vary very considerably. Thus, while in Dr. Hassall's book we are told that cocoa contains albuminoid matter 16·7 per cent.; in Dr. Parkes', Practical Hygiene, it is stated to contain from 13 to 18 per cent. of protein substance. In neither case is it mentioned, whether the bean was examined raw, or after roasting. Having through the kindness of a friend obtained samples of various cocoa beans, both raw and roasted, which he assured me were unmixed, I made a number of analyses of the roasted beans, which as far as food is concerned, are by far the most interesting, as I believe the raw bean is never employed. The results are shown in the following table. They are not so complete as I had hoped to make them, but they comprise the more important constituents, and as such analyses can be done only in the intervals of more pressing work, I prefer leaving the remaining less important constituents for a future communication. In the first column of the Table, is noted the proportion of husk in the different varieties. This difference appears to be mainly due to the husk in some kinds being much thicker than in others; in all cases these thick husks separate much more from the bean in the process of roasting, and can be taken off with much greater facility. The other estimations are made on the roasted bean after removal of the husk. The albuminoids are calculated from the total nitrogen found by combustion with soda lime, the nitrogen contained in the theobromine is thus included, but in the roasted bean this is so small that the difference is hardly worth consideration; hereafter, I hope to estimate the theobromine in the different varieties, as well as the starch, gum, cellulose, &c. It will be observed, that in none of the above samples do the albuminoid substances reach the amount mentioned by Hassall or Parkes, but as neither of them give the method by which the albuminoids were ascertained, no attempt can be made to account for the difference. The amount of these substances in Para, which is about the lowest priced variety, is, with one exception, the highest in the table, so that, viewed as an article of food it is superior to some of the more expensive kinds. The soluble ash consists to a great extent of phosphate of potash, the phosphoric acid in the portion insoluble in water being mostly if not entirely combined with magnesia.

RESULT OF EXAMINATION OF ROASTED BEAN AFTER REMOVAL OF HUSK.										
	Per Cent- age of Husk.	Fat.	Nitrogen.	Albuminoid Substances.	Ash.	Ash Soluble in Water.	Ash Soluble in H Cl.	Phosphoric Acid in Ash, cal- culated as H ₃ PO ₄ .	Moisture.	Starch, Gum, Cellulose, &c.
CARACAS ...	13·8	48·4	1·76	11·14	3·95	2·15	1·80	1·54	4·32	32·19
*TRINIDAD...	15·5	49·4	1·76	11·14	2·80	·9	1·90	·93	3·84	32·82
SURINAM ...	15·5	54·4	1·76	11·14	2·35	·80	1·55	1·23	3·76	28·35
GUAYAQUIL.	11·5	49·8	2·06	13·03	3·50	1·75	1·75	1·87	4·14	30·47
GRENADA ...	14·6	45·6	1·96	12·40	2·40	·60	1·80	1·35	3·90	35·70
BAHIA	9·6	50·3	1·17	7·40	2·60	·90	1·70	1·26	4·40	35·30
CURA	12·0	45·3	1·37	8·67	2·90	·95	1·95	1·13	3·72	39·41
PARA	8·5	54·0	2·00	12·66	3·06	1·40	1·65	1·00	3·96	26·33

* I am inclined to think that the Trinidad sample was not of the finest quality.

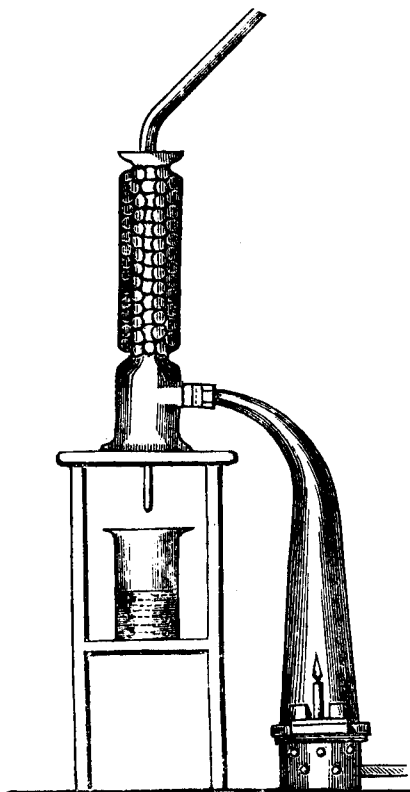
ON THE PRODUCTION OF SULPHURIC ACID BY THE COMBUSTION OF COAL GAS, &c.,

By W. C. YOUNG, F.C.S.

It is the belief of many eminent gas engineers, that the sulphur compounds in coal gas are converted into sulphurous acid by combustion in burners used for lighting purposes, and they are confirmed in their belief by the published opinions of several eminent chemists. The experiments, which are the subject of this paper, were made with the purpose of determining the amount of sulphurous and sulphuric acid respectively, that is produced by burning coal gas in different burners, and were commenced nearly two years ago, their progress having been interrupted until lately.

The apparatus in use at the Official Testing Offices for the estimation of sulphur in gas, is that known as the Gas Referees' apparatus, (*see Fig.*) and is of the following description.

The gas is burnt in a small Bunsen burner with steatite top, which is mounted on a short cylindrical stand, perforated with holes for the admission of air, and having on its upper surface a deep circular channel, to receive the wide end of a glass trumpet-tube, on the top of the stand; between the narrow stem of the burner, and the surrounding glass trumpet-tube, are placed pieces of commercial sesquicarbonate of ammonia, weighing in all about two ounces. The products, both of the combustion of the gas, and of the gradual volatilization of the ammonia salt, go upwards through the trumpet-tube into a vertical glass cylinder packed with glass balls to break up the current, and promote condensation. From the top of the cylinder there proceeds a long glass tube to increase the draught and form an exit for the uncondensable gases. In the bottom of the cylinder is fixed a small glass tube, through which the liquid formed drops into a beaker placed beneath.



The condensed liquor contains the sulphur as sulphate of ammonia.

It is supposed by some that the complete oxidation of the sulphur is effected by nitric acid, formed by the oxidation of the ammonia vapours passing over the flame. The following experiments prove that this is not so, and that the Bunsen flame is sufficient alone to complete the oxidation.

The gas was burnt in a gas referees' apparatus having no carbonate of ammonia round the burner. On the top of the glass balls a few crystals of pure carbonate of soda were placed, so that the interior of the cylinder was kept alkaline, and the absorption of

the acid vapours assured. Care was taken that no ammoniacal vapour was present.
Result:—

	Apparatus with (N H ₄) ₂ CO ₃ round burner. Grains S in 100 c. ft.			Apparatus with Na ₂ CO ₃ on top of cylinder. Grains S in 100 c. ft.		
1.	9.27	...	...	9.65	
2.	10.30	...	...	10.60	
3.	9.40	...	...	9.75	
4.	11.20	...	...	11.60	

Having found that the modified apparatus gave as perfect results as the original, the Bunsen was replaced by a common fish-tail and other burners successively, and the gas burnt at the rate of about 1.25 c. ft. per hour (that being as much as the draft through the apparatus would permit). The condensed liquor was then made up to a known bulk, a portion boiled with hydrochloric acid, so as to expel any sulphurous acid that might be present, and the S estimated as Ba SO₄. Another portion was acidified with nitric acid and set aside for 24 hours, and the S estimated as before; the difference between the two estimations being ascribed to sulphurous acid. The results are stated in grains of sulphur per 100 c. ft. of gas.

FISH TAIL BURNER.

	As H ₂ SO ₄ .	As SO ₂ .	S by Referees' app.
1. ...	11.1	.2	10.9
2. ...	12.1	.3	11.7
3. ...	9.3	.0	9.1

LONDON ARGAND BURNER.

1. ...	12.7	.4	12.6
2. ...	11.3	.2	11.1
3. ...	11.4	.4	11.3

COMMON IRON ARGAND.

1. ...	8.5	.0	8.5
2. ...	9.1	.2	9.0
3. ...	10.3	.4	10.1

In these experiments the conditions were favorable to the production of sulphurous acid, as the supply of air to the burner was little more than sufficient to produce a steady flame, and of course would be less than when in ordinary use. As will be seen, however, the oxidation was as complete as in the Bunsen burner, and but a mere trace of sulphurous acid was obtained in either case.

There can be no doubt, that the notion that sulphurous acid was the principal product of the combustion of sulphur compounds in coal gas, arose from the statements to be found in most text-books, that when sulphur or sulphuretted hydrogen is burnt with an excess of oxygen, the product is sulphurous acid. When sulphur is burnt in *dry* oxygen, sulphurous acid alone is produced of course, but in *moist* oxygen, sulphuric acid will be found in addition. The statement is insufficient as regards sulphuretted hydrogen, as sulphuric acid may always be found in the product of its combustion.

In order to see how far the simultaneous production of water during the combustion of sulphur compounds affected the oxidation of the sulphur present, I burnt sulphuretted hydrogen, a mixture of hydrogen and sulphuretted hydrogen, and coal gas charged with bisulphide of carbon, respectively, under a trumpet-tube fixed to a vertical cylinder, 2 feet high and 4 inches in diameter—about twice as large as the condenser in the Referees' sulphur apparatus—differing in shape from the latter, in having two necks at

the top. In one of these necks was fitted a separating funnel, through which a strong solution of pure caustic soda was slowly run on to the glass balls, with which the interior of the cylinder was filled; to the other was fixed an eduction tube. In the bottom of the cylinder was fitted a tube through which the liquid ran into a vessel beneath. In this way a large alkaline surface was obtained, which was being constantly renewed from the stoppered funnel.

One portion of the liquor obtained was boiled with H Cl, another diluted very considerably with water, acidified with HNO₃, and set aside for 24 hours; the S estimated in both as Ba SO₄.

The H₂S was burnt at as low a rate as possible, and the result showed that very nearly 1 per cent. of the S was converted into H₂SO₄.

A mixture of H and H₂S containing 4 per cent. of the latter, produced no sulphurous acid during its combustion.

The coal gas was charged with bisulphide of carbon, by passing it over a solution of the latter in olive oil. In the first experiment, the gas was burnt at the rate of .5 c. ft. per hour, the result showing a total of sulphur amounting to 444 grs. per 100 c. ft., of which 422 grs. (95 per cent.) had been converted into H₂SO₄.

In a second experiment the solution of bisulphide used was very much stronger, and the gas was burnt at the rate of .2 c. ft. per hour. The result was as follows:— Total sulphur, 1644 grs. per 100 c. ft., of which 1260 (or 76.7 per cent.) was converted into H₂SO₄.

It is evident from these experiments that the presence of aqueous vapour, or, its simultaneous production, does very materially effect the oxidation of sulphur, and that, practically, the sole product of the oxidation of the sulphur in coal gas, is sulphuric acid, even if that impurity be present in very large quantities.

ON A SIMPLE METHOD OF TAKING THE GRAVITIES OF FAT AT HIGH TEMPERATURES.*

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

SOME two months since, I published in *The Analyst*, a short note, on the use of the well known specific gravity bubbles, for the purpose of taking the specific gravities of melted fats at high temperatures.

The method seemed to offer several advantages, amongst others it is easy to work on a very small quantity of the pure fat, and a reading of temperature which can be made with considerable accuracy, is substituted for a weighing at a high temperature, which is, to say the least, a difficult and delicate operation.

The process itself contains one element of error. The bubble, consists of a hollow glass bead, with a tail or shank. The definite adjustment of the bubble to the required specific gravity is made by grinding this shank, and testing this bubble in a solution which is of the required specific gravity, at a temperature of 60° F. When, however, the bubbles are used in hot fats, the expansion of the air sensibly alters the shape and dimensions of the bubble. The consequence is, that the gravity of the bubble determined at 60°, does not represent the actual gravity of the fat at the temperature at which the experiment is made, but requires a certain correction.

* Read at a meeting of the Society of Public Analysts, at Burlington House, on June 14th, 1876.

The results, however, are perfectly regular and concordant, and this slight correction is therefore easily applied; while the figures obtained are so reliable that many samples of butter need no further examination. I am convinced, that when it is desired to take the gravities of liquid fats at temperatures higher than 100°, the bubbles will be found to give much more accurate results than can be obtained by weighing.

The mode of manipulation which I adopt is as follows:—

The fats to be tested, are melted and kept for some time (say half-an-hour) at a temperature considerably in excess of their melting point (say 180°) so as to ensure perfect fusion and uniform mixture. A portion of each is poured into a test tube, of about 5-in. by $\frac{5}{8}$ -in. size, which is filled within an inch of the top. These test tubes are fitted with corks having a notch in the side to allow for the expansion and contraction. The corks are bored with holes, through which are inserted small pieces of glass rod with rounded ends, long enough to dip $\frac{1}{4}$ -in. or more below the surface of the fat. After the bubbles are put into the fat in the tubes, these corks holding the glass rods are inserted, and the bubble is thus forced entirely below the surface of the fat, and therefore is free from the slight surface adhesion which would otherwise exist.

The test tubes are then dropped into holes in a sheet of copper which supports them by their flanges, and are immersed in a beaker of water, at a temperature of say 100° F. This beaker is in turn supported by a tin or copper ring in another larger beaker containing water, at the same temperature, and the whole arrangement is then put on a small sand bath. The burner is so arranged as to raise the heat very slowly, 1° F. per minute is the greatest rate of increase which must be used under any circumstances.

As the temperature rises, the bubbles will be seen to detach themselves from the ends of the glass rods. They will fall at first very slowly, but still there will be no difficulty in observing the time at which the first line of separation appears, within twenty seconds.

Following this procedure, I have worked with bubbles of various specific gravities, but the following results show those which I consider the most generally suitable. I took a sample of ordinary butter, and separated the pure fat in the usual way. I weighed the melted fat according to Muter's method at 100°, and 135° Faht.

The results, all calculated from actual weighings in a *glass* bottle, (no allowance being made for the expansion of the bottle) were as follows:

Specific Gravity at 100° F	...	...	..	} 907.2
Compared with water at 60° F	...	...	...
Corresponding to "Actual Density," at 100° F	...	...	...	} 912.1
Compared with water at 100° F	...	...	...
Specific Gravity at 135° F	...	...	...	} 895.2
Compared with water at 60° F	...	...	...
Corresponding to "Actual Density," at 135° F	...	...	...	} 906.7
Compared with water at 135° F	...	...	...

A bubble, the specific gravity of which (as determined by a mixture of spirit and water) was 896, was tested in this Fat and sank at 135°. The indication given is therefore 896, as against a real specific gravity of 895.2 at 135° F, which corresponds to an error of 2° F in temperature of the specific gravity bottle at the time of taking the weight.

I took some of the same butter fat and mixed it with lard fat in different proportions. The fats were measured when in a melted state instead of being weighed, and were successively increased by one sixth. So that No. 1 is pure lard. No. 2 five-sixths lard, one-sixth butter, and No. 7, pure butter.

These mixed fats were each tested with five bubbles of the following gravities at 60° F.

A and B	...	...	...	...	889.0
C and D	...	...	...	...	888.0
E	...	...	...	...	896.0

The following table shows the "actual densities" of these fats at 100° F, and the temperatures at which the bubbles were found by actual experiment to sink.

Number.	Percentage of Butter.	Actual Density.	Temperature at which the bubbles sank.				
			Degrees Faht.				
			A	B	C	D	E
1	0	905.3	127	126	129	129	114
2	16	906.2	131	131	132	132	117
3	33	907.1	136	136	137	137	122
4	50	908.6	139	139	141	140	124
5	66	910.8	141	141	142	143	128
6	83	911.2	145	145	146	145	132
7	100	912.1	146	147	149	148	135

From these results it follows, that in a sample of so called butter having an actual density of 911° (the density, which has been fixed by Muter as that above which, samples may be safely passed), beads will sink as follows:—

Sp. gr. of Beads	...	...	...	889.0	896.0
Temperature	...	...	...	145° F	132° F.

If the bead sinks at any temperature lower than these, the butter will need further examination by actual determination of the percentage of fatty acids. But as a guide to the gravity it may be assumed that a difference of one degree in the sinking temperature indicates .30 actual density, equal to about .35 per cent. of fatty acids, and nearly 5 per cent. of foreign fats.

CORRESPONDENCE.

BUTTER ANALYSIS.

TO THE EDITOR OF THE "ANALYST."

SIR,—In answer to Dr. Muter's letter on the above subject, in the September number of *The Analyst*, will you please give insertion to the following remarks:—

In June, 1874, we published our book on Butter Analysis, in which we showed, that the detection of foreign fats in butter by chemical means was a comparatively easy matter, and for about two years, Dr. Muter allowed us to get the credit of having first arrived at the complete solution of the much discussed butter question.

Dr. Muter, now refers to pages 586-7 of the *Food Journal*, for 1870. The passages he wishes to point out are the following: "The really exact mode of detecting tallow in butter, can only be based on a proper separation and estimation of the various fatty acids. This is an operation which necessitates practice, and is also tedious." Anyone with a moderate acquaintance with the subject might have said as much.

On page 587, we get however, something more definite, Dr. Muter, says: "want of space forbids any description of the mode adopted in separating and estimating the fatty acids, but we shall soon be able to recur to the subject, when a process will be detailed, which is found most workable, and which is a modification of Heintz's method." Dr. Muter, never recurred to the subject, and it is left to the reader to decide, whether the method had actually been worked out by Dr. Muter, or whether he only *hoped* to get at one, by following Heintz's method. Be that as it may, he never said one word about it until April or May, 1876.

Yours, &c., OTTO HEHNER.
ARTHUR ANGELL.

DETECTION OF FUCHSINE IN WINES.

By E. JACQUEMIN.

Bull. Soc. Chim. [2] xxvi. 68-71.

THE following processes are given :—

1. *By the direct dyeing of gun-cotton.* A wad of gun cotton is heated in about 20 c.c. of the wine, then withdrawn and washed with water. Fuchsine, and archil (which is sometimes used to increase the colour of wine), both dye it, whereas the natural colouring matter of the wine does not. The two former may be differentiated by moistening the dyed wad with ammonia, which changes the archil to violet, and bleaches, though slowly, the fuchsine.

Gun-cotton, which is undergoing change, is more efficacious than that which is new and pure.

Other substances used for artificially colouring wines fix themselves upon gun cotton sufficiently well for conclusions to be drawn as to their nature, by the changes which they undergo on treatment with ammonia.

2. *By the direct dyeing of wool.* Wool is scarcely affected by the natural colouring matters of wines, but is dyed by fuchsine and archil. About 100 c.c. are evaporated till the alcohol is removed. A piece of white embroidering wool is then immersed into it, and the evaporation continued till the bulk is reduced one-half, when the wool is withdrawn and thoroughly washed. The tints of fuchsine and archil are slightly altered by the trace of natural colouring matter from the wine, but, on treatment with ammonia, the last-mentioned changes to brown, whilst the fuchsine is rapidly dissolved, and the ammoniacal solution becomes red on acidification. The archil becomes violet, as does also the ammonia into which it is dipped.

3. *By dyeing wool by means of ammoniacal fuchsine.* The alcohol is evaporated from one or two hundred c.c. of the wine, the remainder made alkaline with ammonia, and then shaken with ether. The ethereal solution is evaporated on a piece of white embroidering wool as before, which then becomes dyed red, as the evaporation proceeds. The destruction of this colour by ammonia, and its reproduction by acetic acid, leaves no doubt as to the nature of the colouring matter. If archil is present the ethereal solution is red.

C. H. P.

CAPSAICIN, THE ACTIVE PRINCIPLE OF CAPSICUM FRUITS.

[Pharmaceut. Journal, No. 315, 1876, p. 21.]

Mr. C. F. THRESH appears to have succeeded in isolating the pungent principle of cayenne.

The first step is to obtain the oily fluid named by Buchheim "capsicol," by treating the powdered fruit with ether, distilling off the ether, dissolving the residual extract in boiling caustic alcoholic ley, diluting with water and precipitating with barium chloride; this precipitate is washed, dried, and treated with ether, and upon evaporation the oily capsicol is obtained, which may be purified by a repetition of the process.

From capsicol; capsaicin may be obtained in two ways—

(a) Capsicol is dissolved in twice its volume of almond oil, and agitated with three successive portions of proof spirit, the alcoholic solution is separated, and upon evaporation leaves a red-brown fatty residue, which when dissolved in dilute solution of potash, and treated with dilute ammonia, deposits, on standing pearly white crystals of Capsaicin.

(b) The capsicol is dissolved in dilute potash, precipitated by ammonium chloride, the coloured precipitate re-dissolved in potash, and re-precipitated at 120° F by ammonium chloride in excess—in a few days an abundant crop of capsaicin crystals will be the result.

Capsaicin may also be obtained by dialysing the tincture of capsicum—the dialysed solution has an acid reaction.

Capsaicin is powerfully pungent, the most minute portion, if volatilised, causing severe fits of coughing. It dissolves slightly in cold water, more readily in boiling water, a portion at that temperature becoming volatilised, and causing long continued fits of sneezing, the excess of what is taken up by the water melts and floats on the surface of the fluid as a colourless oil. The hot solution precipitated by the addition of a strong acid deposits crystals. Capsaicin dissolves readily in proof spirit, giving, when not too dilute, white precipitates with barium and calcium chlorides, both soluble in ether. Silver nitrate gives a precipitate which dissolves in dilute ammonia, and the solution when boiled darkens in colour and deposits a curdy brown-black precipitate. Capsaicin is volatilised slowly at 212° F., and may be obtained as a sublimate of fatty globules, if mixed with water and distilled. The distillate has a distinctly pungent taste.

A. W. B.

CAPSAICIN.

By I. C. THRESH, F.C.S.

(*Pharmaceut. Journal*, [3], 326, page 259.)

MR. THRESH now finds that the red waxey substance from whence capsaicin may be separated, is easily and cheaply obtained by the use of Petroleum as a solvent; the residue may be dissolved in dilute solution of potash and carbonic anhydride passed through the solution; the capsaicin is immediately precipitated in minute crystals. *The Action of Heat.* Capsaicin melts at 138° F., volatilises, unchanged, at 240° F., and at 248° F. becomes brownish black. The specific gravity of the pure substance is 1060.

It is soluble easily in alcohol, rectified and proof spirit, ether, amylic alcohol, acetic ether, acetic acid, benzine, the fixed oils, and solution of the alkalies; it dissolves slowly in turpentine and carbonic bi-sulphide. Petroleum does not dissolve it readily, but its solvent powers are increased by the presence of the red fat.

It is totally insoluble in solutions of the carbonates of the fixed alkalies, and ammonia.

A. W. B.

AVA, OR, KAVA KAVA.

Pharm. Journal, [3] No. 321, p. 149.

AVA is the local name of the *piper methysticum*, a shrub, about 6 ft. high, cultivated in Viti, Tahiti, Hawaii, the Society and Tongan Islands. The root and base of the stem have been introduced into France, as a remedy for gonorrhœa, and it will probably be tried in this country ere long.

According to M. Cuzent, the root contains an essential oil of a pale yellow colour, 2 per cent. of an acrid resin, and about 1 per cent. of a neutral crystalline principle called

kavahin, or methysticin, which is obtained in acicular crystals by crystallisation, from a concentrated tincture. Kavahin differs from piperin, and cubebin, in being coloured red by hydrochloric acid, the red colour fading on exposure to air into a bright yellow, and in being coloured by strong sulphuric acid, a purplish violet colour, which passes into green. The root contains also nearly half its weight of starch.

Since neither kavahin, nor the resin are soluble in water, and the infusion produces the characteristic effects of the drug, it would appear probable, that the active principle is yet to be separated; kava in small doses acts as a stimulant and tonic, in large, it produces a silent and drowsy intoxication, and if used long for this purpose appears to cause a peculiar kind of skin disease.

A. W. B.

THE ACONITE ALKALOIDS.

By Dr. C. R. A. WRIGHT, D. Sc., Lond.

Pharm. Journal, [3] No. 326, p. 286.

DR. C. R. A. WRIGHT, read a very important paper on the aconite alkaloids at the recent Pharmaceutical Conference, in which he suggests, and indeed almost proves, that the different alkaloids named napelline, lycocotinine, acolectine, pseudoaconitine, &c., are really different alteration products of some one parent alkaloid common to all the species of aconites; the practice of using mineral acid to percolate the ground root, and the subsequent boiling down of the acid extract, causing alteration in the alkaloid present. On the other hand, the use of tartaric acid, and a low temperature as recommended by Duquesnel, appears from the crystallisable nature of the base thus obtained, to produce less change or perhaps none at all.

After detailing numerous experiments, which all support the author's assertion, that *aconitum napellus*, contains only one crystallisable physiologically active base, possessing the formula $C_{33}H_{43}NO_{12}$; the author draws the following practical conclusions:—

1. When *A. Napellus* is treated by Duquesnel's process, there are extracted (a.) a crystallisable alkaloid insoluble in potassium carbonate solution, which is difficult to purify by simple crystallisation from ether, but which after conversion into a crystalline salt and regeneration therefrom gives numbers agreeing with the formula $C_{33}H_{43}NO_{12}$, and (b) a second alkaloid or mixture of bases which does not crystallize itself, and does not yield crystalline salts, and which has a lower molecular weight than aconitine, and contains more carbon and hydrogen. (c.) A non-crystalline base or mixture of bases, soluble in dilute potassium carbonate solution and possibly identical with (b).

2. The formula assigned to "crystallizable aconitine," viz.: $C_{27}H_{40}NO_{10}$, by Duquesnel who first isolated the substance in a state of moderate purity does not exactly represent the composition of the pure base, the difference in Duquesnel's results being apparently due to imperfect purity of the substance isolated and examined by him.

3. The amorphous substance examined by Von. Planta, to which he assigned the formula $C_{30}H_{47}NO_7$, was probably a mixture of aconitine more or less altered during the extractive process, and the amorphous bases above-mentioned; whether this amorphous body pre-exists in the fresh roots, or whether it is formed during the extraction process, it is at present impossible to say. Probably "napelline" is identical with, or closely allied to, this body.

4. Although when alcoholic hydrochloric acid is used to extract the alkaloides from *A Napellus*, a considerable quantity of a comparatively inert base appears to be formed, and largely dilutes the crystalline nitrate of the active base, $C_{33}H_{43}NO_{12}$, yet no appreciable amount of this substance appears to be produced by Duquesnel's tartaric acid method.

5. The method that ought to be adopted for the preparation of a pharmaceutical product of constant composition and properties is: 1st. Percolation by alcoholic tartaric acid and evaporation, to a small bulk of the percolate, at as low a temperature as possible (probably in a vacuum pan would be best.) 2nd. Crystallisation from ether of the base, separated by sodium or potassium carbonate from the aqueous solutions of the extracts. 3rd. Further purification by conversion into a crystalline salt, for which purpose the hydrobromide is well fitted. The base obtained in this way is a simple body, expressed by the formula $C_{33}H_{43}NO_{12}$ in a state of great purity, and possessing high physiological activity.

A. W. B.

NOTES ON THE DETERMINATION OF SULPHUR IN COAL.

By W. MORGAN, PH. D.

SOME time ago I had occasion to determine the amount of sulphur in a sample *A* of coal which was submitted to me for analysis. Another sample, *B*, was also taken from the same parcel and delivered to another chemist, the coal having been previously pulverised finely and well mixed. On comparing the results *B* was one per cent. higher in sulphur than *A*. This difference in results led me to make the following experiments in order to test the various methods employed, viz. :—

Oxidation of the sulphur by HCl , $KClO_3$, & HNO_3

Ditto by fusion with KNO_3 , Na_2CO_3 & $NaCl$.

Oxidation by combustion in oxygen and passing the products into a bulbed U tube containing HCl and bromine, as described by Sauer, Fresenius (*Leitosch Anal.*, Ch., Vol 12, page 32.)

For anthracite coals I employ a short tube about 9 inches long, one end drawn out and bent so as to pass down into a chloride of calcium tube, conducted into a beaker containing water, the other end connected with the oxygen gas holder. With bituminous coals I find it is better to take a larger tube and keep the boat back in it, so as to let the volatile matters condense in the cool part of the tube, and they may afterwards be carefully burned off. I would strongly urge the importance of rinsing the tube out thoroughly, otherwise the results will be below the truth. The rinsings and contents are afterwards transferred to a beaker, heated to expel excess of bromine, filtered if necessary, and afterwards precipitated by barium chloride treated in the usual manner.

As a rule the combustion of 0.5 to 0.75 anthracite coal takes about three-quarters to one hour; bituminous coal usually takes less time.

The great advantage of this method is that the residual ash in the boat may be weighed and further examined for calcium sulphate, which is a very important point, and generally overlooked, thereby leading to erroneous results if present in large quantity. For instance, a sample of coal I examined gave the following—

Carbon ...	...	...	...	73.21	per cent.
Hydrogen ...	...	...	...	5.24	"
Oxygen and Nitrogen ...	...	...	...	9.92	"
Sulphur ..	...	...	...	1.83	"
Ash ...	...	...	...	9.80	"
				<u>100.00</u>	

The sulphur was determined by combustion in oxygen, the ash on testing with H Cl and filtering gave a precipitate of Ba SO₄, equal to 0.67 per cent. on the coal taken. Now by the ordinary fusion methods the analysis would have been somewhat as follows—

Carbon	73.21	per cent.
Hydrogen	5.24	"
Oxygen and Nitrogen	9.25	"
Sulphur	2.50	"
Ash	9.80	"
	<u>100.00</u>	

The 0.67 being given twice over, viz., as sulphur and in the ash.

I take it that all that is required and understood by the determination of sulphur is how much is removable by the burning of the sample of coal, the sulphur present as sulphate of lime remains unchanged.

OXIDATION BY THE FUSION METHOD.

A Sample.

	Ba. SO ₄
1.—9 gr. Fusion Mixture + 4 gr. Na. Cl. dissolved, acidulated, not filtered, gave	0.0473 grammes
2.—Quantities, &c., as in 1, but filtered	0.0458 "
3.—Ditto as in 1, but heated for 25 minutes over Bunsen gas burner	0.0538 "
4.—Ditto as in 3, but further heated for 15 minutes over table blowpipe	0.0623 "
5.—Precisely the same as in 4	0.0648 "
6.—0.5 gr. Coal with the same quantity of materials, and heated for the same length of time as 4 and 5	0.1278 "
7.—Same materials and quantities as in 6, but heated as 3	0.1198 "
8.—0.5850 gr. Coal burned in Oxygen, bend of the tube not rinsed out	0.0568 "
9.—0.5454 gr. ditto ditto bend of tube thoroughly rinsed out into beaker	0.0688 "

B Sample.

10.—0.5 gr. Coal, materials and heating as in 4 and 5	0.1313 "
11.—Ditto ditto ditto as in 3 and 7	0.1188 "
12.—0.5 gr. Coal, treated as 9	0.0598 "
13.—0.5 gr. Coal, 9 gr. Fusion Mixture + 4 gr. Na. Cl., heated 30 minutes over Bunsen gas burner, and 30 minutes in a muffle furnace*	0.1278 "
14.—Fusion Mixture and Salt heated during and for the same length of time as in 13	0.0628 "
15.—0.5 gr. Coal, treated as in 9 and 12	0.0638 "

In all the Fusions the platinum crucibles were covered during the whole time.

* Muffle heated by Coal.

SUMMARY OF RESULTS.

10.—0.1278 — 0.0635 (mean of 4 and 5,) = 0.0643 Ba SO ₄	= 1.76 per cent. Sulphur.
7.—0.1198 — 0.0538 (3) = 0.0660 "	= 1.81 " "
8.—Results too low, showing necessity of rinsing out the tube	= 1.33 " "
9.—Tube thoroughly rinsed out	= 1.73 " "
10.—0.1313 — 0.0635 (mean of 4 and 5,) = 0.0678	= 1.86 " "
11.—0.1188 — 0.0538 (3) = 0.0650	= 1.78 " "
12.—	= 1.64 " "
13.—0.1278 — 0.0628 (14) = 0.0650	= 1.78 " "
14.	= 1.75 " "

Oxidation by treating with H Cl, K ClO₃, and HNO₃, the usual precautions being adopted with regard to removal of chlorine and nitric acid.

15 gave	1.30	per cent. Sulphur.
16 "	1.28	" "
17 "	1.24	" "
18 "	1.29	" "

These last mentioned results conclusively prove that the oxidation in the humid way does not give accurate results in determining sulphur in coal, I have also found that treating coal with hot water alone, in order to test for sulphates is extremely fallacious.

PROSECUTIONS UNDER THE SALE OF FOOD AND DRUGS' ACT.

At the Kirkdale Petty Sessions, two informations were heard against milk dealers for adulteration. In the first case Henry Barton, was charged with having sold half a pint of adulterated milk. Mr. Superintendent Martin said that on the 13th of September he met a shandry which was being driven by the defendant's son in Rice Lane, Walton, and purchased from him half a pint, which he afterwards submitted to Dr. Campbell Brown, the county analyst. He had since received from Dr. Brown, a certificate stating that the milk contained 2.9 per cent. of fat, 7.1 per cent. of other solids, and that upwards of 25 parts of water had been added to every hundred parts of milk. The defendant was fined £5 and costs, or two months' imprisonment in default. Matthias Clarkson, was charged with a similar offence. On the 13th of September, Mr. Superintendent Martin visited the milkhouse of the defendant and bought half a pint of milk, which he submitted to Dr. Campbell Brown, whose certificate showed the following result: 2.93 per cent. of fat, 7.7 per cent. of other solids, and 17 parts of water had been added to every hundred parts of otherwise rich milk. The defendant was fined £5 and costs, and Mr. Neilson said if those cases again occurred the fines would be doubled.

SOUTHWARK.—Henry James, a cheesemonger in a small way in business at 21, Manor road, Bermondsey, was summoned by order of the Bermondsey Vestry for selling as pure butter a mixture containing 67 per cent. of foreign matter. Mr. Doman, the inspector appointed for the purpose of carrying out this act of parliament, said that on the 11th ult. he caused three quarters of a pound of butter to be purchased at defendant's shop, for which he paid 1s. He took a portion produced to Dr. Muter to be analysed, and the result of that was Dr. Muter's certificate, showing 67 parts out of 100 were not butter. The defendant said he sold it as he purchased it. He believed it to be genuine butter. Mr. Benson directed him to be sworn, when he produced an invoice showing that he purchased the butter of Mr. G. S. Rayment, 265, Blue Anchor road, on the 6th ult. Since he had received the summons he had seen Mr. Rayment about it, and he told him there was nothing injurious to health. Mr. Benson said it appeared to him to be a very impudent fraud, and the sooner it was put a stop to the better. He should like to know where such stuff was manufactured. Mr. Wells, a cheesemonger, in the Lower Marsh, Lambeth, who happened to be in court, informed his worship that it was manufactured abroad, and sent over to this country packed in cases. Mr. Benson told defendant he was not excused from the penalties, but to give the vestry an opportunity of proceeding against Mr. Rayment he should adjourn the case until Tuesday next. Henry Bowhead, grocer, 54, Tranton street, Bermondsey, was summoned for selling as pure coffee, a mixture containing 75 per cent. of chicory. Mr. Doman said that on the same day he caused a quarter of a pound of shilling coffee to be purchased at defendant's shop. He took it to Dr. Muter who certified that it contained 75 per cent. of chicory. The defendant said he was not at home at the time or he should not have sold it; as coffee could not be purchased for a shilling a pound. Mr. Benson told him it was sold as coffee. It was his duty to tell the customer at the time they purchased a cheap coffee that it contained chicory. Mr. Safford, chief clerk, here intimated that defendant was liable to a penalty of £100 under the Excise laws.—Mr. Benson fined defendant 20s. and 12s. costs, telling him it would be fortunate for him if the Excise did not take proceedings against him.

WORSHP STREET.—Mr. Walker, vestry clerk of the parish of St. Leonard, Shoreditch, attended to support three summonses, taken out by the parish authorities against John Goldborough, of 193, New North road, Hoxton, against William Baily, 41, Park street, Hoxton, and against James Jackson, 3 Queen street, Hoxton, for selling milk and water as milk.—The defendants Goldborough and Jackson pleaded Guilty, Baily Not Guilty, and formal proof was given of the purchase of the milk. The milk sold by Goldborough was stated to have been adulterated to the extent of 20 per cent., and he was fined 20s. and 12s.; that sold by Jackson to the extent of 25 per cent., and to the extent of 30 per cent. in the case of Baily. Both these defendants were, however, keepers of cows, and the milk drawn on the premises.—Mr. Cooke inflicted fines of 40s. and costs in both cases.

SELLING BAD BUTTER AT BARROW. —Mr. Hugh McKenna, butter Merchant, was charged with refusing to sell a certain article of food—viz., butter—by retail in the public market, the value of the quantity required having been offered to him by Mr. Superintendent Barker, who wanted the butter for public analysis. Mr. Nalder appeared for the defence, and pleaded not guilty. Superintendent Barker, in reply to the chairman, said he held his authority in this matter, under the Food and Drugs Act as inspector of weights and measures. On Saturday, September 23, he visited defendant's stall in Barrow market, and observed a quantity of butter thereon lying in lumps. Pointing out a small lump he asked what was the price of it. The defendant replied, that it was 1s. 4d. per lb. He then said, "Weigh me a pound," which the defendant did. Witness then tendered 1s. 6d., stating at the same time that he was going to have the butter analysed. The defendant, on hearing this, took the butter off the scales, and, having smelt it, said, "I won't let you have this." Witness said, "you weighed that butter for me and you had better let me have it; if not I shall summon you for refusing to sell it." The defendant replied, "This is what I sell to the confectioners for making pastry, and I won't sell it to you." Cross-examined by Mr. Nalder: Witness did not select the butter as the worst on the stall. The defendant did not raise any objection to sell it till after hearing that it was wanted for analysis. Mr. Nalder wished to show that this butter was not sold as an article of food. Mr. Fell observed that the quality of the butter was not in question. The defendant was charged with refusing to sell the inspector the butter on the stall. Mr. Nalder: Which we say was not being sold as food. Mr. Fell: You may take that point if you like. Police-constable Potter said he was with Superintendent Barker when he visited the defendant's stall, and proceeded to corroborate Mr. Barker's evidence. Mr. Fell: Where did he take this butter from? Witness: He took it from the top lumps on the counter. Mr. Fell: So far as you observed, the superintendent made no special selection? Witness: No, sir; he did not. When he told him he wanted it to be analysed, McKenna took the butter in his hand, unfolded the cloth that was wrapped round it, smelt it, and said, "I will not sell you this, but I will sell you that," pointing to another piece on the counter. Mr. Fell: Then it was wrapped in a cloth when Mr. Barker offered to purchase? Witness: Yes, sir. The only reason the defendant assigned for refusing to sell the butter was that he sold it to confectioners for pastry purposes. Mr. Nalder inquired whether 1s. 4d. per lb. was not a very low price for butter. Witness replied that he saw some in the market that day for 1s. 2d. Mr. Nalder: But it was not fresh butter. Witness: I don't know. Mr. Nalder asked if McKenna did not offer to sell the inspector fresh butter at a higher price. Witness did not recollect the defendant saying anything about fresh butter at all. Mr. Nalder, this is a case of great importance to the butter trade. Mr. Fell: It is a case of great importance to the public. Mr. Nalder, wished to show what the butter was used for. He was informed that they had a quality known in the trade as "pastry" or "second" butter, which was generally sold to pastrycooks for buttering their tins, and 1s. 4d. was the price of this particular class of butter. His client never intended to sell this for food, and no person would be foolish enough to buy an article for food which was merely intended for greasing cooking utensils. A superior class of butter at 1s. 6d. per lb. was offered to Mr. Barker, and his client was quite willing that this butter which he sold for food should be analysed. The butter which he refused to sell was not exposed there as an "article of food," which was the wording of the summons. Superintendent Barker: Mr. Nalder has just stated that 1s. 4d. is a cheap price for butter. I may say in reply, that I bought a sample at another stall for 1s. 2d. per lb. on the same day. Mr. Fell said the Bench had been considering if the defendant might be called as a witness, which did not appear quite clear in the section. Mr. Nalder remarked that if he could not be called he could not have any witnesses for the defence without an adjournment. The defendant was then called. He said he had had twenty-eight years' experience in the trade, and at the present time regularly imported large quantities of butter from Ireland. After a length of time butter would not sell for table purposes, and it was then used for several things, the better quality of this inferior class of butter being used for pastry purposes. His best butter was 1s. 6d. per lb., and it was very seldom he sold any of the inferior quality in the market; when he did it was for pastry purposes. It would damage his trade if he attempted to offer this secondary butter for food, and he had only refused to sell Mr. Barker as good butter, to be analysed as food, what he sold for refuse butter. Mr. Nalder expressed the hope that, as this was the first case under the Act, a lenient penalty would be imposed. Mr. Fell said there could not be a clearer case, and the magistrates were agreed in imposing half the full penalty of £10 attaching to this offence, with costs.

THE ANALYST.

SOCIETY OF PUBLIC ANALYSTS.

The usual ordinary meeting of this Society was held on Wednesday Evening, the 15th inst., in the rooms of the Chemical Society, Burlington House, Piccadilly. Dr. Dupré, F.R.S., in the absence of the President, occupied the chair.

On the motion that the minutes of the last meeting (held at Glasgow) be confirmed, a discussion arose as to the desirability or otherwise of confirming a certain resolution, the practical result of a compliance with which it was considered would be to limit the power and fetter the hands of the publication committee of this journal. Eventually the minutes were confirmed with the exception of the objectionable resolution referred to, which was unanimously rescinded and ordered to be struck out of the minute book.

The name of Mr. R. H. Harland, F.C.S., who applied for admission as a member was read.

The following papers were then read by their respective authors, and discussed—

The detection and estimation of Castor and other fixed Oils in Balsam Copaiba, by Dr. Muter.

Note on "Patent Imperial Finings" for the use of Brewers, by A. Angell.

Note on a simple apparatus for the Volumetric determination of Carbonic Acid in Carbonates, by G. W. Wigner.

A classification and description, designed to facilitate the detection of the presence of Starches which are added to certain articles of Food and Drugs, by Dr. Muter.

THE PUBLIC, AND "PUBLIC ANALYSTS."

THAT much ignorance exists in the public mind with respect to the real function of "The Public Analyst" under the "Sale of Food and Drugs Act," is evident from the paragraphs which from time to time appear in different journals, and which could only be justified, were it the analyst's duty to procure samples, institute prosecutions, and indeed insure convictions, as well as to make analyses. Thus, we are told that in a certain place, the rate-payers are being made to pay for nothing, as the analyst confesses in his quarterly report, that he has not analyzed a single sample, or again, that the analyst's report was read with the usual result, viz., that everything he had examined was found to be genuine!!! &c.

Not only so, but if an analyst meets any of the inhabitants of his district he is pretty sure to be saluted with the inquiry, "what are you about, you prosecute no one? while to my knowledge, the district is full of adulterated food." With a view to dissipate the misapprehension which underlies these remarks, we propose not only to state--what everyone might know for himself--that the analyst has nothing to do but to examine *samples that are brought to him*; but also to point out the difficulties which often lie in the way of his procuring such samples, as would give anything like a fair idea, of the articles sold in the district.

There are some Vestries and District Boards, which show only too clearly that they have no desire that the fact that adulterated articles are to be found in their parish should be published. The inspector soon takes his cue from his superiors and purchases articles where there is no chance of obtaining any that are not pure, and the vestrymen, when the analyst's report is read, stating that everything he has examined during the quarter was genuine, exclaim with one voice "how very satisfactory!"

A much more frequent cause of difficulty in procuring fairly representative samples is the jealousy which Boards feel of anything being procured without their express order. At a meeting of the Board a resolution is passed that "the Inspector be ordered to procure so many samples of such an article, and submit them to the Analyst." This is published in the local paper next morning, and it is not surprising that after this kindly warning only pure samples of the article in question are sold in the district (except by accident) till the specified number is known to have been bought. The fact that the Inspector is always well known to the shopkeepers in his district is also a great hindrance to his procuring samples of inferior quality, and if he be not a man of resource, with a good deal of the spirit of a detective in him, he will rarely succeed in doing so.

But, perhaps, the worst feature of the case is that the public who complain (often, we believe, without cause) of the food supplied to them, and of the Analyst for not making it better, will not move a finger to help themselves. Under the older Adulteration Act, when the local authority had power to prosecute the vendor of an article brought for analysis by a private individual, and to *subpoena* that individual to prove the purchase, scarcely an article was so brought, or if brought, was often taken away again as soon as the purchaser became aware of the fact that if it was found to be as he suspected, he would have to give evidence in a Police Court. Under the present Act, where the purchaser may (if he will) become the prosecutor, but need not unless he likes, the Analyst is often called on to make analyses not really for any public good, but merely to satisfy the mind of the purchaser, and if the Analyst ventures to hint to him that the intention of the Act is to put a stop to adulteration by punishing those who are guilty of it, and that, therefore, he ought to prosecute the vendor, if the certificate of analysis justifies such a course, he generally replies, "Oh! I could not go into a Police Court; of course, I shall not deal at that shop any more." We are convinced that more good would be done to honest tradesmen, and the intention of the "Sale of Food and Drugs Act" be better carried out if, for a short time, the public, or even a few individuals, would make up their minds not only to have suspected articles analysed, but to take the trouble of prosecuting if they were found impure.

We may here remark that a doubt exists in some people's minds whether, if they purchase an article, and when they begin to use it have reason to believe it impure, they can have it analysed under the Act, as they cannot give the vendor the option of keeping a sample of the article. We have good legal advice that they can do so, the clause requiring articles to be divided relating only to those bought "with the intention of submitting the same to analysis," which clause does not take away the power granted by clause 12 to any purchaser of any article of food or drink to have it analysed if he wishes. If this opinion be correct, of which we have little doubt, it takes away the only excuse the public really have for not doing their share in carrying out the "Sale of Food and Drugs Act," and we can promise them that if they will awake to a sense of their duty, every aid will be given them by the much abused Public Analysts.

ANALYSTS' REPORTS.

THE report of Dr. Dupré, analyst for the Westminster district, for the quarter ending September 29, just issued, states:—"During the quarter just elapsed twenty-four samples of articles of food have been examined, namely:—Of bread, 9 samples; milk, 15. The results of the examinations, I am happy to be able to report, have been very satisfactory. All the samples of bread were found to be pure wheat bread, free from alum or other foreign admixture."

The annual report of Dr. Corfield, analyst to the parish of St. George's, Hanover-square, states that of five samples of butter examined, three were found to be genuine, one poor, and one largely adulterated with foreign fats, and a certificate to that effect was given to the purchaser. Of eight samples of tea analysed, five were genuine, two fairly good, and one contained exhausted leaves. Of four samples of vinegar got to obtain information, three were genuine and one adulterated with sulphuric acid.

SOCIETY OF PUBLIC ANALYSTS.

Those of our readers who have read a recent article which we felt it our duty to write in reference to a case of Butter Adulteration in Scotland, as well as a second one in reply to an attack made upon "*The Analyst*" by Mr. Dittmar, in a Scotch newspaper, and a third one commenting upon the unusual course pursued by a gentleman who had made himself conspicuous in the controversy, will not be surprised to hear that Mr. J. Alfred Wanklyn has no longer any connection either with "The Society of Public Analysts" or "*The Analyst*."

We notice that Mr. J. Alfred Wanklyn has already announced his secession from the Society in the "*Chemical News*," and we are happy to be able to confirm the accuracy of his statement.

We may add that Dr. Stevenson is no longer Treasurer, as he has retired from the Society.

UNPUBLISHED PROCESSES OF ANALYSIS.

After, and to a great extent, in consequence of, the passing of the Act of 1872, for the prevention of adulteration, a great *impetus* was given to analytical work.

Many articles of food and drugs which had previously only been analysed as curiosities came to be carefully examined for the purposes of the Act, and processes were worked out with care, for the detection of any impurities or adulterations which might be present.

Some few of these processes were published; but until the formation of "The Society of Public Analysts," chemists, as a rule, worked according to their own individually acquired knowledge, there being no authenticated collection of those processes which had been found successful.

"The Society of Public Analysts" took the first step in this direction, and by the reading, discussion, and publication of papers, gradually familiarised its members with a number of processes which had been carefully worked out and their accuracy tested.

By these means public analysts have so far adopted a uniform system of work, and made a uniform allowance (necessarily an excessive one) for the natural impurities and variations of samples, that it is now quite the exception to have an analysis disputed.

So far, no doubt, the Society deserves credit, and any one who examines the first volume of its "Proceedings," will find that no previous work has contained so much information on food analysis. *The Analyst* has endeavoured to continue this work, and has published the description of numerous processes for the analysis of many commercial samples other than articles of food, but an examination of the authorship of these articles, as well as of those which have appeared in our scientific contemporaries, clearly bring out the fact that the greater part are contributed by a very limited number of chemists.

There are, probably, at least two hundred individuals who fairly deserve to be described as "analysts," and yet we are of opinion that not one fourth of them have ever contributed any number of analyses of different varieties of some known substance, still less the descriptions of any new processes.

We do not, by any means, intend to limit our remarks to food analysis; but leaving out that class of original work which consists in the discovery of previously unknown substances (highly essential though this is), we believe that not fifty chemists in England have, during the last five years, contributed anything which can be considered really in advance of the analytical methods previously in use; and some of what it is the fashion to call "leading chemists," have done absolutely nothing.

If analytical chemistry is to take its proper rank as a profession, this must be changed.

Analysts, young and old, must make public the results of their work, and the columns of scientific journals must show not only descriptions of many processes, but the names of many discoverers of the same.

It is not given to every one to be a Davy, or a Faraday, but every chemist who honestly works, can contribute to the common fund *something*, which shall at least have the merit of being alike original and accurate.

ON THE VOLUMETRIC DETERMINATION OF CARBONIC ACID,

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

Read before the Society of Public Analysts, November 15, 1876.

I have used for some time a very simple apparatus for the volumetric determination (in a gaseous state) of the combined Carbonic Acid, in Carbonates. Schiebler's apparatus is, of course, only adapted for those carbonates which produce salts with Hydrochloric or Nitric Acid, which are readily soluble in cold water, and although it is an extremely handy instrument, it is open to several objections, the principal of which are—

That the temperature of the evolved carbonic acid gas, requires to be carefully taken, and this can only be done by taking the temperature of the external air, and allowing the instrument to rest, until the evolved gas has acquired this temperature, and

That the acid solution used to decompose the carbonates, absorbs a proportion, and (according to my experiments) an irregular amount of Carbonic Acid, and finally the scale of the instruments is purely empirical.

Most laboratories are now furnished with the McLeod apparatus, or with some similar efficient apparatus for measuring the volume of gases under known conditions of temperature and pressure, and I have therefore devised a simple apparatus for the

decomposition of carbonates, and the measurement of the gas evolved.

I take a test tube of about 7 inches by 1 inch, and provide it with a good India rubber stopper, bored with two holes. Through one of these holes I pass a tubulated thistle-headed funnel of small size, furnished with a stop-cock, and through the other a bent piece of small bore glass tubing, also provided with a stopcock.

This bent tube is coupled to the McLeod, or other gas measurement apparatus, by a short length, (say 6 inches) of very stout, small bore, India rubber tube, 1-16in. is large enough for the bore of this.

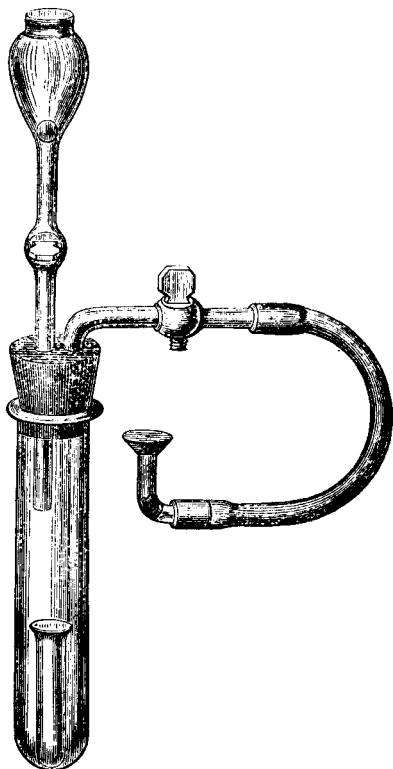
In the bowl of the thistle funnel, I put a glass marble, and in the interior of the test tube, a smaller test tube of about 2in. \times $\frac{3}{8}$, containing the sample to be analysed.

The apparatus is shown complete in the accompanying sketch.

The process is as follows :—

The tubes of the McLeod apparatus are filled with mercury, as if for an ordinary gas analysis, and the stopcocks closed. The sample, (say 25

grains of carbonate of lead) is weighed and transferred to the smallest tube, and about half-an-ounce of distilled water is poured into the large test tube. The small tube is then carefully dropped in, taking care that its mouth is above the level of the water in the



large tube; the stopper, into which the funnel and bent tube have been inserted is then carefully put in place, and the whole held in a slightly oblique position in a retort stand clamp, on the ordinary rising table of the McLeod apparatus; the India rubber tube is then coupled up to the facets of the measuring tube of the McLeod apparatus. If the stopcocks on the bent tube, and on the funnel are opened for a moment, any excess of air in the India rubber tube is liberated.

The stopcock on the bent tube is now closed, and the mercury in the measuring tube of the McLeod apparatus allowed to fall, so as to produce a vacuum.

The stopcock on the funnel remains open, and a lamp is applied to the bottom of the test tube, until the water boils briskly when distilled water is poured into the funnel and kept from running into the test tube by the pressure of steam generated by the ebullition of the water; the boiling is continued until the steam escaping through the funnel and under the glass marble, *all condenses*, showing that the tube is filled with pure steam. The lamp is now withdrawn, and the stopcock instantly closed. This is not difficult, as it is three or four seconds before the water in the funnel begins to draw back.

Meanwhile, a portion of dilute nitric acid has been boiled on another burner, and is poured into the funnel. I prefer not to use much more than is necessary for the liberator of the carbonic acid present. The stopcock on the bent tube, and the stopcock on the measuring tube of the McLeod apparatus are opened, and then the stopcock on the funnel is cautiously opened. The hot acid, of course, immediately runs in, and the only precaution necessary, is to avoid liberating the gas too quickly.

When the test tube is about two-thirds full and all effervescence has ceased I again boil the solution in the tube, and then, still maintaining a partial vacuum, by means of the mercury, fill the tube *completely*, through the funnel with *boiling* distilled water, until every bubble of air is driven into the measuring tube of the McLeod.

The stopcock on the bent tube is then shut and the mercury in the pressure tube and the measuring tube of the McLeod brought to the same level. This brings the internal pressure of the air on the short india rubber connecting tube to the atmospheric pressure, and as its volume does not exceed 1 c.c. the correction for its temperature may be safely omitted.

The gas is then measured in the ordinary way, and its volume calculated to weight and per centage.

I find that it is easy to make four determinations of carbonic acid per hour by this apparatus, and the accuracy of the results is very great.

The following are repeat analyses of commercial white lead, taken at random from some hundreds which I have tabulated, and fairly represent the character of the results, since they include the errors incident to determination of temperature, and barometric pressure, as well as those of mere manipulations in the apparatus.

On 25 grains	1st determination CO ₂	12.222	per cent.
in each case.	2nd	12.274	"
	1st	13.836	"
	2nd	13.867	"
	1st	13.322	"
	2nd	13.334	"
	1st	13.228	"
	2nd	13.212	"
	1st	11.707	"
	2nd	11.703	"

In 6 determinations in different weights of calc. spar. the results varied from 43.83 per cent., to 43.92 per cent., as against 44 per cent. theoretical. Assuming the calc. spar. to have been absolutely pure, the loss of carbonic acid only amounted to an average of .10 per cent., 5 grains being about the average quantity used for the analysis.

A METHOD OF DETECTING AND ESTIMATING CASTOR AND OTHER FIXED OILS IN BALSAM COPAIBA.

Read before the Society of Public Analysts, November 15th, 1876.

BY DR. MUTER,

THIS oleo-resin, commonly but wrongly termed a balsam, has been said in books for many years back, to be subject to admixture with fixed oils, especially castor oil. The *British Pharmacopœia* furnishes a qualitative method of examination, but the tests are, in practice, totally insufficient, as the exact degree of rectification of the benzole (an important point) is not stated, and the difference between a pure balsam stain and that with a small percentage of oil is very slight, unless the two are observed side by side. The other methods which have been proposed may be summarised as follows:—

1. Pure balsam gives a translucent and not an opaque emulsion, with strong solution of ammonia.
2. Pure balsam, if boiled with water for some hours, leaves a tenacious resin.
3. The specific gravity.

The latter test is entirely fallacious, owing to the great variation in commercial samples, and the others, though possibly characteristic with large admixtures, fail with anything under 20 per cent.

Observing the close affinity between copaivic and pinic acids it struck me that advantage might be taken of the difference of solubility of the sodium soaps in certain *menstrua*. A very good solvent for sodium pinate has been discovered by M. Barfoed to be a mixture of five parts by volume of *absolute* ether, and one part *absolute* alcohol, which, moreover, only dissolves sodium oleate to an exact extent corresponding to 1 in 1,000 of oleic acid. I will not occupy space by detailing at length the numerous experiments on a great number of samples of balsam, varying in age and colour from every known commercial source, but the whole thing ended in the certain conclusion that besides the essential oil (which is dissipated in the process of analysis) good commercial balsam contains only copaivic acid, which forms a sodium salt, instantly soluble in the ether-alcohol mixture, and a little altered resin not so readily saponifiable, forming a salt only slowly soluble. The amount of this second resin I have found to vary slightly, and, in very old samples, especially of Maranham balsam may sometimes amount to five per cent., although usually really less. Going upon the principle that performing any official analysis the lowest commercial standard should be taken, I have adopted six per cent. as the highest possible quantity of the second resin ever existing in any sample of balsam still having a trace of odour remaining. This wide standard may sometimes lead to an under estimation of the oil by two or three per cent., but renders any over estimation impossible.

The actual process I employ is as follows: 3 to 4 grammes of the sample are weighed into a clean dry flask, and saponified on the water bath with 50 c.c. of alcohol and lump of caustic soda, weighing not less than 5 grammes. When all is dissolved water is added, and the whole washed into a half-pint basin so as to nearly fill it, and evaporated to 100 c.c. over a low gas flame. Dilute sulphuric acid is then added till the whole just becomes permanently turbid, and then solution of caustic soda is dropped in till it *just clears* again. By this means a solution is obtained with the least possible excess of alkali, and with a good amount of sodium sulphate. The whole is now evaporated to *perfect dryness** on the water bath, stirring towards the end, so that the sulphate may mix with the soaps and produce an easily pulverulent residue. The residue is removed from the basin into a small wide-mouthed stoppered bottle, and treated with 70 c.c. of

* The best way to ensure absolute dryness is to moisten the apparently dry residue with a few drops of absolute alcohol and again dry.

ether-alcohol, and well shaken up. As soon as it is fairly settled the fluid is filtered off through a *quick* filter, and this is repeated with two successive quantities of 70 c.c., making 210 c.c. in all of the solvent used. The residue in the bottle and on the filter now consists of sodium oleate and sulphate if the balsam be impure, and of the latter only if pure, with a little trace of the insoluble resin soap already referred to. The contents of the bottle and filter are then dissolved in warm water, and after heating until all smell of ether is gone, the whole is boiled, freely acidulated with hydrochloric acid, and set to cool. If, when cold, nothing but a few specks of brown resin should rise to the surface, the balsam is pure, but if an oily layer be formed, it is adulterated, and the smell of the separated oleic acid will at once determine whether it is actually castor oil or not. In the case of the presence of oil, two grammes of pure and dry white wax are added, and the whole heated till the wax melts with the oleic acid. On cooling, a solid cake is formed, which is detached from the side of the beaker, and the fluid below passed through a filter. The cake is once more melted in boiling water, cooled, detached, dried by gentle pressure in blotting paper, put into the water oven in a weighed platinum dish till dry, and then weighed, and the weight of the wax used deducted. The beaker, filter and rod, &c., used are, if at all dirty, dried, extracted with ether, and the residue, left after evaporation, weighed and added to the total.

The calculation is then performed as follows:—

1. To the weight in grammes found, add .20 for loss of oleic acid in solvent, and then say as

$$95 : 100 :: \text{total oleic acid.}$$

2. Calculate to per cent. from the quantity taken, and from the total percentage deduct six per cent. for possible altered resin in the balsam.

Out of the whole number of samples I have done, I have selected the following twelve, as being fair representations of the degree of accuracy obtainable by the process. The error, owing to the correction, of course increases with the amount of oil present, but it is always an error in the direction of under estimation, which is the great point for public analysts.

Nature of Sample.	Calculated.	Found.
Para (pale)	Pure	No oil drops.
Para (pale)	23.60 per cent. castor	23.50
Old Para (dark)	Pure	No oil drops.
Old Para (dark)	51.0 per cent. castor	50.0 per cent.
Carthage (medium)	Pure	No oil drops.
Carthage (medium)	21.5 per cent. castor	21.20
Maranham (pale)	Pure	No oil drops.
Maranham (pale)	26.5 per cent. castor	26.27
Old Maranham (darkish very little odour)	Pure	No oil drops.
Old Maranham (" ")	47.3 per cent. castor	46.4
Para (fine pale)	Pure	No oil drops.
Para (fine pale)	21.4 per cent. lard oil	20.9

In conclusion, I may say, that the process, although it looks formidable, is in practice very simple, and for all ordinary purposes, if the beaker be well scraped out, the weight of the main cake, may be taken as sufficient to give an analysis true within 3 per cent. *below* the real amount, which is accurate enough for public purposes, and saves time and the expense of the extra ether. Unless oil actually floats *and remains on cooling in fluid drops*, after adding the hydrochloric acid, the sample may be passed as good.

When working on 3 to 4 grammes, with an admixture of not over 25 per cent., the errors due to loss of oleic acid and insoluble resin soap respectively so nearly balance each other, than any correction is unnecessary, and the actual amount of oleic acid found may be taken as correct within a per cent.

Mr. Hehner stated, that he had experience of Barfoed's process for the analysis of resin soaps, and had found it successful, and he had no doubt that if copaiba behaved like resin the process would be reliable.

Dr. Bartlett, thought it a very good process, so long as no other foreign substance was present, but feared that the presence of boric acid might be found to interfere seriously with its accuracy, as he had sometimes found to be the case in soap analysis.

Dr. Dupré, inquired whether the testing of the ethereal solution would give any data for estimating the proportion of added resin (if any).

Dr. Muter, in reply, said he had not yet tested the ethereal solution for resin, so as ascertain if any had been added, but Dr. Dupré must remember, that it is the detection of oil only that the process aimed at, resin being an extremely improbable addition, as it would spoil the balsam.

The instructions in the P.B., were comparatively worthless; while in the new process, if the oil actually did separate, there was proof positive of adulteration.

As to Dr. Bartlett's objection, although borax sometimes occurred in soap, it never existed in balsam copaiba, nor could it be added to that substance without emulsifying it.

DETERMINATION OF THEIN.

Berichte des Deutschen Chemischen Gesellschaft zu Berlin, 1876. No. 14. Page 1312.

CORRESPONDENCE FROM ST. PETERSBURG.

[*Meetings of the Russian Chemical Society on the 6th and 18th May.*]

HERR BUTLEROW (for Herr Märkownikoff), reports on the determination of thein in tea. Since the methods hitherto adopted yield unsatisfactory results, partly because they leave out of consideration the peculiarities of the combinations in which thein exists in the tea-leaf, and partly because they are inconvenient; the author proposes the following:— 15 grams of powdered tea are covered with 500 c.c. water, and then, 15 grams burnt magnesia being added for each 5 grams (tea?), rapidly heated to boiling. The liquid is then filtered, the precipitate washed with hot water, and the filtrate evaporated to dryness, with addition of a little magnesia and sand. The thein is extracted from the residue with hot benzol (in a special apparatus, not described), the latter distilled off on the water bath, and after every trace of it has been removed by a gentle current of air, (from a *blowing-bag*.) the thein is weighed. In the opinion of the author, the want of strict accuracy in the method is due to the possible volatilization of a small quantity of thein, with the benzol vapour. His experiments prove, that the quantity of inorganic constituents, which remain as ash, decreases as that of the thein increases. Since, however, the better sorts of tea are made from younger leaves than the poorer, relatively more thein is contained in the young leaf than in the old.

Herr Märkownikoff is, moreover, of opinion, that the value of tea is determined, not by its thein, but by tannic acid, ethereal oils, and other constituents.

C. A. C.

FLOWER OF TEA; OR, PEKOE FLOWER.

By T. B. GROVES, F.C.S.

Pharm. Journal, [3], 327, p. 285.

It appears from Mr. Groves' paper, that 100 lbs. of a substance bearing the above appellation, was received at the Weymouth Custom House for export to Jersey. A portion of it was sent to the London Custom House for report, and an answer was returned that the article was really tea, that it was not the leaf of the plant, but the pollen of its flower.

On microscopical examination, it was at once seen not to be the pollen of the tea flower, or, any other flower: but to be composed of simple uncellular vegetable hairs, mixed with small fragments of tea leaves, together with sand and probably other extraneous substances.

These hairs, by the assistance of Mr. Holmes, were established to be really the hair of the leaf-buds of the tea plant, and the sample was then handed to Mr. Wigner, in order to ascertain its chemical composition. Mr. Wigner's report, is as follows:—

	Analyses of Tea marked		The average	
	Pekoe Flower.		Analyses of Pekoe.	
	per cent.		per cent.	
Ash soluble in Water	1.15	3.30	...	...
Ash soluble in Acid	4.54	2.60	...	...
Silicious matter	13.04	.30	...	...
Total Ash	18.73	6.20	...	...
Moisture	7.00	7.30	...	...
Extract (soluble in water)	14.65	34.00	...	...
Ash of ditto	2.40	5.00	...	...
Theine	1.50	3.50	...	...
Tannin (Pb. process)	12.00	28.00	...	...

The composition of the ash, was as follows:—

Oxide of Iron	6.01	5.00
Lime	4.83	11.00
Magnesia	2.05	
Potash and traces of soda	4.97	32.50
Oxide of Manganese	1.02	
Sulphuric acid	1.29	4.80
Carbonic acid	7.39	12.00
Chlorine... ..	0.61	
Phosphoric acid... ..	5.33	16.00
Silica	66.18	
Loss in analysis... ..	.32	

100.00

“I have made several unsuccessful attempts to sift the sample. A large portion of the hair has passed through with the dust. The gross ash yielded by the sifted part corresponded tolerably with that of the original sample. The microscope shows much leaf in fragments, and some of these fragments certainly appear to belong to some plant, which is not tea.”

A. W. B.

“GELSEMINIC ACID” AND GELSEMINE.

PROFESSOR SONNENSCHN (Berichte, des deutschen chem. Gessellschaft, jahr ix. Sep. 18. p. 1182) has apparently established the identity of Wormley's "Gelseminic Acid," obtained from *Gelsemium Semper-Virens*, with æsculin $C_{30} H_{34} O_{19}$.

Gelsemine is obtained by treating the alcoholic extract of the root after separation of the resin with basic acetate of lead, filtering, then removing the lead by sulphuretted hydrogen from the filtrate, shaking with ether, and adding potash to an alkaline re-action. The light flocculent precipitate is collected, and purified by redissolving in hydrochloric acid, again precipitating by potash and shaking up with ether. On removing the ether and evaporating it down, Gelsemine is left as an amorphous, almost colourless, alkaline, bitter powder. Gelsemine melts under $100^{\circ}C$ to a colourless liquid, at higher temperatures, it is decomposed; it is freely soluble in ether and chloroform, somewhat soluble in alcohol, but not very soluble in water.

Gelsemine neutralizes acids, but as yet no crystallisable salts have been formed. The chloride is readily soluble in water, and gives precipitates with chloride of gold, iodine in iodide of potassium, potassio mercuric iodide, and platinic chloride.

The best test for the presence of gelsemine is the bright light cherry red colour, which a small portion exhibits, if dissolved in concentrated sulphuric acid, to which a small portion of ceroso-ceric oxide has been added. The formula of gelsemine appears to be $C_{11} H_{19} NO_2$.
A. W. B.

THE BENZOATES IN SUINT.

By ANDREW TAYLOR, F.C.S.

Pharmaceut. Journal. [3] No. 327, p. 272.

MR. ANDREW TAYLOR has made some experiments with regard to the extraction of Benzoic Acid from *Suint*, he distilled in an 80-gallon steam jacketed still, working at a pressure of 20-lbs. to the square inch, equal parts of petroleum spirit and suint, until a ton of the latter had been operated upon. A yellow fatty liquid of sp. gr. 1.2 was by this means obtained, which gave characteristic tests for benzoic and hydrocyanic acids. Eight gallons of this liquid were mixed with about a gallon of hydrochloric acid, and heated in a steam jacket for about an hour and a half, there was a copious evolution of ammoniacal and other fumes, and the residue consisted of a brown liquid rich in benzoic acid. From this $\frac{1}{4}$ -of a pound of benzoic acid was obtained, or nearly three pounds to the ton of suint.
A. W. B.

REVIEWS OF BOOKS, &c.

A SYSTEMATIC HANDBOOK OF VOLUMETRIC ANALYSIS.

By FRANCIS SUTTON, F.C.S., &c., &c.

London, J & A. CHURCHILL, 1876.

THIS is a third edition of this useful work, which has, as the preface states, been out of print for nearly two years. The author specially acknowledges the valuable aid he has received from Mr. Thorp and Professor McLeod, and points out that the latter has, "with characteristic modesty," said but little about his own special improvements in the apparatus for gas analysis. We find a confirmation of this statement in the fact that we do not discover any reference to the last new form of "facet" which Professor McLeod

has devised for his gas analysis apparatus, which though a small improvement, is one certain to be appreciated by all who are in the habit of using the apparatus.

The present edition contains about 50 pages of new matter, some 15 pages of which relate to the analysis of water.

Among the additions, we notice the colorimetric processes for the estimation of iron and copper, which are rightly included in such a work.

Volumetric processes are also introduced for the determination of nickel, cobalt, bismuth, cadmium, uranium, arsenic and bromine. We have not yet been able to form an opinion on these processes, from actual experiments, but they appear to be useful additions to the work. The processes for the determination of zinc and manganese appear to be revised and judiciously extended.

The book appears fairly free from *errata*, but there are two of such importance, that they need a notice here. On page 86 in the description of the indirect process for the estimation of potash and soda, a factor is stated as 0.36288, whereas, if we adopt the equivalents used in the book, namely, Na=23, K=39, this factor will be 3.6562, (or more than ten times as high as quoted.) The mistake is evidently a double one, arising from the misplacing of a decimal point, and the mis-calculation of the factor. The key to the mis-calculation is found on page 330, where, however, the directions for the calculation are again in error.

An alteration in the mode of setting the type in the description of the details of the processes, certainly adds to the convenience of the work as a book of reference. The extra matter (some 15 pages) introduced with reference to the Frankland and Armstrong water process will also be valued by those chemists who adopt that mode of analysis; but we cannot avoid an expression of regret that the much more serviceable process devised by Messrs. Wanklyn, Chapman & Smith, is passed over with only some half dozen pages. This is the more unfortunate, since we believe we are quite safe in assuming that the latter process is at least ten times as much used as the former.

We notice that, under the head of Sugar, our author omits all reference to Polarization, we presume, because it would hardly come within the title of volumetric analysis. Yet all who are in the habit of analysing sugars daily, know well that no other method can be depended on to give results, within two or three per cent.

The processes for Tannin determination are considerably enlarged and improved, and the same remarks will apply to the determination of urea, phosphoric acid, and zinc.

On the whole, the new edition is unquestionably of greater value than its predecessors, and certainly forms by far the most complete *résumé* in the English language of volumetric processes of analysis, and very few such processes, which have any pretensions to accuracy are omitted. We must not forget to mention one great point in the author's favour, namely, the extreme care which has been taken to acknowledge the source, from which the processes have been derived.

WATER ANALYSIS: A PRACTICAL TREATISE ON THE EXAMINATION OF POTABLE WATER.

By J. ALFRED WANKLYN, AND ERNEST THEOPHON CHAPMAN.

FOURTH EDITION.—*Rewritten by J. ALFRED WANKLYN, M.R.C.S., &c., &c.*

London: TRÜBNER & Co.

THIS Edition of the above treatise, has been enlarged and improved in various directions. The work is now divided into three parts: the first part gives direction for "Water Analysis for General Sanitary Purposes;" part two, treats of "Special Analysis, &c.;" and part three, gives "Examples of Complete Mineral Analyses." The directions given are, for the most part, precise and to the point, and we can confidently recommend the little work to all requiring a guide to the analysis of water.

The albuminoid ammonia process, which is the back-bone of the work, has in the course of the last eight years, worked its way into very general use. This cannot, we think, be attributed entirely, or even mainly, to its exceeding simplicity, as some of its opponents allege, but is, we believe, due chiefly to the conviction becoming more and more general among water analysts, that its indications taken in conjunction with a few other constituents of the water, are amply sufficient to guide them to a correct conclusion. In part, however, it must be ascribed to the very complete way in which the process has been placed before chemists by its inventors. Thus we know, for certain, that the presence of even considerable proportions of ammonia, or of nitric acid, is absolutely without influence on the estimation of the albuminoid ammonia. We know also the behaviour of a great variety of nitrogenized substances, when submitted to the process. There is, therefore, a great body of experimental evidence, showing what the albuminoid ammonia process is, or is not, capable of accomplishing.

It is far otherwise, with the rival process of Professors Frankland and Armstrong. Many thousand analyses have been made in Prof. Frankland's laboratory, by means of this process, but as far as we know, not a single experiment has been made, certainly not one has been published, which really demonstrates in a satisfactory manner, the soundness of the method as applied to the analysis of water. Most chemists are, we believe, convinced that, assuming the organic matter to be once inside the combustion tube free from an admixture of nitrates, its carbon and nitrogen can be estimated with an extraordinary degree of accuracy, by means of Frankland and Armstrong's process. The real questions, however, are, firstly: does the process enable us to get the organic matter dissolved in a litre of water into our combustion tube undiminished in quantity, and freed from the large excess of nitrates, with which it is often associated, and secondly, can we make accurate allowance for any ammonia which may be present in the water? None of the published experiments prove these absolutely vital points, and we venture to affirm, that until Dr. Frankland, or some other chemist, supplies this necessary experimental evidence, the combustion process will find but few adherents.

But while thus strongly recommending Mr. Wanklyn's work, we would not be understood as endorsing everything the author advances, for he has committed many sins, both of omission and commission. Thus we believe that Mr. Wanklyn seriously, and most injudiciously, under-estimates the importance to be attached to the presence of nitrates in water, and the same may be said regarding phosphoric acid. The chapter on gases dissolved by water, is most meagre, none of the newer processes for their estimation being given. A special chapter is given to iodates, bromates and chlorates, the latter of which have never yet been found in a natural water, while nitrous acid is only once incidentally mentioned, and no test is given for its recognition, and sulphuretted hydrogen is not even alluded to. Very little information is given respecting the presence of the alkaline chlorides, nothing whatever for example is said regarding the conclusions to be drawn in case either the potassium or sodium chloride is found to predominate. These and like defects, we hope to see made good in the next edition, which, we doubt not, will soon be called for.

In conclusion, we must express our deep regret, that Mr. Wanklyn has introduced controversial matter into the pages of his work; such matter is wholly out of place in a treatise, and when put forward in the manner in which it is here done, it constitutes a very serious blemish in an otherwise most meritorious work.

LAW REPORT.—COURT OF APPEAL.

BIGSBY *v.* DICKINSON.

THIS was an action for the suppression of a nuisance alleged to have been caused by the defendant in the manufacture of sulphate of ammonia and anthracene, and as it possesses some points of interest to chemists, we give a condensed report of it.

The Defendant, Dickinson, manufactures sulphate of ammonia and anthracene in Deptford. The Plaintiff, and other persons, having complained that in so doing he created a nuisance, the local authorities, last year, took summary proceedings before the Police Magistrates to compel an abatement of the nuisance. After hearing the case, it was dismissed on a technical objection, that sulphate of ammonia being "the product of a mineral" its manufacture was exempt from the usual liabilities to prevent nuisance.

The Plaintiff, Bigsby, then applied for, and obtained, two interim injunctions, but on a full hearing, extending over eight days, before Vice Chancellor Bacon, the Bill was dismissed.

The Plaintiff appealed, and the case was heard in the Court of Appeal, before Lords Justices James, Baggallay, and Bramwell, the hearing extending over five days.

The Plaintiff's case was, in effect, that he and his family, at intervals, suffered seriously by the fumes of sulphuretted hydrogen, which were emitted from the Defendant's works, and the evidence of some of the witnesses went to prove that at times certain irritating vapours, of other character, were also evolved.

The Defendant's case was that the nuisance had been greatly exaggerated; that it might have been caused by other factories, and, that the Plaintiff himself, being a varnish maker, would produce large quantities of sulphuretted hydrogen, which would produce the effects of which he complained.

For the Plaintiff numerous witnesses were called, who proved the existence of a serious nuisance, and some of these witnesses actually swore that they were able to trace it to the Defendant's works.

For the Defendant, the general purport of the evidence was that the works were "perfect," and that, except by gross carelessness or wilful negligence, no such nuisance as that complained of could possibly be produced.

On the appeal the Plaintiff applied for, and obtained, leave (which had been previously refused by the Vice Chancellor) to prove that the materials which he used did not, and in fact could not, produce a sulphuretted hydrogen, and proved this fact to the satisfaction of the three Judges.

Their Lordships gave separate judgments, all, however, being in favour of the Plaintiff. The decisions may be summarized as follows:—

That the existence of a serious nuisance arising from sulphuretted hydrogen had been proved. That this nuisance occurred at intervals only, and then mostly at night, when the fires for consuming the waste gas from the Defendant's saturators were likely to be out. That the nuisance did not arise from the Plaintiff's own works. That in some cases the noxious fumes had been clearly traced to the Defendant's works, and finally, that the defence of "perfect" works *only* could be of no avail, because the testimony of a few witnesses, who had smelt the offensive odours, was necessarily of more value than the evidence of hundreds of witnesses who had failed to do so.

The judgment of the Court below was, therefore, reversed, and an injunction given in the terms of the Plaintiff's Bill.

The Analysts engaged in the case were for the Plaintiff, Mr. Heisch, the late Dr. Letheby, Dr. Voelcker, Messrs. Wigner and Wanklyn. For the Defendant, Messrs. Campbell, Manning, Tribe, and Dr. Wright.

The case will form a valuable precedent for the future suppression of such nuisances.

RECENT CHEMICAL PATENTS.

The following specifications have been published during the current month, and can be obtained from the Great Seal Office, Southampton Row, Chancery Lane, London.

No.	Name of Patentee.	Title of Patent.	Price.
656	E. Hunkler	Varnish	8d.
670	J. Firth	Dyeing	6d.
708	N. C. Cookson	White Lead	4d.
854	S. G. Thomas	Roasting and amalgamating Ores	6d.
858	M. H. Strong	Manufacture of Gas	6d.
903	Cammack & Walker	Manufacture of Sulphates of Soda and Potash	6d.
1003	L. T. Wright	Revivifying Foul Gas Lime	2d.
1068	H. E. Newton	Colours used in ornamenting Glass	2d.
1106	C. T. Ashmore	Baking Powder	2d.
1121	C. Muratori	Manufacture of Paints	2d.
1157	S. S. Lewis	Soap	2d.
1172	Archbold Cooper & Wanklyn	Distilling Spirits	2d.
1194	W. R. Lake	Manufacture of Nickel from its Oxides	6d.
1196	A. M. Clark	Air and Waterproof Fabrics	2d.
1229	J. H. Johnson	Preparing Colouring Matters for Dyeing	4d.
1278	C. Reimer	Obtaining Aldehyds from Phenols	2d.
1293	E. P. H. Vaughan	Manufacturing Sugar	2d.
1355	F. Hills	Treating Sewage	4d.
1368	J. Riley	Manufacture of Soda Ash	2d.
1541	H. E. Newton	Revivifying Animal Charcoal	4d.
1652	J. Fleming	Vulcanized India Rubber Types, Stamps, &c.	2d.
1567	E. Oliver	Disinfectants for treating Fibrous Materials	2d.
1596	J. Hooker	Mixing Cocoa, Corn Flour, &c., with Milk	2d.
1597	J. Hooker	Prepared Milk	2d.
1682	H. L. Jones	Disinfectants and Deodorizers	4d.
1704	B. Fixsen	India Rubber and Gutta Percha Compounds	4d.
1705	D. C. Lowber	Disinfecting and Packing Manure	2d.
1714	A. Blake	Treating Grains	4d.

FINES FOR OFFENCES AGAINST THE "SALE OF FOOD AND DRUGS' ACT,"
IN IRELAND.

D. Farrell, for refusing to serve an Inspector	£5 0 0
P. Nolan, for selling milk adulterated with 25 per cent. of water	4 0 0
T. Lambert, for selling milk adulterated with 20 per cent. of water	3 0 0
W. Barry, for selling milk adulterated with 30 per cent. of water	5 0 0
L. Woods, for selling milk adulterated with 20 per cent. of water	3 0 0
P. Murphy, for refusing to serve an Inspector	10 0 0
P. Behan, for refusing to serve an Inspector, (with the alternative of imprisonment with hard labour for three months)	5 0 0
P. M'Arabe, for selling milk adulterated with 20 per cent. of water	3 0 0
Kate Kenna, for selling milk adulterated with 50 per cent. of water	9 0 0
J. Doran, for selling milk adulterated with 20 per cent. of water	3 0 0
G. Keogh, for selling milk adulterated with 20 per cent. of water	3 0 0
J. Cullen, for selling milk adulterated with 20 per cent. of water	3 0 0
P. Brookall, for selling milk adulterated with 10 per cent. of water	3 0 0
J. Lencham, for selling milk adulterated with 30 per cent. of water	5 0 0
M. Maguire, for selling milk adulterated with 30 per cent. of water	5 0 0

We take the foregoing fifteen cases from the *Irish Times*, of the 3rd inst., and seeing that they were all tried on the same day, that the analyses were all performed by one analyst (Dr. Cameron), and that the fines amount in the aggregate to £69, we think the tabulated report will be of interest to some of our English brethren, in whose districts, for similar offences as those detailed above, half-crown and five shilling fines obtain.

PROSECUTIONS UNDER THE SALE OF FOOD AND DRUGS' ACT.

AT MARLBOROUGH STREET.—Mr. Edwin Holland, cheesemonger, 2, Goodge Street, was summoned before Mr. Knox for selling adulterated butter. Mr. Ricketts prosecuted, Mr. Flegg defended. Mr. Ricketts stated that the butter purchased at the defendant's shop was found to be adulterated to the extent of 75 or 80 per cent. Mr. Knox asked if there was any suggestion that the adulteration contained anything injurious to health. Mr. Ricketts replied there was not. The case was that there was grease of some sort, not butter. Mr. Flegg said the defendant had bought the butter in the State he sold it from a firm in West Smithfield. The practice of the firm was to send to customers a man with a van. It was impossible for the defendant to make an analysis on the spot of butter sent to him as he wanted it for immediate sale. He was in the habit, however, of applying at once a particular test by inserting a knife, and when the knife was withdrawn, if fat adhered to it the butter was held to be good butter. The defendant applied this test and found it, as he supposed, to be good butter. He asked the man who came with the van for good butter, and the man said the butter he gave him was good. As soon as he knew he was to be summoned, he wrote to the firm who supplied the butter, Messrs. Garstin & Co., West Smithfield. The answer he received was to the effect that they did not sell such goods as butter, but as "bosh." The defendant had done all he could be fairly expected to do in testing the butter, and that the wholesale dealers ought to be the persons summoned. Mr. Ricketts said the defendant had not protected himself as he might have done by a warranty. Mr. Flegg said a warranty was not given with foreign butter. John Brown, the defendant's foreman, said he bought the butter in question of a man named James Franklin, in the employ of Messrs. Garstin & Co., West Smithfield, and on testing it in the usual way he found it waxy. If butter was of inferior quality it would be found "sticky" when rubbed between the fingers. Before completing the purchase he asked Franklin if the butter would stand the test, and Franklin replied quite indignantly, "Stand the test?—yes;" and he then bought the butter at 11s. per cwt. and sold it at 14d. per lb. They got more profit on good butter than on bad or inferior butter. Replying to Mr. Ricketts, witness said the best fresh butter was sold at 2s. per lb. This butter was salt, and the best Dorsetshire salt butter sold for 1s. 6d. per lb. The defendant, on being sworn, said he had been in business about seven years. The man who bought the butter in question asserted that it would stand the test, and it did so. It was more to the defendant's interest in the way of profit to sell real butter than bad butter. He never had a guarantee from Messrs. Garstin and Co., and they never would give one. Mr. Ricketts reminded the defendant of the printed notice he had stuck on the butter—that a warranty would not be given. The defendant said a person came round to shops with printed labels, and he bought some. He had never taken any butter he bought to the analyst to be analysed. Mr. Knox thought it was asking him too much to say that a man who had been in the trade for seven years did not know what he was buying. He did not mean to say a man in trade was bound to know everything at once, but the defendant, if he had doubts, ought to have taken the butter to the analyst without delay. The public looked upon the retail dealer as responsible for the quality of the goods he sold. The defendant was fined £5 and costs.—Mr. Abraham Hunt, 41, Goodge Street, was summoned for a similar offence. The certificate of the analyst stated that the adulteration matter was 80 per cent. The defendant said the butter was just as he received it from the wholesale dealer in the City, and he had placed a notice on the butter stating that it was adulterated. Mr. Knox fined the defendant £5 and 2s. costs.—*The Times.*

THE ANALYST.

THE SOCIETY OF PUBLIC ANALYSTS AND ITS CENSORS.

THE following four extracts—three from the *Local Government Chronicle* and one from the *Medical Examiner*—will probably be read with some amusement.

It will be seen that according to the same authority, on the 2nd instant the Society was in a state of “disintegration” and “dissolution,” that on the 16th it had so far improved that our contemporary was enabled to state that it would “still continue its course of usefulness,” but unfortunately by the 23rd it had suffered a relapse, and was again in a state of “disintegration.”

It is difficult to account for these fluctuations, but we think the notice in the *Medical Examiner* is a sufficient answer to the *Local Government Chronicle*, if any reply were needed, on which point we leave our readers to judge.

LOCAL GOVERNMENT CHRONICLE, *December 2nd, 1876.*

The Society of Public Analysts appears to be in process of disintegration. At a meeting held last week, at Burlington House, on the motion to confirm the minutes of the meeting held at Glasgow, an amendment was proposed and carried to omit therefrom the resolution censuring the *Analyst* journal for an article on Professor Dittmar. This resolution has, it is rumoured, led to the resignation of the president, vice-president, and treasurer, and will, with the dissention of which it is the outcome, it is feared, bring about the dissolution of the Society.

LOCAL GOVERNMENT CHRONICLE, *December 16th, 1876.*

THE SOCIETY OF PUBLIC ANALYSTS.—In reference to a paragraph which appeared in our issue of the 2nd instant, we have authority to state that the Society will still continue its course of usefulness, notwithstanding the secession of certain dissentient members. The Society has during its short existence done good work, and it would be a great pity were its labours to come to an end through a want of harmony or personal ill-feeling. The next meeting of the Council will take place in January, when Dr. Dupré, who has been nominated, will probably be elected president for the ensuing year.

MEDICAL EXAMINER, *December 14th, 1876.*

THE SOCIETY OF PUBLIC ANALYSTS.—The *Local Government Chronicle* of the 2nd inst. contains a paragraph in reference to the above Society, which would appear to be either the result of guess-work or of sinister inspiration, at any rate so far as the probable “disintegration” of the Society is concerned. That certain officers have resigned is, no doubt, true; but that any resolution was passed at the Glasgow meeting censuring the *Analyst* for its remarks on Mr. Dittmar—about whose individual opinion on the matter of butter, it appears to us, a great deal of unnecessary fuss has been made—is, we believe, entirely a mistake. It is not an infrequent, in fact it is an almost inevitable occurrence, that soon after the formation of a new Society it is found to contain certain incongruous elements; and an amount of weeding out becomes necessary. It generally happens, however, that at the right moment the desired end is attained by the requisite number of voluntary retirements; and in this case, if, as we understand, a very distinguished chemist has consented to allow himself to be nominated as president for the coming year, and if, as we also believe, the Council is likely to be considerably strengthened, we may fairly hope that the “dissolution” of this Society, which has already done much good, may, in spite of the secession of three or four of its members, and of the prophecy of our contemporary, not be so very imminent after all.

LOCAL GOVERNMENT CHRONICLE, *December 23rd, 1876.*

THE SOCIETY OF PUBLIC ANALYSTS.—Under this title a paragraph appeared in the *Medical Examiner* of last Saturday, in which a statement in the *Local Government Chronicle* was said to be “the result of guess-work or of sinister inspiration.” We readily acquit our usually careful contemporary of intentional discourtesy. The Editor of the *Medical Examiner* can hardly need to be told that the *Local Government Chronicle* does not deal in guess-work, or knowingly admit of sinister inspiration; and the very improper paragraph must have been admitted by an oversight. On the writer of the paragraph it would be idle to waste a word. With any one who could fabricate, or even imagine, such a charge, the *Local Government Chronicle* can have no concern. As to the particular statement at which offence was taken, it is enough to say that we merely repeated what was common talk in well-informed circles, and had, in effect, already appeared in other journals. That a Society from which its president, vice-president, and treasurer, with all their following, had at one stroke, fallen away, had made some progress in “disintegration” it scarcely needed, as the writer oddly supposes, the gift of “prophecy” to determine.

NOTES ON A CLASSIFICATION OF THE CHIEF STARCHES EXISTING IN,
OR ADDED TO, ARTICLES OF FOOD AND DRUGS TO FACILITATE
THEIR DETECTION.

By Dr. MUTER, F.C.S. *Read before the Society of Public Analysts, November 15th, 1876.*

HAVING at the moment in the press an illustrated work on the starches, specially for the use of analysts, I have thought that a few tabulated hints, read before you in advance of the book, would be useful for aiding the memory of such of my colleagues as have not had the time to make a speciality of microscopy to any great extent. The following table is arranged as a sort of analytical chart, and is such as I have for some years used in teaching microscopy to my students. I do not say, but here and there, granules may be found which do not quite follow my measurements and chief distinctions, but all analysts must know, that it is by the majority of the granules that starches should be judged. The measurements given, are those of such majority, leaving out extremes, which are duly treated of in the forthcoming book. The Table depends on the use of a $\frac{4}{10}$ objective, and a "B" micrometer eye-piece, which gives a power of about 230 to 240 diameters, and I should like to impress upon all that this extent of enlargement is quite sufficient. Indeed any further power is not only unnecessary, but mischievous, for an analyst's daily use. The arrangement into classes is of course purely one of convenience, but whatever scientific objections may be taken to it, it is at least, so far as I know, perfectly original, and very useful in practice for assisting the memory. The measurements are condensed from those in my coming work, and are the result of the examination of more than 1000 commercial samples. Modified by the extremes, when the book is published, they can be implicitly relied on.*

TABLE FOR THE DETECTION OF STARCHES WHEN MAGNIFIED ABOUT 230 DIAMETERS.

All measurements are given in decimals of an inch.

GROUP I.—All more or less oval in shape, and having both *hilum* and *rings* visible.

NAME.	Shape.	Normal Measurements.	Remarks.
TOUS LES MOIS	Oval with flat ends	·00370 to ·00185	Hilum annular near one end, and incomplete rings
POTATO	Oval	·00270 to ·00148	Hilum annular, rings incomplete, shape and size very variable
BERMUDA ARROWROOT.	Sack shaped	·00148 to ·00129	Hilum distinct annular, shape variable, rings faint
ST. VINCENT DO.	Oval-oblong	·00148 to ·00129	Hilum semilunar, rings faint, shape not very variable
NATAL DO.	Broadly ovate	·00148 to ·00129	Hilum annular in centre and well marked complete rings
GALANGAL	Skittle shaped	About ·00135	Hilum elongated, very faint incomplete rings
CALUMBA	Broadly pear shaped	„ ·00185	Hilum semilunar, faint but complete rings, shape variable
ORRIS ROOT	Elongated-oblong	„ ·00092	Hilum faint, shape characteristic
TURMERIC	Oval-oblong, conical	„ ·00148	Very strongly marked incomplete rings
GINGER	Shortly conical, with rounded angles	„ ·00148	Hilum and rings scarcely visible, shape variable, but characteristic

GROUP II.—With strongly developed *hilum* more or less stellate.

NAME.	Shape.	Normal Measurements.	Remarks.
BEAN	Oval-oblong	About ·00135	Fairly uniform
PEA	Like bean	From ·00111 to ·00074	Very variable in size, with granules under ·00111 preponderating
LENTIL	Like bean	About ·00111	Hilum, a long depression, seldom radiate
NUTMEG	Rounded	„ ·00055	The small size, and rounded form distinctive
DARI	Elongated hexagon	„ ·00074	Irregular appearance and great convexity distinctive
MAIZE	Round and polygonal	„ ·00074	The rounded angles of the polygonal granules distinctive

* The expression *complete* rings, means those in which the entire circle is visible on one side of the granules, and *incomplete* when segments of a circle only are seen. I have limited the number of starches in the present abstract to 48.

GROUP III.—Hilum and rings, practically invisible.

NAME.	Shape.	Normal Measurements.	Remarks.
WHEAT	Circular and flat	·00185 to ·00009	<i>Very variable</i> in size, and <i>very dull</i> polarization in water
BARLEY	<i>Slightly</i> angular circles	·00073 and a few four times this size	The majority measuring about ·00373 distinctive
RYE	Like barley	·00148 to ·00009	Small granules quite round, and here and there cracked
JALAP	Like wheat	Like wheat	Polarizes <i>brightly</i> in water
RHUBARB	Like wheat	·00055 to ·00033 for small	Polarizes between jalap and wheat, and runs smaller and more convex
SENEGA	" "	·00148 to ·00009	} Measurements the only guide
BAY BERRY	" "	·00074 to ·00011	
SUMBUL	" "	·00074 to ·00009	
CHESTNUT	Very variable	·00090 to ·00009	Variable form and small, but regular size, distinctive
ACORN.....	Round-oval	About ·00074	Small and uniform size distinctive
CALABAR BEAN.....	Oval-oblong	·00296 to ·00180	Large size and shape characteristic
LIQUORICE	Elongated-oval	About ·00018	Small size and shape distinctive
HELLEBORE (Green or Black)	Perfectly rotund	·00037 to ·00009	Small regular size and rotundity, distinctive
HELLEBORE (White) ...	Irregular	·00055 to ·00009	Irregular shape and faint central depression, distinctive

GROUP IV.—More or less truncated at one end.

NAME.	Shape.	Normal Measurements.	Remarks.
CASSIA.....	Round	·00111 to ·00018	Round or muller shaped granules, and faint circular hilum
CINNAMON	Like cassia	·00074 to ·00009	More frequently truncated than cassia, and smaller
SAGO (raw).....	Oval-ovate	·00260 to ·00111	Has circular hilum at convex end and rings faintly visible
SAGO (prepared).....	" "	" "	Has a large oval or circular depression, covering $\frac{1}{3}$ nearly of each granule
TAPIOCA	Roundish	·00074 to ·00055	A little over 50 per cent. truncated by <i>one</i> facet, and a pearly <i>hilum</i>
ARUM	Like tapioca	About ·00056	Smaller than tapioca and truncated by <i>two</i> facets
BELLADONNA ...	" "		Not distinguishable from tapioca
COLCHICUM	" "	·00074 (about)	Larger than tapioca, and contains many more truncated granules
SCAMMONY	" "	·00045 (about)	Smaller than tapioca, more irregular, and <i>hilum</i> not visible
CANELLA.....	Very variable	·00033 to ·00022	Very variable form, and small size the only points
PODOPHYLLIN.....	Like tapioca	About ·00010	Like scammony, but has visible hilum in most of the granules
ACONITE	" "	About ·00037	Like tapioca. but half the size

GROUP V.—All granules more or less polygonal.

NAME.	Shape.	Normal Measurements.	Remarks.
TACCA	Poly or hexagonal	·00075 to ·00037	Distinguished from Maize by its <i>sharp</i> angles
OAT.....	Polygonal	About ·00037	Larger than rice and hilum visible in some granules
RICE	„	·00030 to ·00020	Measurement using 1.8 or 1-12 inch power, and then hilum visible
PEPPER	„	·00020 to ·00002	Ditto ditto ditto
IPCACUANHA.....	,	About ·00018	Some round and truncated granules, adhering in groups of three

Mr. Allen, spoke as to the use of glycerine, versus water, as a mounting medium, and also as to the discrimination between starch of rice, and of pepper. He found that rice lumps, not too much crushed, would polarize well. He had also based the detection on an estimation of the woody fibre, as he had found, that while rice only gives 1 per cent. woody fibre, pepper yields 6 to 8 per cent. of that constituent, and any deficiency thus easily shows adulteration.

Dr. Dupré, spoke as to the ashes of different starches.

Mr. Wigner, agreed with Dr. Muter, as to the great usefulness of the 4-10 power, and also of a contracting diaphragm.

Dr. Muter, in reply, stated, that he was experimenting on the bursting point of starches in hot water, as an additional means for their detection, but he had not yet come to a conclusion on the point. His favourite mounting agent for preservation was, 1 part glycerine, and 2 parts camphor water. He considered that the only really accurate method of detecting rice in pepper, was by measurement, using 1-12 inch objective and a micrometer eye-piece. Day light only should be used for examining starches, and the illumination should always be more or less oblique.

OFFENCES AGAINST THE SALE OF FOOD AND DRUGS' ACT.

ADULTERATION BY CHEMISTS.—Three prosecutions took place at Runcorn against three chemists named Marshall, Speakman, and Brown, for selling milk of sulphur.—Mr. Glaisyer, of Birmingham, defended at the instance of the Chemists and Druggists Trade association.—Dr. Bell, of Manchester, stated that the milk of sulphur purchased from the defendants was adulterated with sulphate of lime 58½ per cent., and in one case 65.—For the defence Dr. Pemberton, of Birmingham, and Dr. Redwood, of London, Editor of the "British Pharmacopœia," were called, and spoke to the general use of milk of sulphur being such that it was much more beneficial when mixed with sulphate of lime.—Messrs. Evans, wholesale druggists, of Liverpool, said they sold thirteen times more milk of sulphur than of the other preparation. Milk of sulphur was known to contain sulphate of lime, and was extensively used by the medical profession. The Bench decided to convict, on the ground that the article was not supplied that was asked for. In each case a fine of £1 and costs was inflicted. Mr. Glaisyer gave notice of appeal in each case.—*Standard*.

BUTTERINE.—Charles Theobald of 20, Regent Street, Westminster, was summoned for that he did on the 20th inst., sell to Owen Williams, an officer of the Board of Works for the Westminster district, an article not of the quality, nature, and substance demanded by the purchaser.—Mr. Warrington Rogers prosecuted.—The evidence showed that the officer, having asked for a pound of butter, was served, and, on his telling the son of the defendant that it was for the purpose of analysis, the reply was that it was not butter, but "butterine," which was not sold as the natural production of the cow.—The certificate of Dr. Dupré, the analyst, showed that there was only 10 per cent. of real butter; the other 90 per cent. was composed of the fat of various animals.—The defendant urged that he ought not to be bound by what his boy, only 12 years of age had said. He himself had been in the shop only 6 days, and had purchased the stock of the outgoing tenant, so that he was perfectly innocent of any attempt at fraud, and any deception lay with his predecessor.—Mr. Woolrych having cautioned the defendant as to his future conduct, recommended the withdrawal of the summons, as the defendant had evidently acted in ignorance.—Mr. Rogers accordingly withdrew the summons.—*Daily Telegraph*.

NOTES ON SOME PECULIAR MODIFICATIONS OF ANIMAL FATS, THE
RESULT OF FERMENTATION AND DIGESTION OF THE NEUTRAL
FATS OF FOOD PRIOR TO AND DURING ASSIMILATION.

By H. C. BARTLETT, PH.D., F.C.S.

DURING a very prolonged series of analytical experiments, undertaken at the request of the late Dr. Bence Jones, for the purpose of elucidating the principles of the digestion of food, some very curious results have been brought to light. Among others, the partial transformation of the neutral fats into volatile and soluble fatty acids has a direct bearing upon butter analyses, and on that account, may prove of greater interest to the Society of Public Analysts.

In July or August, 1873, I was able to announce in a letter to *The Times*, that butter could be analysed to detect 20 per cent. of adulteration with neutral fats. The presence of foreign neutral fats in butter is usually indicated by palmitic and stearic crystals, but no dependance can be placed upon the microscopic examination, except as affording very valuable occasional hints. The tolerably constant proportion of the so-called "butyrine," in pure butter, has been held to distinguish the unmixed fat of milk from the ordinary neutral fats commonly employed for adulterating butter. The experiments of Messrs. Hehner and Angell, Dr. Muter, and Dr. A. Dupré, have taken the accuracy in estimating this description of adulteration, far beyond the modest pretensions claimed by me three years ago. I must confess, I have now some reluctance in bringing forward all the details of the transformation of neutral fats into volatile fatty acids, because it may be used as a means of weakening the present confidence in being able to state with certainty, that any sample of butter is absolutely pure and unmixed. The actual means of adulteration derivable from my description of this transformation, is however, so unlikely to be adopted, on the score of the expense and skill required, that I have but little fear of the present method of butter analysis being brought into disrepute, or doubt, in consequence. As a matter of fact, we must not assume that all the animal fats of the body, except butter, are composed of varying mixtures of tri-stearate, palmitate, and oleate of glycerine only. On the contrary, I find the fatty components of most of the glands, contain a considerable proportion of volatile fatty acids combined with glycerine. These are, perhaps, not true synthetical reproductions of the glycerides, but as compounds of soluble fatty acids and glycerin, resulting from the decomposition of the natural saponification during digestion, they are almost identical with the similar compounds released from butter by the artificial means now used for butter analysis.*

The analysis of a large number of pancreatic glands taken from pigs, dogs, calves, and other animals, first led to this peculiarity being observed. Indeed, the fat extracted from such glands is very difficult of separation from water by drying, even at low temperatures in the water-bath. The loss of weight is so continuous by the vapour of water carrying off the volatile acids, that no absolutely steady weighings can be taken until the oxidation of the fat just counterbalances the evaporation of the volatile oils. I need not observe, that when this point is reached the whole analysis is spoilt.

* The transformation of neutral fats by fermentation into volatile fatty acids, appears also to be supplemented by an after reaction of synthetical reproduction of the neutral fat.

To estimate the proportion of volatile oil in the fat extracted, I use potash and alcohol for saponification, and decompose with dilute acid, sulphuric or hydrochloric. This being accomplished in a retort, the condenser is luted tight, and the aqueous liquid distilled over until an exact fourth is left. To this, fresh water is added, and the distillation continued as long as the water condensed gives any acid reaction.

A hectogramme of fat produces about five times that amount of a milky liquid, on which, drops of oil and particles of a harder fat float. Baryta water is added to the distillate which is returned to a cleansed retort and again distilled down to about 5 per cent. of its original bulk, after which it is evaporated to dryness in vacuo, at a temperature of 45 C.

The barium salts thus obtained are in triplicate, one series being easily soluble, the intermediate salts less so, and the third somewhat difficult of solution. I have not yet succeeded in separating these, each in sufficient purity from the others, to be able to speak with certainty as to their exact identity with the caprates, butyrates, caprylates, and caproates of butter. The crystallization and resemblance to benzoate of calcium, together with the absence of efflorescence of the second series of salts appear to confirm the presence of caproic acid. The minute crystalline scales like spermaceti, are most difficult of solution, and are, I think, undoubtedly caprates, which after recrystallization leaves the caprylates dissolved in the mother liquor.

A barium salt so highly soluble as to be taken up in 2.5 parts of distilled water is also found, which resembles a butyrate, but differs from butyric acid, when decomposed with dilute sulphuric acid, both in taste and smell.

The total of volatile soluble fatty acids contained in the fatty extract of some glands appears to vary from 4 to 7 per cent., I am, however, under the impression that I shall obtain a larger proportion than this, as there is an evident loss during some processes of the analyses.

Not only is a considerable quantity of volatile and soluble fatty matter to be obtained from the pancreatic and other glands, but the same may be found during the digestion of fat in the intestine, and particularly at the time of absorption. From this I was induced to conclude that the transformation of a portion of neutral fats into fatty acids and glycerin, by the pancreatic and other digestional fluids is the result of fermentation.

We know that the stimulating principles of the pancreatic and other digestive juices are true ferments. These ferments are different to the alcoholic ferment of yeast, being incompetent to their own reproduction by the organised development and multiplication of cells. They are, however, thrown off by the organism of the digestive glands, and resemble very closely that soluble nitrogenous matter discovered in the water in which yeast has been washed after it has been filtered free from any of the cells. Just as the inversive ferment from yeast washings splits up cane sugar by hydration into glucose and lævulose, converts starch into glucose and dextrin, so the neutral fats are split up into fatty acids and glycerin in the presence of water by the soluble inversive ferments of the digestive fluids of the animal body. This only takes place in the presence of the alkaline salts of bile, and only after being worked, with the full fermentative vigour of healthy pancreatic principles.

With these, the neutral fats of food are emulsified to a fineness of globular form exceeding that of milk, and a slight saponification continues to be produced in the intestine, which natural soap is rapidly and continuously decomposed so as to set free the soluble and volatile fatty acids.

Neutral fats were taken and most carefully tested for the presence of volatile fatty acids, none being found. The same fat was given to dogs, which were killed from 6 to 8 hours afterwards, and the fat, digesting and absorbed, was again tested and contained considerable quantities of these soluble fatty matters.

Outside the living animal digestion of fat, a somewhat similar transformation can be accomplished by obtaining the proper description of inversive ferment, and closely imitating the natural processes. Pancreatin taken during digestion and not injured by heat or any admixture will produce an emulsion in fat or oil precisely similar to that in the living body. The preacreatin must, however, be in itself perfectly soluble in water, or the emulsion will neither be permanent nor sufficiently fine to permit of any saponification at a low temperature. This can also be accomplished by the addition of a solution of healthy bile at 45° C., after which, dilute hydrochloric acid liberates traces of soluble fatty acids and glycerin.

It is not necessary, or even advantageous, to use the crude extractive of bile for this purpose, soda, a trace of glyco-cholic acid being equally efficacious if the pancreatic emulsion has been really complete.

A great misconception as to the real characteristics of a true pancreatic emulsion has been entertained by many, and but few appear to have studied the different aspects presented by such an emulsion as is produced on fat by the energetic action of pure soluble pancreatin, as contrasted with the coarse mechanical mixtures of oil or fat and water which are commonly supposed to represent this result of fermentative digestion.

Some seem to think that if a bottle of oil is shaken up with the compounds sold as the active principle of the pancreas, and a yellowish cloud is diffused for a time through the oil, an emulsion has been obtained. So it has, but not the true pancreatic emulsion, which forms an integral portion of the process by which fats are digested and assimilated. From the unvarying result of many hundred trials with the pure, active principles of healthy pancreatic fluid, taken at the time of digestion, I am perfectly convinced that no valuable result has been obtained unless the slightly saponified emulsion formed is as highly refractive of light as milk. The colour may vary, according to the oil or fat used, from a far whiter fluid than the densest milk to the opacity and colour of Devonshire cream; but unless at least the density of the best milk be attained, when a third of water is held in suspension no real pancreatic emulsion has been formed.

The effect of fermenting neutral fats containing none but fixed fatty acids for a lengthened period is invariably to produce still larger quantities of the volatile matters. In such cases they are accompanied by so nauseous a development of putrefactive decomposition, that this alone would preclude the artificial manufacture of fat similar to butter.

As I find other fats in the animal body besides butter to contain soluble fatty acids, and that this transformation of neutral fats can be carried on artificially, Analysts will do well to bear the fact in mind when giving evidence.

CHEMICAL SOCIETY.—*Dec. 7th.*

A COLOURING matter obtained from the stems and leaves of a well-known exotic plant, the *Coleus Verschaffeltii*, was described by Professor Church. Colein (for such is the provisional name assigned to this substance), is extracted from the crushed stems by means of alcohol, faintly acidulated with sulphuric acid. By filtration and evaporation the crude colein separates in a resinous form, plastic when plunged in water of 50° to 60° C.; it may be purified by solution in a small quantity of strong alcohol, and precipitation by means of absolute ether. Re-solution in alcohol and re-precipitation and washing with water at 50° completes the removal of foreign matters. Very numerous analyses of Colein have been made by the author of the paper, and he has been led to the formula $C_{10}H_{10}O_5$ for the substance itself, and to $C_{20}H_{18}PbO_{10}$ for the lead compound. Professor Church is strongly inclined to regard Colein as identical with the cenolin obtained from red wines by Glénard, and with the cyanin, anthocyan, and erythrophyll of other experimenters. Differences in the spectra shown by these bodies may be traced to the presence of other substances, as sugar and saline matters; to the acid, neutral or alkaline re-actions of the solutions, and to the nature of the solvents. The paper was illustrated by a diagram showing the distribution of colein in the stem of the plant, and by the exhibition of various re-actions and absorption-spectra by means of the lime-light.

ON THE ANALYSIS OF PLATING AND GILDING SOLUTIONS.

By ALFRED H. ALLEN, F.C.S.

IN Sheffield and Birmingham, where the electro-deposition of precious metals is carried on extensively, the consulting chemist is frequently called on to assay samples of the liquors used for electro-depositing gold or silver. The liquors consist essentially of double cyanides, but it is erroneous to assume that any particular sample will only contain a single heavy metal. Thus, the ordinary electro-plating liquid—consisting chiefly of the double cyanide of potassium and silver ($KCy + Ag Cy$), on being acidified, gives a precipitate nearly always more or less coloured pink by cupric ferrocyanide, the formation of which indicates the presence of both iron and copper in the solution. For this reason also it is impossible to determine the silver as cyanide by adding an acid, and subsequently weighing the precipitate formed, or converting it into metal. In short, the presence of cyanides renders most of the ordinary methods of analysis inapplicable to the assay of silver in plating solutions.

The method I have been in the habit of employing for the determination of silver in cyanide solutions is as follows:—A definite measure of the sample liquid is largely diluted with water, and the whole raised to boiling. Sulphuretted hydrogen is then passed through the liquid, or sulphide of ammonium gradually added. The silver falls as a black sulphide, which filters and washes well, and, according to the books, is free from copper. This, however, is not always the case, while any zinc which may have been present is sure to be thrown down. On this account I never weigh the precipitate, but always treat it further. For a long time I was in the habit of treating it with nitric acid, filtering from undissolved sulphur, and precipitating the silver from the solution as chloride. A more recent and shorter plan, and one which is quite as satisfactory, is as

follows:—The washed sulphide of silver is rinsed off the filter into a flask or beaker, and treated with excess of bromine water, which converts it rapidly and completely into silver bromide.* If any sulphur appear to have separated, a drop of bromine should be added to the residue, so as to ensure complete oxidation. Boiling water is now added, and the silver bromide is washed, dried, fused, and weighed. The high atomic weight of bromine gives this form of weighing silver some little advantage over the chloride.

I have been unable to devise a satisfactory and rapid method of determining, in the wet way, the gold of gilding solutions containing cyanides. The following method, however, leaves nothing to be desired:—A measured quantity of the gilding solution is introduced into a porcelain crucible, and cautiously concentrated; when in a syrupy condition, a few grammes of pure red lead or litharge are added, and the evaporation is continued to complete dryness. There is little or no tendency to spitting. The crucible containing the above residue is covered, and raised for a short time to a moderate red heat. The oxide of lead is reduced by the cyanide present, with production of metallic lead and cyanate, and the reduced metal unites with the gold. The resultant button of metal is separated from the slag, and the gold obtained either by cupellation or treatment with pure nitric acid.

Electro-silvering solutions can be analysed in a precisely similar manner, but of course, in this case, treatment of the rich lead with nitric acid is inadmissible, and cupellation must be resorted to.

The amount of precious metal found in an electro-depositing solution is commonly reported in troy ounces, pennyweights, and grains per pint of solution. Some clients expect to have the excess of solution returned, or else want to deduct its value from the amount of the fee!

ON BIRCH-WATER.

By OTTO HEHNER, F.C.S.

IN Spring few trees exhibit so prominent marks of vitality as does the common birch (*Betula alba*). In March and April the sap rises with extraordinary power and in great quantity, and freely escapes from any wound which may be inflicted on the tree. This juice, Birch-water, is in some parts of Germany allowed to ferment, when it is said to yield an agreeable mild, alcoholic beverage.

Having collected a large quantity of this liquid, I found its chemical composition to be as follows:—

Acidity, calculated as Acetic Acid...	...	...	0.0156 per cent.
Total solid residue	...	...	1.8255 „
Mineral Matter	...	...	0.0646 „

The solid residue included 0.0176 per cent. of Nitrogen and 1.10 per cent. of Glucose, cane sugar being entirely absent. The juice turns the plane of polarisation to the left, 0.2.

* I hope shortly to be able to give an account of some experiments on the oxidation of metallic sulphides by bromine water. I may say now that the precipitated sulphides of zinc, nickel, lead, and silver, are almost instantaneously oxidised by bromine water. Sulphides of bismuth, antimony, arsenic, copper, and mercury, are almost as readily acted on. Even sulphide of platinum is completely soluble. I believe I shall shortly be able to point out some instances in which this action of bromine on the metallic sulphides may be very advantageously employed both for qualitative and quantitative purposes.

The mineral matter was composed as follows:—

Chlorine	...	...	...	...	...	0·708
Carbonic Acid	...	...	...	...	...	20·937
Soluble Silica	...	...	...	...	...	0·114
Insoluble Silica	...	...	...	...	...	1·530
Sulphuric Acid	...	...	...	...	...	7·448
Phosphoric Acid	...	...	...	...	...	10·855
Lime	...	...	...	...	...	18·825
Magnesia	...	...	...	...	...	10·105
Soda	...	...	...	...	...	0·939
Potash	...	...	...	...	...	29·283
						100·744
					Minus Oxygen for Chlorine ...	0·158
						100·586

The trees from which the juice was collected grew on slaty soil.

BUTTER ANALYSIS.

THE Food Bureau of the Leipzig Pharmaceutical Society offers a prize of 300 Mark (£15) for the discovery of a practical and certain method for the detection of the adulteration of butter with other fats. The papers have to be sent without name, but with motto and accompanied by a sealed envelope bearing the same motto, and containing the name of the author, to Herrn. Apotheker Kohlmann, Leipzig, not later than September 30th, 1877. The prize essay is to become the property of the above Society.

Had this Leipzig Society been in the habit of taking in the *Analyst* it would not, we believe, at this time of day, offer a prize for the solution of a question which, for all practical purposes, has already been solved.

OBITUARY—DAVID FORBES, F.R.S.

It is so fully a fact in the daily routine of our lives to recognise the law of mortality, that we peruse the death-records, even of public men, without much emotion; yet there are times when the loss of an illustrious man seems to startle us into the reflection that the greatest benefactors of our race are subject to the common lot of all. Few scientific men will have heard of the decease of David Forbes without experiencing this feeling. It will be remembered that David Forbes was a considerable traveller, that many contributions to geology resulted from his varied wanderings, and that his communications are counted as among the most valuable acquisitions of that science. It is to be deeply regretted that many of his observations remain yet unpublished, and that his premature and somewhat sudden death has left his MS. notes unelaborated. Some of his best work is that which he achieved as mining engineer, while in connection with the Iron and Steel Institute, of which he was Foreign Secretary. He was a Fellow of the Geological, Chemical and Royal Societies. He died at the early age of 49 on the 5th inst., and was followed to the grave by many scientific and other friends.

CORRESPONDENCE.

TO THE EDITOR OF THE "ANALYST."

SIR,—In an extract from the *Pharmaceutical Journal* in your last number, I am credited with having stated that the substance called "Pekoe Flower" was the pollen of the Tea Flower. As I do not wish to claim a distinction not actually my due, allow me to state that my knowledge of the article dates sometime previously to the special importation named; that it was first sent to me as being the pollen of the Tea Flower; and that a microscopic examination at once disposed of that error, and identified it with the hairs of the young leaves.

It is always found, in more or less amount, after bulking Pekoes, and can be obtained,—mixed with much dust-and dirt,—in almost any London Tea Warehouse, on the beams or projections of the walls.

I am, Sir, yours obediently,

THE CUSTOM'S ANALYST.

SOCIETY OF PUBLIC ANALYSTS.

THE next meeting will be held on January 17th, 1877, in the Rooms of the Chemical Society, Burlington House, Piccadilly, when Officers and Members of Council for the ensuing year will be elected, and a new member will be balloted for, after which sundry chemical papers will be read and discussed.

The members and their friends, will, subsequently dine together at the Café Royal, 68, Regent Street.

THE ANALYST.

THE ADULTERATION OF PEAS.

ON another page we reprint from *The Times* a report of a case in which an importer of foreign provisions was summoned before Mr. Knox, on a charge of selling preserved peas which were adulterated with copper, and consequently injurious to health.

The case presents several unique features which render it desirable that we should draw attention to it, and in doing so we must point out that we have no special report of our own, but rely upon that published in *The Times*.

We note first that the defendant was charged with selling peas which were so adulterated as to be consequently injurious to health. This seems to us to have been an absolutely unnecessary and even unwise step to have taken under the circumstances. The mere fact of the adulteration is sufficient for the summons in a case of this kind, and evidence that the adulteration is injurious to health can be given at the hearing, the addition of the last clause to the summons can only have the effect of increasing the penalty, which it is in the power of the magistrate to inflict, and generally introduces some technical difficulty.

The next point which claims our attention is the fact that a medical man, a Fellow of the Royal Society, should have appeared for the defence, and endeavoured to convince the magistrate that the adulteration of peas and preserved fruits with copper was not injurious to health. His argument appears to be based upon such a fallacy that it seems strange it should be listened to even for a moment. It is perfectly true that copper is found in minute traces in the human body, and Dr. Pavy thought fit to base upon this fact, an argument that copper might be legitimately used in the preparation of peas for human food. It appears to us that it would be equally rational to argue that because the human body contains seventy per cent. of water it is therefore legitimate for a milkman to add seventy per cent. of water to the milk which he vends for sale, or that because the human body contains minute traces of alumina it would be perfectly legitimate and justifiable for the baker to add alum to the loaf with which he supplies us.

The special pleading of Dr. Pavy, and the clever Counsel by whom he was put forward had however its desired effect, the magistrate was so puzzled by what he called the widely different opinions of medical men, and was so greatly impressed with the importance of the case to the "trade," which he said would be "seriously affected," that he adjourned his decision, in order that he might fully consider the evidence, and expressed a hope that one result of the adjournment would be to induce qualified persons to discuss the question in medical circles and give him the benefit of their deliberations.

We have carefully considered the question, and we have no hesitation whatever in giving Mr. Knox the benefit of our deliberations, by saying unhesitatingly that the *smallest* admixture of copper when contained in any preserved article of food, ought to be viewed as an adulteration.

It is well known that the copper is added solely for the purpose of improving the colour of the preserved vegetables, and so giving a fictitious value to an otherwise inferior article.

SOCIETY OF PUBLIC ANALYSTS.

Extraordinary Meeting at Burlington House, Piccadilly, January 17th, 1877.

THIS Meeting was called by the Council for the purpose of proposing the following resolution :—

“ That the constitution of the Society as printed, be changed by altering the word ‘two,’ in the last line but two of the second page, to the word ‘three,’ so as to make the clause read thus—

“ The affairs of the Society shall be managed by a Council consisting of the President, *three* Vice-Presidents, the Treasurer, and two Honorary Secretaries, and not more than twelve other Members, five to constitute a quorum.”

The resolution for this change was carried unanimously.

After the Extraordinary Meeting an Ordinary Meeting was held, which was numerously attended, Mr. Heaton was voted to the Chair.

The minutes of the last meeting were read and confirmed.

The following Report of the Council was read, and it was resolved that the same be adopted and circulated among the Members.

REPORT OF THE COUNCIL.

IN consequence of the recent resignation of the President, it becomes the duty of the Council to submit a resumé of the proceedings of the Society during the past year.

They have to announce with regret the withdrawal from the Society not only of the President, but also of one of the Vice-Presidents, and of the Treasurer. Besides the secession of the gentlemen just referred to, seven other members have resigned during the year, the reason being in most of the cases that they had ceased to hold the office of “Public Analyst,” and consequently considered their further connection with the Society unnecessary. On the other hand the Council have to report the accession of fourteen New Members and of seven Associates.

During the year the number of original papers read before the Society has been twenty-two, besides which nine others have appeared in *The Analyst*, which is receiving increased recognition both at home and abroad, as a scientific journal, and is attracting subscribers outside the Society.

This paper not having been in existence a full year no accounts are now presented, but a balance sheet will be submitted after the expiration of its first twelve months’ career, when the question of the further conduct of the paper and its connection with the Society will be considered and decided upon.

The Council believe that the papers which have appeared have afforded much interesting information to members of the Society, both on processes of analysis and on the constitution of various substances, but it is to be regretted that though the number of contributions has been large the names of the contributors have been few. It is therefore hoped that in the present year a much larger number of members will feel it their duty to contribute something to the common fund of information.

The Sale of Food and Drugs Act has been carried out with fair success during the past year. There has been an agitation amongst its opponents to get some alterations

made, with a view of rendering the Act even less of a protection to the public than it is at present, and should this attempt be made your Council will do their utmost to prevent any such alteration.

It appears that the question of the purity of the Drugs supplied to the Public may be considered in the next session of Parliament, and in such case, your Council will be prepared to give all necessary attention to the subject.

The accounts as passed by the Council were read, and it was resolved to request Messrs. Cleaver and Dyer to audit the same on behalf of the Society, and report to the next meeting.

Messrs. Adams and Hill were nominated by the Chairman as Scrutineers; to examine the ballot papers for the election of Officers and Council for the ensuing year and for the election of a Member.

After examining the papers, they reported that the following had been elected as Officers and Council, viz :

Dr. DUPRÉ, F.R.S., F.C.S., *President.*

A. H. ALLEN, F.C.S.

A. H. CHURCH, M.A., F.C.S. } *Vice-Presidents.*

Dr. MUTER, M.A., F.C.S. }

C. W. HEATON, F.C.S., *Treasurer.*

CHAS. HEISCH, F.C.S.

G. W. WIGNER, F.C.S. } *Hon. Secretaries.*

and Messrs. A. W. BLYTH, M.R.C.S., F.C.S. }

JOHN CLARKE, Ph.D, F.C.S.

ALFRED HILL, M.D., F.C.S.

E. W. T. JONES, F.C.S.

W. W. STODDART, F.C.S. } *As New Members of Council.*

The Scrutineers also reported that Mr. R. H. Harland, F.C.S., had been elected a member of the Society.

Dr. Dupré having taken the chair as President, read a paper on "Artificial Colouring Matters in Wine."

Messrs. Cleaver, Allen & Jones took part in the discussion, and Dr. Dupré replied.

Mr. E. L. Cleaver read a paper on the "Adulterations of Oatmeal."

Messrs. Jones, Muter, Allen, Hill, Hastie, Dyer, Church, Thomas, Wigner, Vogan and Dupré took part in the discussion, and Mr. Cleaver replied.

Dr. Muter read a paper on "Salicylic Acid." Messrs. Heaton, Dupré and Bartlett, took part in the discussion, and Dr. Muter replied.

The President thanked the authors of the several papers in the name of the Society, and the meeting then adjourned.

After the meeting many of the members of the Society and their friends dined together, and the unanimous opinion of the members present was in favour of having an annual dinner of the Society in the January of each year.

NOTE ON THE DETECTION OF VARIOUS COLOURING MATTERS IN WINE.

By A. DUPRE, Ph.D., F.R.S.

Read before the Society of Public Analysts at Burlington House, on 17th January, 1877.

From time to time the public is alarmed by sensational statements about the extent to which the fraudulent colouration of wines is carried on, and the poisonous nature of the substances alleged to be employed for this purpose. I am strongly inclined to believe that all such statements are gross exaggerations, and shall be greatly obliged to any one who will send me a bottle of red wine, bought from an English wine merchant, which owes its colour to anything else than the colouring matter of the grape. I have not as yet met with a single sample of the kind. These statements, however, having been made, methods for the detection of foreign colouring matters in wine have to be devised, were it only to allay the fears of the public.

At the meeting of this Society in January last, I read a short communication on this subject. I then showed that, whereas the colouring matter of a pure wine is almost incapable of dialysis through parchment paper, several of the colouring matters, said to be employed for the fraudulent colouration of wine, dialyse readily. When carefully conducted the process yields reliable results, but in practice it is open to these objections. It is not possible always to secure parchment paper of the same substance, and the rate at which one and the same colouring matter dialyses through different papers varies accordingly; besides this, most sheets have spots in which the paper is very much thinner than it is over the sheet generally, and if such spots are overlooked they may seriously interfere with the success of the experiment; lastly, it requires great care to avoid the intermingling of the liquids, in and outside the dialyser, by capillary action. To obviate these difficulties I now adopt the following plan. Instead of putting the wine into a dialyser, I put into the wine a small cube of jelly about $\frac{3}{4}$ in. square. (These cubes are made by dissolving 5 grms. gelatine in 100 c.c. of warm water, and pouring the solution into a square flat mould made of paper, of such a size as to yield a plate of jelly about $\frac{3}{4}$ in. thick. From this plate the cubes are cut with a sharp wet knife). After the lapse of from 24 to 48 hours the cube is taken out and washed slightly, and a slice is cut out through the centre of the cube and in a direction parallel with one of its sides. I prefer to cut the slice parallel with the side on which the cube has rested. This slice is now examined either by being placed on a glass slide which is then held up towards the light, or by placing it upon a sheet of white paper. If the wine was pure the colour will be confined almost entirely to the edges of the slice, or will not have penetrated more than from $\frac{1}{16}$ in. to $\frac{1}{8}$ in. into the jelly. The case is widely different if any one of the colouring matters given below, under group *b*, was present. It will then be found that the colour has penetrated more or less deeply into the jelly, frequently to the very centre, and may, in many cases, be recognized by its characteristic colour, which is more distinct in the jelly than it was in the wine. Thus rosaniline imparts to the jelly a beautiful red colour, a somewhat similar colour is imparted by the red colouring matter extracted from beet-root and red cabbage. Logwood colours the jelly yellowish brown, indigo blue, &c., &c.

In many cases the nature of the foreign colouring matter present may thus be detected by the colour of the jelly. In some cases the slice may be examined spectroscopically with good effect, in the cases of rosaniline, red cabbage, and beet root, for example. In others again the action of dilute ammonia on the coloured slice will yield

characteristic results, such as decolourising the rosaniline slice, turning the red cabbage slice beautifully dark green, the logwood slice dark brown, &c. In the case of logwood and cochineal the ammonia dissolves much colour from the slice, in the case of rosaniline, red cabbage, and beet root, the ammonia remains almost, if not quite, colourless. Similar tests will readily suggest themselves to every chemist. In some cases it might, for example, be found advantageous to add some chemical, such as alum or borax, to the jelly, and to observe the effect which these have on the colouration of the jelly.

Group *a* Colouring matters that penetrate but slowly into the jelly.

Colouring matter of pure wine.

Colouring matter of Rhatany root.

Group *b* Colouring matters that penetrate rapidly into the jelly.

Rosaniline. Litmus.

Cochineal. Red cabbage.

Logwood. Beet root.

Brazilwood. Malva sylvestris.

Indigo. Althea officinalis.

An addition of 10 per cent. of any of the colouring matters of group *b*, to a claret of ordinary colour, is sufficient to yield very distinct results, in the case of logwood 5 per cent. is enough, while of rosaniline only 1 per cent. is required. By an addition of 10 per cent. of colouring matter, I understand that $\frac{1}{10}$ of the intensity of colour in the mixture is due to the colouring matter added. I have not been able to procure any of the colouring matter, or of the flower, of the hollyhock (*althea rosea*), said to be largely used in France for the fraudulent colouration of wines. As I find, however, that the colouring matters from Malva sylvestris and Althea officinalis, the flowers of which I obtained through the kindness of Mr. Holmes, of the Pharmaceutical Society, readily penetrate the jelly, I expect that the colouring matter of hollyhock will do the same. I hope soon to be able to continue these experiments with other colouring matters, and should be greatly obliged to any one who would furnish me with any colouring matter, known, or suspected, to be used in the fraudulent colouration of wine.

In conclusion, I would express the hope that some of our members may be induced to take this subject up and give us their experience at some of our future meetings. Any such process can only be placed on a sufficiently wide and secure basis by being tried and tested by a number of workers.

After a short discussion, Dr. Duprè said, in the presence of wine the action of ammonia on various colouring matters is considerably altered, and by itself is an extremely unreliable test, although in conjunction with the spectroscope it sometimes yields good results. I have not as yet examined the colouring matters from elderberries, or cherries, but hope to do so soon. I am also, I am sorry to say, entirely ignorant of the nature of the wonderful test paper lately brought forward by a French chemist.

THE ADMIXTURE OF OATMEAL WITH BARLEY MEAL.

By E. L. CLEAVER, F.C.S.

Read before the Society of Public Analysts, on the 18th January, 1877.

In a case recently decided at Hammersmith Police Court, I stated that all samples of oats which I had up to that time examined contained barley in varying proportions, and that, consequently, I did not consider that oatmeal could be obtained free from admixture with barley meal.

This statement has been much disputed by oatmeal manufacturers, and I have, therefore, gone very fully into the matter, and the object of this paper is to point out the real facts of the case as to the actual amount of admixture that may arise from unavoidable causes.

The oats at present in the market may be roughly classed into three divisions: English, Scotch, Foreign; and if these are closely examined, it will be seen that most of the foreign contain considerable quantities of barley, in some cases to the extent of 10 per cent. A few kinds of foreign, such as Russian, some kinds of Swedish, and Archangel oats, however, contain but very little barley indeed. The English also contain barley, but not, on the average, to the extent of more than two or three per cent., whilst Scotch are practically quite free from barley, although a grain may occasionally be met with. The practice of growing an oat crop after a barley crop, doubtless, accounts for some of the admixture, but not to the extent above mentioned; and it must be borne in mind that as barley is, weight for weight, cheaper than oats, there is some incentive to mix the one with the other.

That this is sometimes done there is no reasonable doubt, and I believe that notices have lately been sent to foreign ports, warning shippers against so doing.

The next question that arises is how much of the mixed grain is used in the manufacture of meal?

The greater part of the oatmeal at present consumed is, I believe, manufactured in Scotland, and by tacit agreement between miller and consumer is supposed to be made from Scotch oats; indeed, a glance at the different varieties of oats will at once show the superiority of the Scotch over other oats for the manufacture into meal, as it is very broad in proportion to its length, and has a remarkably thin skin. Towards the middle of the year, however, supplies of Scotch oats begin to run short, consequently increasing the price, and some makers are obliged to purchase other sorts for conversion into meal. The varieties occasionally used for this purpose are the finer sorts of Swedish and Archangel oats, which always contain small quantities of barley, but the amount so introduced into meal cannot be great, never exceeding one or two per cent., and often below that quantity.

I have, therefore, come to the conclusion that oatmeal can be obtained *practically* pure, and that any admixture of barley above one, or at the most, two per cent., is deliberately made for the purpose of cheapness, or obtaining more profit on the sale of the meal.

I now pass to the consideration of the means of detecting barley in oatmeal. A method was published in the *Chemical News*, some time since, by Messrs. Pattinson & Stead, and I think the method to be for the most part very good, but I have found that it is not easy to obtain the meal so evenly distributed under the slide as I could wish, and I also think that the continual rubbing the cover on the slide is apt to cause the barley granules to be moved out from under the cover, and to aggregate just outside its edge, the reason, I suppose, being that they are so much larger than the oat granules. The method I have adopted is as follows:—I take the barley and oats, mixed in the proper proportion, according to the standard required, and pound them well in a mortar. I then separate the husks, and pass the powder through a wire sieve of about 40 meshes to the linear inch. I then dry the powder at a gentle heat over a water bath, and put it

into a stoppered bottle. Five grains of the powder are put into a small mortar, and rubbed with liquid (that used by myself being a mixture of equal parts of Glycerine and Alcohol), for a few minutes, until a smooth paste is obtained. I then add more liquid and wash out into a small measure, and make up to the bulk of $\frac{1}{2}$ a fl. oz. After well stirring with a glass rod, a drop is taken out, placed on the slide, a small glass cover dropped upon it and gently pressed down. The slide is then ready for observation of the number of granules of barley starch which appear in the field. When testing a sample of oatmeal, the meal is treated exactly as stated above, and compared with the standard sample, whence the admixture of barley is easily calculated.

The advantages I claim for the method are, that—

First.—The meal and standard samples are, by drying, deprived of their water, consequently the same weight of substance is taken in comparing samples, which would not be so if not dried, as *oats and oatmeal* contain different proportions of water.

Second.—The danger of rubbing out the granules from the field is entirely obviated.

Third.—The quantity of material under the slide is always constant in different experiments.

The precautions to be observed, are: firstly—to thoroughly pound the material, and take care it all passes through the sieve; secondly—to well stir the liquid before taking out the sample drop, as otherwise, owing to the greater weight of the particles of barley meal, they will subside to the bottom, leaving the supernatant liquid comparatively free from barley. Also care must be taken not to confound the large compound bodies of the oat with particles of barley starch; but if the rubbing with the liquid in the mortar has been properly done, these bodies will all be broken up. They are easily seen by taking an oat grain, cutting out a morsel, and putting it on the slide with a drop of liquid. If a cover is then gently placed on the drop without much rubbing, these bodies will appear all over the field. They are more pear-shaped than barley starch granules, and by rubbing the cover over the slide can easily be broken up, and the field then presents the usual appearance of oat starch.

Dr. Muter said that he had read the evidence of Mr. Cleaver, as reported in the papers, with feelings of regret, as it was just the description of evidence which so greatly tended to bring analysts, as a body, into disrepute; especially when men, without giving proper attention to their subject, too frequently are apt to be pitted against those who have thoroughly studied and practised the matter that may, for the moment, be under discussion. Many of those present, no doubt, had already felt the absurdity of this so-called defence-evidence. Oatmeal was a subject upon which he could speak with some amount of authority, being a Scotchman who was brought up upon that most excellent diet, and having from the first moment of his possessing a microscope made it one of his amusements, even as a boy, to test the quality of the meal he consumed.

The published statements of Mr. Cleaver having apparently made a sensation in the meal trade, he had been called upon to examine lately a larger number of samples than usual, and he could state positively that no sample of genuine Scotch oatmeal ever contained, unless by design, any distinct quantity of either barley or wheat. Of course

oatmeal was a commercial article, and now and then a few granules of foreign starches would appear under the microscope; but they were so few that no analyst would take any notice of them as deliberate impurities. He presumed Mr. Cleaver had led himself into error by examining samples of Russian oats, which are well-known in the trade to be imported for cattle-feeding purposes, and are not suitable for making oatmeal. Most samples of these oats certainly do contain corns not only of barley but of several other cereals, together with seeds of tares, &c., but even in the most unclean samples these few corns would never produce any distinct per centage, such as 15 or 20, in the manufactured meal. It was necessary to be careful in examining any sample of oatmeal to see that one was not deceived by the round masses found in genuine oats, and exactly simulating barley, especially when using lamp light. On the other hand, if an adulteration of barley were really present it is necessary to be very careful, and calls for the employment of great experience. This is owing to the large number of small granules found in barley starch, measuring $\cdot 00073$, and which have, in many cases, a decided tendency towards a certain angularity that renders them very liable to be confused with the larger oat granules. He would not have much confidence in the ability of many analysts to distinguish barley from wheat in the presence of oats. If, however, by the judicious use of the light and micrometer, the presence of barley be really established, the best criterion to go on for the estimation of the percentage, is the number of granules measuring $\cdot 00292$ which are found in barley to bear a very constant relation to the $\cdot 00073$ granules already referred to. In conclusion he believed that his colleagues now present would bear him out in the fact that, given an admixture of say 5 per cent, they would consider it a most decidedly adulterated sample.

Mr. Allen expressed his opinion that Mr. Cleaver had not sufficient evidence to justify him in going into Court to oppose the analysis in question, and Dr. Hill spoke to the same effect.

Mr. Hastie, having thanked the president for being allowed the privilege as a visitor of speaking, remarked that he was much interested in the question, being a manufacturer in Scotland of oatmeal, and a wholesale dealer in London, and he could, with confidence, say that all the oatmeal which he manufactured and sent out was made from the finest Scotch oats that could be obtained. With regard to some remarks which had been made about oats and barley being grown together in some districts in England, such a practice is unknown in Scotland, and the only way in which a few grains of barley or wheat could get into a parcel of oats is from the thrashing machine, which may have been thrashing barley or wheat before the oats, and consequently a few grains of either may have been left in, but the proportion is so small as to be scarcely perceptible. He had had three samples drawn from the bins of oats in his mills in Scotland, two of which he found absolutely pure oats, but the third contained 2 grains of barley in 1,250 grains of oats, and he considered this as pure as they could be produced. To talk of 5, 10, or 15 per cent. as not being adulteration was simply absurd; there was no doubt whatever that a deal of the oatmeal sold in London was adulterated, but the present enquiry would, probably, have the effect of putting a stop to a practice that has been carried on for years.

Mr. Dyer remarked that he had found considerable proportions of barley-meal in oatmeal sold for cattle-feeding purposes. He thought it possible that in some rare instances this admixture might be attributable to the custom which was said to

prevail to a certain extent among farmers in some parts of England, of growing oats and barley as a "mixed crop," the meal from the mixed grain finding its way into the market as "oatmeal."

Mr. A. H. Church had analysed both barley meal and oatmeal, and had examined many samples of the grain of these two meals. The casual weed seeds and barley grains which he had detected in such samples of oats as were used in the manufacture of oatmeal, if not originally below 1 per cent., would be reduced, and are reduced below that figure in the operations subsequent to kiln drying, to which the oats are submitted. He had found Scotch oats to be of remarkably good quality, while the oatmeal made from them, often contained 10 per cent. of fat, and less than 5 per cent. of moisture, when fresh. The speaker had, however, found that the barley-meal used for pig feeding was liable to a serious adulteration with a preparation, known in the trade as "mixing stuff." This substance consisted of ground gypsum, to which from 10 to 25 per cent. of coarse barley-dust or similar products from the cleaning of rice, or oats has been added.

Mr. Thomas said he was connected with agriculture, and thrashing oats by portable steam machines led to a slight admixture with other corn lodged in the machine from a previous thrashing. It should not amount to one part in 10,000, and more than one per cent. ought to be regarded as adulteration.

Mr. Wigner pointed out that it was clear that Mr. Cleaver must have gone into Court with the evident intention of upsetting Dr. Dupré's analysis, if possible, and that such a course was not only unprofessional, but the evidence, as reported, and the paper read this evening showed that the gentleman in question had not made himself fully acquainted with the subject. He, the speaker, had himself examined the samples of oatmeal in question, and was convinced that Dr. Dupré was within the bounds of truth, when he stated the adulteration at 35 per cent. He thought it was extremely to be regretted that a public analyst, whose duty it was to protect the public from adulterations of every kind, should sacrifice his reputation by going into Court for the defence, when no legitimate case for defence existed, and suggested that Mr. Cleaver should write a letter to "The Analyst," stating that having considerably extended his knowledge of oatmeal since the hearing of the case, he is now of opinion that oatmeal *can* be obtained practically free from barley meal.

Mr. Vogan said he thought it useless to go into ingenious theories as to the way in which barley and wheat got mixed with oats before grinding, because all who understood the manufacture of oatmeal were perfectly aware that there is in fact no such mixture to any discernible extent in such oats as are used by honest manufacturers. He would be sorry to say anything unkind of Mr. Cleaver, but he thought that gentleman would have acted more wisely if he had made himself acquainted with the facts before he reported upon the meal. Mr. Cleaver came to Mark Lane, and was shewn round the market by the gentleman who was implicated, and saw many samples of oats, and he stated that he found a large percentage of barley in all of them; this was no doubt true, but unfortunately, the oats he saw were not such as are used for the purpose of making oatmeal. He (the speaker), was an old Mark Lane man, and although neither a chemist nor an analyst, he had been familiar with the use of the microscope for many years, and his friend Mr. Hastie asked his opinion upon this subject, and introduced him to Mr. Cleaver when he came to Mark Lane, bringing with him a sample of oatmeal which he pronounced to be adulterated. Mr. Cleaver showed us certain discs, which "he would

stake his life were barley granules." He, (the speaker) took a portion of the impugned sample home, and having made himself carefully acquainted with the appearance of barley starch by polarised, direct, transmitted, and diagonal, light he found the discs referred to, but was convinced that they were not barley at all, but the agglomerated granules always found in oats, Mr. Cleaver had evidently made an error, and he should take some steps to clear himself from the unpleasant position in which he had placed himself.

Dr. Duprè after expressing the pleasure felt by the Society in seeing several members of the corn trade amongst them this evening, remarked that a speaker had alluded to the declaration of the magistrate, which had appeared in some of the papers, that an admixture of 15 per cent., or less of barley meal in the sample in question would be allowed to pass, but that a fine would be inflicted, if more than 15 per cent. were found. Knowing that the sample contained more than 15 per cent., he did not think it worth while to raise any discussion on this point. At the adjourned hearing, the magistrate however stated that this limit of 15 per cent. was not to be taken, as forming in any way a precedent for future cases, for he knew that Scotch oatmeal could be obtained with a much less proportion of barley meal; unfortunately this statement did not appear in the papers. The Society is, however, indebted to Mr. Cleaver for bringing the subject forward this evening, since it has shown that, in the opinion of every one here present, practical men, as well as analysts, anything more than 1 per cent., or at most 2 per cent. must be looked upon as adulteration. He hoped that this unanimously expressed opinion would once for all settle the question, and render a dispute between analysts on this point impossible for the future. In conclusion, he expressed a hope that Mr. Cleaver would follow Mr. Wigner's advice, and write a letter to "The Analyst," stating, that having considerably extended his knowledge of oatmeal since the hearing of the case, he is now of opinion that oatmeal can be obtained practically free from barley meal; Mr. Cleaver owed them he thought some amends, and he could not offer them in a better way than by writing the letter suggested.

Mr. Cleaver, in reply, said that the published reports of the case were so erroneous that he was not surprised at the severe criticisms that had fallen from the several speakers, he would however, give them the true facts of the matter. A corn dealer was summonsed by the Westminster authorities for selling oatmeal adulterated with 35 per cent. of barley meal, and he came to him to analyse a similar sample. This he did, and found that it did contain about 20 per cent. of barley. The dealer then said that it was impossible to obtain pure meal, and in support of this statement accompanied Mr. Cleaver to Mark Lane, where they examined a large number of samples of oats, as imported, all of which contained barley, in one case to the extent of 15 per cent. Whether these oats were used in the manufacture of Meal was not asked by him (Mr. Cleaver), and he regretted not having done so, as it would have saved him great annoyance, still his evidence was correct, as far as it went; but he must acknowledge that the deduction drawn, that oatmeal cannot be obtained pure, is incorrect. With regard to what Mr. Vogan had said, he thought there was some misunderstanding on that gentleman's part, as he (Mr. Cleaver) merely told him that there were a few barley granules to be seen, but not to a great extent, and he had since told Mr. Hastie that it was under 1 per cent. He did not think that there was any chance of his having made a mistake, especially as regards confounding the compound bodies in the oat with barley starch, as he had particularly mentioned those bodies in his paper.

NOTE ON A SIMPLE METHOD FOR ESTIMATING THE VALUE OF
COMMERCIAL SAMPLES OF SALICYLIC ACID AND ITS DETEC-
TION IN MILK AND SIMILAR ORGANIC SOLUTIONS.

By DR. MUTER, F.C.S.

Read before the Society of Public Analysts, at Burlington House, on 17th January, 1877.

BEING called upon to estimate the purity and value of several samples of commercial Salicylic Acid, and not having seen any process as yet published for that purpose, I was led to adopt the following colorimetric method, by which I find it possible to detect and correctly estimate 1 milligram. The necessary appliances are; (1) A standard solution of pure acid; (2) A weak solution of neutral ferric chloride; and (3) the usual tubes and burette as used for nesslerizing.

1. *Preparation of the Standard Acid.* Some of the purest commercial acid obtainable is first perfectly purified by dialysis and recrystallization, and the pure and bold crystals thus obtained, are kept for use, after properly drying. One grm. of the chemically pure acid is dissolved in a litre of water, and a solution is thus obtained, each c.c. of which represents one milligram of Salicylic Acid.*
2. *The Indicator* is a very weak solution of pure neutral ferric chloride, of such a strength, that 1 c.c. added drop by drop to 50 c.c. of the standard acid, just ceases to give any increase in intensity of colour before the addition of the last drop or two.
3. *The process.* One grm. of the commercial sample (after well mixing) is dissolved in 1 litre of water, and 50 c.c. is put into one of the nessler tubes. To this, 1 c.c. of the ferric solution is added, and the colour observed after standing for five minutes. As many c.c. of the standard acid as may be judged necessary are introduced into another tube, made up to 50 c.c. with water, and the 1 c.c. of ferric chloride added. If after five minutes the colours agree, then the experiment is finished, if not, it must be tried again exactly like nesslerizing. The number of c.c. of standard acid used indicates of course the real amount of Salicylic Acid present in the sample. The colour deepens very distinctly indeed for each $\frac{1}{10}$ c.c. of the standard acid. To ensure perfect success, all mineral acids must be practically absent. The colour is affected at first by the presence of *small* quantities of acetic acid, but by standing for ten minutes instead of five it recovers itself. I am now experimenting to see what substances affect the colour, and hope to be able to give a full list shortly, but in the meantime I find that the presence of neutral mineral salts generally does not interfere, provided they are such as have no action on the iron. The presence of certain albumenous bodies, notably casein, and the soluble albumenoid of milk causes the colour to become reddish and bad for estimation, but these can be thoroughly eliminated as hereafter described.

Detection of Salicylic Acid in Milk, Beer, &c. The march of chemistry has caused quite a trade to spring up in tasteless antiseptics, which may be added to milk, (hitherto

**Note.*—When intended for use in the analysis of milk, this solution had better be made in grains, (i.e.) 10 grains in 10,000 grains water.

without detection) so as to cause it to keep sweet for a day or two. The two articles at present sold for that purpose are Salicylic and Boracic Acids, and the quantities added are, of course, so minute as not to appreciably affect the total solids. I have found that both may be easily separated from the milk by dialysis, and then made manifest. In the present paper I have taken the Salicylic Acid first, and leave the detailed consideration of the boracic acid till a future meeting, as although I can *qualitatively* prove its presence by dialysis; I have not yet succeeded in finding a process of even approximate estimation sufficiently delicate and convenient for the small traces with which we have to deal. To proceed therefore with the former antiseptic:—I take four ounces of the milk or beer and dialyse for twelve hours on a pint of distilled water, at the end of that time I take half-an-ounce out from the dialysed liquid, place it in a narrow tube, add a little of the ferric chloride solution, and look down over white paper, if no violet colour be produced, the milk is pure, but if it be tinged, then the dialysis is to be continued for 48 hours. In practice, I find that working with the usual small quantities added to milk, 48 hours is sufficient to fairly equalise the amount of acid, both inside and outside the dialyser, so that on taking a portion for estimation, and calculating to the total amount of fluid, I have never got back less than 86 per cent. of what I put in, even under the worst circumstances. If the presence of the acid be proved, and an attempt at estimation thus rendered necessary, four ounces of pure milk should be put on to dialyse, so as to give a comparison liquid. This is required because if the milk in the dialyser should go very sour, the colour with ferric chloride will be rendered more reddish, and will not be fairly comparable with the standard. The estimation is to be conducted by the colorimetric method already described, using instead of distilled water, the dialysed fluid from the pure milk or beer.

I cannot say at present exactly the degree of accuracy I can claim for the *quantitative* process as I have not yet experimented in hot weather, or with a great variety of parchment papers, but I may say that I have up till the present got back, as a rule, from 50 to 60 per cent. of the acid put in, after 24 hours, and about 90 per cent. in 48 hours. In the meantime the process is excellent from a qualitative point of view, while it can be said in favour of the estimation, that at all events the quantity cannot be over stated, and that is an important point for public purposes.

Dr. Dupré remarked that the question whether the addition of salicylic acid to milk is, or is not to be looked upon as an adulteration, is one which cannot be decided off-hand.

On the one hand, assuming that such addition really preserves milk, some milk becomes valuable, which would otherwise have been lost; the public is so far a gainer.

On the other hand, assuming the efficiency of salicylic acid, it will enable the dairyman to carry on his business in a more slovenly and careless manner. He was of opinion that the chief cause of the early turning of milk was carelessness in washing out or scouring vessels which were to hold the milk. Cleanliness is at present essential in every part of a dairy, but with the use of salicylic acid, this becomes more or less unnecessary, and sweet milk would be no longer a guarantee that the dairy is cleanly conducted; on this account, he felt strongly inclined to look upon the presence of salicylic acid in milk as an adulteration. Be this however, as it may, the Society was greatly indebted to Dr. Muter for giving a ready means for its detection and estimation.

Dr. Bartlett, who was not present during the reading of the first portion of the paper, observed that he was delighted to hear that progress had been made in the detec-

tion and possible estimation of boracic and salicylic acids in milk. He had encountered both during his somewhat large experience of different samples of milk, representing over 4,000 gallons daily. When either of these acids is used in minute quantities only, it is slightly antiseptic, and prevents for some short time the further development of lactic acid ferment germs. If, however, the germs are present in large quantities, or are derived from that advanced growth proceeding from the vigorous lactous fermentation, often taken up in the use of uncleansed utensils, neither boracic nor salicylic acid is able to stop the rapid increase of acidity, even if employed in large proportions. The more minute quantities are, therefore, more to be suspected.

Dr. Muter's plan of dialysis appears admirably suitable for the separation of the serum of the milk from the solids, so that the solution of salicylic salts may be concentrated, until it gives the well-known characteristic reaction of forming an inky-blue precipitate with persalts of iron, the colour disappearing on the addition of free hydrochloric acid.

In reply to a question from Dr. Muter, Dr. Bartlett replied that he was only acquainted with one delicate test for boracic acid, and that was by forming nitride of boron, which gives a peculiar colour reaction to a solution of sulph-amido-benzoic acid.

CORRESPONDENCE.

TO THE EDITOR OF "THE ANALYST."

SIR,—It will perhaps interest some of your readers to learn that two or three years ago a Patent was taken out in America for the conversion of ordinary fat into butter, by precisely the same agencies as are described in the valuable paper of Dr. Bartlett, in No. 10 of *The Analyst*.

Fat of the cow, according to the Patentee, is transformed into a substance resembling butter, by simply digesting it at a blood heat for some length of time with pig's or calf's stomach.

If the time of digestion be regulated by analysis, there seems to be every reason for believing that a fat may thus be produced, identical with natural butter fat. As little as we are able to distinguish between, say natural and artificial urea, so it would be impossible to discriminate between natural and artificial butter fat.

I am, &c.,

25th January, 1877.

OTTO HEHNER, F.C.S.

TO THE EDITOR OF "THE ANALYST."

SIR,—In the published reports of a case of oatmeal adulteration lately decided at Hammersmith police court, I am reported to have said that oatmeal always contained barley meal to the extent of 15 per cent. or under.

I need hardly say that the accounts are erroneous, and, as I have been asked by several members of the Society of Public Analysts why I made such a statement, I think that some explanation in your columns would be desirable.

What I said was as follows :—

That I examined a large number of samples of oats as imported, and every one of them contained varying quantities of barley in one case to the extent of fifteen per cent.

The difference between the two statements is very great, and a glance at the paper read by me at the meeting of the Society of Public Analysts, will I think be sufficient to show my opinion on that subject.

I am, &c.,

18th January, 1877.

E. L. CLEAVER.

TO THE EDITOR OF "THE ANALYST."

SIR,—The substitution of salicylic acid for bisulphite of lime by brewers to prevent secondary fermentations is rapidly becoming the fashion. German acid is imported at a low rate, some brewers using fifty pounds worth in a month. Its detection is but a simple matter.*

Is salicylic acid an adulterant in beer, and further, what is beer legally understood.

I am, &c.,

EDWARD MOORE.

Brighton, 20th January, 1877.

TO THE EDITOR OF "THE ANALYST."

SIR,—Having resigned my appointment as Food Analyst for this County, in consequence of increasing professional work, I would call the attention of those Public Analysts who are so usefully devoting their whole energies to their special department—to the subject of the adulteration and impurities of drugs.

That this is a matter of pressing importance is the painful experience of the whole medical profession—and more particularly that branch of it whose prescriptions are at the mercy of any struggling dispensing chemist, whose drugs are necessarily obtained in the cheapest market.

Many London Physicians direct their patients to go to some particular druggist, and even to ask for an especial dispenser by name, surely, sir, a sufficiently significant fact as regards "town" drugs! What then is the condition of the country shops? We know that there is such an article as a town-hat and a country-hat, although issued by the same firm,—and we have some reason to believe that a similar variety obtains in the matter of town and country drugs.

Shortly before the much lamented death of my friend Dr. Anstie, I was in correspondence with him on the subject of "*Country Bismuth*," out of a large number

*NOTE.—The detection of salicylic acid in beer is rendered simple by the process detailed in our present number, but we are not aware that any process for this purpose has previously been made public.

of samples of Trisnitrate, obtained from "Chemists" in various towns in the midland counties, almost all contained *arsenic*—and some to an alarming extent—now although this substance is *only* present as an *impurity*, I have personal knowledge of a case where the administration of Bismuth produced symptoms of arsenical poisoning, and its presence was subsequently confirmed by analysis. If considered only from a *medico-legal* point of view, to what important results might not this subject lead! I am aware that many other mineral drugs contain arsenic as an impurity, but take bismuth as a type.

Poisoning by arsenic, in continued moderate doses produces symptoms that have in certain cases been mistaken for those of typhoid fever. Bismuth has been administered as a remedy! Mary Cotton, at the Durham Assizes not long ago, would have undoubtedly escaped by this loophole, had not her victims been too numerous, and other evidence too clear against her.

This line was suggested to the Counsel for the defence; the medical witnesses stated that the cases *were* treated for typhoid, and *had* taken bismuth; the expert, Dr. Scattergood, of Leeds, said that bismuth did frequently contain arsenic, but only in small quantities; still, *pari passu*, this would have accounted for the presence of arsenic in the exhumed bodies, in many cases a sufficient evidence in favour of the accused.

But it is not only mineral drugs that demand the attention of Public Analysts, a wider and more difficult field looms to the front, viz., our tinctures, "as one star differs from another star in glory," so does one sample of *Tinctura Aurantii* from another sample of the same *simple stomachic*, and so of other tinctures—of what vile ingredients are they composed? consider the quality of the spirit alone—I have known the simplest *Placebo* produce violent headache after each dose.

Again, take chloroform—how must the revered names of Duncan and Flockhart be abused! sulphuric ether too, and spirit of nitrous ether, and a host of other drugs would amply repay an analytical examination. A few well selected cases would arouse popular attention, and revolutionise, for a time at least, the whole drug trade; at present it is safer to trust to one or two well-known firms—but every prescription that leaves our hands is felt to be an uncertainty, and the burden thus experienced by our profession calls for remedy at your hands—for with your assistance, Mr. Editor, the subject will be carefully investigated by the members of our well organised Society, and then, Sir, I do not doubt the result.

Mr. Allen, of Sheffield, has already done good and courageous service in this field, and it is to him and his fellow-labourers that we confidently look for further and more brilliant results.

Trusting that the importance of the subject will be sufficient apology for the length of this communication.

I am, &c.,

GEO. MAY LOWE, M.D.

Lincoln, *January 8th*, 1877.

RECENT CHEMICAL PATENTS.

THE following specifications have been published during the current month, and can be obtained from the Great Seal Office, Southampton Row, Chancery Lane, London.

1876. No.	Name of Patentee.	Title of Patent.	Price.
650	C. Wright	Treating Metallic Ores	6d.
999	E. Solvay	Manufacture of Carbonate of Soda	8d.
1256	W. R. Lake	Manufacture of Gas	6d.
1302	W. T. Carpenter	Ditto	6d.
1337	F. W. Mackay	Manufacture of Ice... ..	6d.
1499	K. M. L. P. Louttit	Manufacture of Gas	6d.
1619	Spalding and another... ..	Treating Lye Waste	6d.
1680	T. Bowen	Concentrating Sulphuric Acid	6d.
1697	J. H. Porter	Filtering Water	6d.
1747	H. V. Weyde	Photography	6d.
1782	J. Hargreaves	Manufacture of Sulphate of Soda... ..	6d.
1783	J. A. Muller	Manufacture of Gas	6d.
1796	W. H. Gilbert... ..	Distilling Alcohol	6d.
1839	B. Hunt	Tanning	6d.
1851	Simpson and others	Preparation of Alizarin	2d.
1856	D. Esplavier	Artificial Manure	2d.
1865	A. Lloyd	Preparation of Cocoa Extract	4d.
1875	G. Barhandy	Food for Cattle	2d.
1893	Rawson & Slater	Purifying Sewage	4d.
1904	E. Solvay	Manufacture of Carbonate of Soda	4d.
1927	H. Deacon	Manufacture of Chlorine	4d.
1930	W. Clark	Treating Sewage Matter	4d.
1977	Downing & Hughes	Paper Pulp	6d.
1998	C. Humphrey	Treating Mineral Oils	4d.
2001	W. M. Browne	Purifying Turpentine	2d.
2000	W. M. Browne	Filters	6d.
2053	Coxeter and another	Surgical Batteries	2d.
2069	W. E. Robinson	Treating Phosphatic Minerals	4d.
2080	G. Bischof	Purifying Water and Sewage	4d.
2147	F. W. B. Mohr	Treating Spent Oxide	2d.
2305	J. Schwartz	Sugar	4d.
2339	W. E. Newton	Treating Refuse or Sludge Oil	4d.
2398	E. Morgan	Milk Powder	2d.
2420	P. Jensen	Treating Nitrated Alkalies	2d.
2501	F. W. Colls	Gas	2d.
2505	E. G. Brewer	Bleaching Wool	4d.
2515	A. Browne	Extracting Essential Oils	4d.
2534	A. M. Clarke... ..	Black Dye	2d.
2535	A. M. Clarke... ..	Preparing Bone Black	4d.
2563	Swindells and another	Manufacture of Ammonia	2d.
2591	T. B. Redwood	Manufacture of Gas	4d.
2846	S. Hjerleid	Manufacture of Sulphate of Soda	2d.

A NEW TEST FOR ALCOHOL.

Pharm. Journal, [3] No. 336, p. 463.

Dr. Ed. W. Davy noticing a deep azure blue colouration as the result of the action of alcohol upon a solution of molybdic acid in strong sulphuric acid, proposes the re-action as a very delicate test for the presence of alcohol. The blue colouration is not confined to ethylic alcohol, but appears to be produced in the same way by methylic, propylic, butylic, and amylic alcohols.

Three or four drops of the molybdic solution are placed in a small white porcelain capsule, heated slightly in the water bath, and then a few drops of the liquid to be

tested are added gently to the acid solution, if alcohol be present, blue colouration appears either immediately or in a few moments.

Dr. Davy especially points out the ready way in which the test detects alcohol in chloroform, and asserts that he has found no chloroform in commerce which did not give the blue colouration. The abstractor would like to remark that he believes a small percentage of alcohol is added to chloroform by the very best manufacturers in order to prevent decomposition, and unless more than 6 per cent. of alcohol be found in any sample of chloroform, it would probably be unwise to report it as adulterated.

A. W. B.

PROSECUTIONS UNDER THE SALE OF FOOD AND DRUGS' ACT.

AT MARLBOROUGH STREET.—Louis Barron, Compton Street, Soho, importer of foreign provisions, was summoned before Mr. Knox, charged with selling French preserved peas which were adulterated with copper, and consequently injurious to health. There were three other dealers summoned, but it was arranged that one should be decisive of the rest. Mr. Jenkins, on the part of the Board of Works, prosecuted; Mr. Edward Lewis, defended. It will be recollected that similar summonses were heard at this Court about three weeks ago, and were dismissed on technical objections taken by Mr. Lewis. It was then arranged, as differences between analytical results were shown to exist, that a portion of the peas should be sent to Somerset House to be examined by the Government Analyst. Frederick Taylor, an officer of the Board of Works, proved purchasing a tin of French peas at the defendant's shop. He told the defendant they would be analyzed, and a portion was left with him. Mr. Charles Piesse, of 303, Strand, analyst said he examined a portion of the peas, and produced some of the copper. He had no doubt that copper was present in the peas. He found the result of his analysis was to discover 0.56 of a grain in a specified portion of the peas. The quantity taken for a continuance would, in his opinion, prove injurious to health. Cross-examined by Mr. Lewis, witness said he was aware that Dr. Pereira, held that if six grains of copper were repeatedly given it would not be injurious to health; but he did not concur in that view, as the opinion was given before the mode of analysis was as perfect as at present. The Government certificate of analysis was produced. It stated the quantity of copper at 0.31 part of a grain. The analysis of Mr. Piesse showed 0.56 part of a grain. Dr. Evans, District of London Officer of Health, thought that the quantity of copper found in the peas, if taken repeatedly, would be injurious to health. Cross-examined, he said he could not say that a single dose would be injurious, nor could he say how long it would take to affect a person injuriously. Could not show any authority for the assertion that copper would destroy life. Mr. Lewis, for the defence, said what he had to establish was that by no possibility could the quantity of copper stated, taking even the analysis of Mr. Piesse, prove injurious to health, and he was prepared to quote the authority of eminent foreign and English chemists to show that a certain quantity of copper, so far from being hurtful, was a tonic, anti-spasmodic, and actually beneficial to health. Dr. Pavy, F.R.S., of 35, Grosvenor Street, author of a work on food and lecturer at Guy's Hospital, said he was of opinion that 0.31 of a grain of copper would not be injurious to health. If a tin of peas were consumed at once, he was of opinion that no injury to health would result. Copper was found in the human body—in the kidney, the spleen, and the blood. It was one of the natural constituents of the body. Drs. Odling and Dupre found a 20,000 part of a grain in sheep's liver. Copper was found in many cereals and even in the feathers of a particular bird. Nearly all kinds of food if cooked in copper vessels would be found impregnated with copper. The quantity of 0.31 grain of copper might be consumed daily by an adult without injury. If any injury were occasioned, it would arise more from the peas than the copper. Mr. Knox said the question was one of great public interest. On the one hand, if he gave an adverse decision, an important trade would be seriously affected; on the other, if the theory that the peas were injurious to health was correct, the public would be poisoned. It had been shown, on the skilful cross-examination for the defence, how widely medical men differed in opinion. Taking into consideration

the importance of the case, he would adjourn his decision in order that he might fully consider the evidence, and he hoped that one result of the adjournment would be to induce qualified persons to discuss the question in medical circles and give him the benefit of their deliberations. *The Times*.

ADULTERATION AT WIESBADEN.—A miller was recently (Dec. 23rd, 1876) brought before the Wiesbaden Police Court, and charged with having admixed with his flour ground heavy spar, for the purpose of fraudulently increasing the weight of the flour. He was sentenced to three months' imprisonment and £50 fine, with costs.

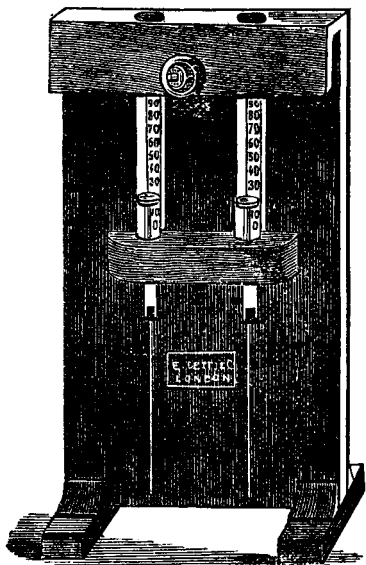
At the Sheriff's Court at Kilmarnock, on the 12th January, 1877, Alexander Mills was charged with having sold a quantity of sweet milk, which was adulterated with 16 per cent. of skim milk.

A Sanitary Inspector deposed that he purchased 2d. of sweet milk, which he told him he purchased, in order to have it analysed by the public analyst. On the same day he took a sample of the milk to Dr. Wallace, of Glasgow, the Public Analyst, he received the certificate produced, showing that the milk contained 16 per cent. of skim milk. He had not previously received any specific complaints in reference to the milk, but met him at his own door as he was coming from supplying his customers, and bought 2d. of milk, he offered the defendant a sample, but he refused to have it, he asked for new milk, there would be about twice as much left.

The defendant was then examined, and stated that his customers were supplied with partly morning milk, and partly night's milk, he never adulterated his milk in any way, he protested against its being a fair sample on account of its being at the bottom of the can. He had previously refused to sell such milk as unfit for sale, and lost money by doing so; it took him from an 1½ to 2 hours to serve his customers, and according to his experience, cream came to the top in less than that time, so that it was gradually skimmed off, he had served customers only five minutes previously, but had had no complaints from them.

The counsel for the defence contended that there was no evidence of the abstraction of the cream. The deficiency was quite sufficiently accounted for by the fact that the cream had a tendency to come to the top of the cans in which the sweet milk was carried. In further support of his argument he quoted an opinion of Dr. Macadam and Mr. Wanklyn, in which they stated that a large percentage of cream would be inevitably abstracted in the way indicated. Sheriff Anderson, in giving his decision, pointed out that the only question was, had it been proved to the satisfaction of the Court that the milk was adulterated, as that was a Court of Law, and not one for an inquiry into scientific subjects, and as the statute in the interests of the public had pointed out a certain way in which articles of food should be shown to be genuine or otherwise, he was bound to take the report of the Analyst, as conclusive evidence of the fact of the articles submitted to him, being genuine or otherwise. He had nothing to do with the opinion of Dr. Macadam or any other person, all he had to do was to be guided by the Analysts' report, and he therefore found the case proved. Under the circumstances he fined the defendant 5s.

WE have received from Messrs. Cetti & Co., of Brooke Street, Holborn, a specimen of a new piece of apparatus invented by Dr. E. J. Mills, of the Andersonian University, for the purpose of estimating the relative proportions of colour in different samples of liquids. It appears to be extremely well adapted for nesslerising, and for taking the colours of sugar syrups, and will certainly enable such estimations to be made with increased accuracy.



From the illustration it will be seen that it consists of two graduated tubes, drawn out below, and corked with perforated corks. Through these corks are passed two glass rods, carrying at their upper ends two flat discs of opal glass, like pistons, which fit loosely into the tubes, so as to allow the liquid to pass the pistons.

To use the apparatus the tubes are filled with the solutions to be compared, and the piston of the tube containing the standard solution is set at zero, and the piston of the other tube is then moved up or down, until, on looking down the tubes from the top on to the opal discs, the two solutions appear identical in colour. The position of the piston is then read off, and indicates the relative amount of colour in the liquids.

THE ANALYST.

THE present Number completes the first year of the existence of "The Analyst." We are too young to boast, but we hope that we have fulfilled the promises which we held out, not only to Members of the Society, but to our intending subscribers, when we started in April last.

We shall commence the next Number with an enlarged, and, we hope, considerably improved programme, and shall fully announce in that Number all the changes which are to be made.

Meanwhile we may hope that our increased circulation and the quantity of original matter which we are able to put before our readers, will justify us in the position we have taken up.

THE ADULTERATION OF PEAS.

OUR readers will be pleased to see, from a Report reprinted on another page, that the article which we felt it our duty to write last month, and the conclusions at which we arrived, have been confirmed by the decisions which have been given by Mr. Knox on the cases before him.

The vendors of several tins of preserved peas in which the Analyst of the district, Mr. C. H. Piesse, had found quantities of copper, varying between a quarter and a half grain, have all been fined, excepting one, and we presume the reason which Mr. Knox had in view in not giving any decision in that case, was simply that the defendant had been put to very considerable expense in preparing his so-called defence, and that, therefore, he had been sufficiently punished. However, from Mr. Knox's statement, that in future cases of the same kind, real and substantial punishment would be inflicted, it is evident that he himself is satisfied as to the correctness of the analytical evidence.

It will be noted with interest that Dr. Guy, Dr. Dupré, and Dr. Tidy, all gave evidence fully confirming the opinion which we so strongly expressed, that articles of food ought not to contain any trace of copper.

SKIMMED MILK.

ON another page we reprint an important case of appeal against a conviction for selling milk which had been skimmed.

Our readers will, doubtless, be familiar with the absurd character of the defence usually set up in such cases, and which, unfortunately, has received considerable support from some one or two analysts.

It is quite clear to us, however, that it is as much a milkman's duty to stir his milk before he supplies his customers, as it is his duty not to add water to the milk in the pails, and we are very glad indeed to see that the learned Recorder of Liverpool fully coincides in this opinion.

We hope this will be the last we shall hear of such ridiculous defences.

THE SOCIETY OF PUBLIC ANALYSTS.

An ordinary meeting was held at Burlington House, Piccadilly, on 14th February, 1877.

THE minutes of the last meeting were read and confirmed. The auditors presented the accounts of the Society, audited, which were ordered to be printed in slip form, and sent to the members.

The following papers were then read and discussed :

Dr. Dupré, "On Copper as a normal Constituent of the Tissues of Animals and Plants."

Mr. C. H. Piesse, "On Copper in Food."

Mr. A. W. Blyth, "On the Poison of the Cobra."

Mr. Wigner and Mr. Harland, "On the Composition of the White Lead Paint of Commerce."

Dr. Bartlett, "On the Fermentation of Food."||

THE POISON OF THE COBRA DE CAPELLO,

By A. WYNTER BLYTH, M.R.C.S.

Read before the Society of Public Analysts, at Burlington House, 14th February, 1877.

THE COBRA, from the most ancient times to our own, has been an object of interest, worship, superstition and research.

The lovers of the marvellous have invested the snake with attributes of almost human intelligence. Pliny stated that when a Cobra was killed his companion always sought to avenge his death,† and it has been affirmed that in a house at Negombo, Ceylon, Cobras were kept as a protection against thieves, instead of watch dogs.††

Traces of snake worship still linger in India and Ceylon; the Singhalese, instead of destroying the reptile, deposit it reverentially in a wicker cage, and set it adrift on the nearest stream,* while the dark spirit of superstition, Hecate like, concocts the *cobra tel*, an infernal broth of snake venom and arsenic.‡

It has been stated by Fayer, that the Cobra destroys in India 20,000 people annually, yet the largest specimen out of 1,200 examined by Nicholson did not exceed 5-feet 8½-inches in length.

There are two species of Cobra in India, (1) the *naja tripudians*, †† or spectacled cobra, (2), *naja monocellata*, § but no difference in the activity or character of the poison of the two species has been as yet ascertained to exist. The poison itself is secreted by the parotid gland, and when the Cobra bites an animal the venom is expelled through a curved fang, in shape something like a dog's canine tooth, and hollowed or tunnelled like the needle of the modern surgeon's subcutaneous syringe. I send with this paper a fang of the Cobra, and if carefully examined there will be seen, at its base and in front, an aperture through which a very fine bristle may be passed. If this is done, it will be seen that the little tunnel does not occupy the centre but the front part of the fang, while the lower aperture, through which the poison exudes, is on the anterior surface

|| We are compelled from lack of space to hold over some of these papers until next month, but we print part of them.—Ed. ANALYST.

† Lib. viii. c. 37. †† Tennant's Ceylon, i. 193. * ib. p. 373. ‡ ib. p. 183.

‡‡ tripudiate, to dance on the toe.

§ Dr. Günther (Reptiles of British India, p. 329), however enumerates eight varieties, and considers them all of the same species.

and not exactly at the apex. So fine is the inferior orifice that Nicholson† found by experiment that a Cobra could not inject its venom through the fang with more force than would be necessary to expel a minim in three seconds. There appears to be no structural connection between the duct of the gland and the duct of the tooth, for the opening of the duct is on the inside of a loose gum. When the Cobra bites its enemy, which it does just like a dog, upon the fang sticking in the flesh, this loose gum is puckered up, the lower orifice of the duct is applied to the upper orifice of the bony canal, so that the two channels then become continuous, and the poison is discharged from the apex of the tooth, whilst at all other times, when the puckering up of the gum does not occur, the poison is discharged like any other saliva into the mouth; hence it follows that the whole secretion in the mouth of a Cobra is poisonous. The poison from the living Cobra is obtained by pressing on the parotid glands while the fangs are erected over the edge of a watchglass or spoon. Dr. Shortt boldly takes hold of the reptile just behind the head with a firm grasp, whilst the free portion of the snake plays and writhes in a chilly and uncomfortable way around the arm. The Cobra cannot, like the viper, bite sideways, so that it is possible, without much danger, for an intrepid experimenter to handle it in this way, and receive the venom ejected in a suitable vessel. This venom oozes out in large drops from between the gum and the fang, and sometimes in a fine jet from the apex of the fang itself.

As thus obtained, it is an amber coloured rather syrupy frothy liquid, of spec: gr. 1.046 and of feeble acid reaction—it dries rapidly on exposure to the air, into a yellow film breaking up into little brilliant yellow granules, which closely imitate crystals.

Mr. Nicholson gives the following statements as the extremes of the quantity secreted by Cobras:—

Grains.	Solid residue. Grains.
A Cobra gave 8 of poison, containing	1.6
" 7 "	4.7
" 22 "	6.6

But the average appears to be 6 grains of poison containing 2 grains of solid matter, hence it would appear that the solid residue varies from 22.5 to 67.5 per cent., but that a little over 33.0 per cent. is the most common quantity.

The yellow powder is very acrid and pungent to the nostrils, and if a little gets in the eye it excites a painful inflammation, which, however, soon subsides. The taste is bitter, and it raises little blisters on the tongue; it is probably poisonous if swallowed in any quantity, for a few years ago a native servant of Dr. Shortt's, in replacing a Cobra in a basket, was bit, and Dr. Shortt immediately sucked the wound, saving the man's life; he himself, however, was seized with alarming symptoms of poisoning, which happily passed away after a few hours.

The poison is perfectly stable, for I have heated a solution of it to 212° F., and yet the uncoagulated portion has preserved its activity. Cobra poison sent to me from India in the middle of 1875, was as active in a year from that date as when first excreted.

The dried residue is very soluble in water, and if the water is added in proper proportions the original fluid is, without doubt, reproduced. The solution usually deposits a sediment of epithelial debris, and often contains little white shreds.

† Indian Snakes, by Edward Nicholson, Madras, 1874.

Dumas made a combustion of the dried poison, and found carbon 46, nitrogen 13, oxygen 25, sulphur 2.5, and the rest hydrogen; and if you put a milk residue into a combustion tube, and express the milk as so many atoms of carbon, nitrogen, oxygen, and hydrogen, the one knowledge is of as little value as the other. The active principle of the Cobra poison is, indeed, as I shall shortly show, a single definite substance, but the product obtained from the reptile is a complex mixture of inert and active substances, which must be separated and identified previous to any numerical statement of carbon and other atoms.

In June, 1875, Dr. John Shortt, of Madras, kindly placed at my disposal a small quantity of cobra poison, and he sent me another small portion in the middle of last year. From that time up till now I have been working intermittently at the subject, both in its physiological and chemical aspects; the former I will bring forward elsewhere, the latter may be interesting to the members of this society.

Of its solubility in water I have already spoken; in other ordinary menstrua, such as alcohol, ether, bisulphide of carbon, benzole, &c., it is only partially soluble.

On heating the yellow granules or powder about 270° C, there is blackening and decomposition, and at temperatures above 270° there is a sublimate under favourable conditions of microscopic needles, this sublimate I obtained and shewed Dr. Shortt, in 1875, but was not then aware of its nature.

On incineration, from 1.4 to 1.5 per cent. of a white soluble ash is left, mainly consisting of chloride of sodium. The aqueous solution of the poison filters readily, and since it contains albumen, it is coagulated by heat, alcohol, acids, and other agents which render albumen insoluble. The albumen is principally serum albumen, but I have reason to believe that there is a small quantity of another variety mixed with the first.

There is a minute quantity of fat always present.

Sugar, glucosides, and alkaloids are absent.

In the latter part of last year, I found that when a solution of the poison was put in a dialysing apparatus, the outer liquid soon became acid, and on injecting small quantities of it under the skin of various animals, the usual fatal symptoms of Cobra poisoning rapidly manifested themselves. On the 1st of January of this year, I succeeded in obtaining a crystalline, acid, extremely poisonous substance, which appears to be contained in the venom to the extent of 10 per cent.; this substance, there is every reason to believe, is the sole and only active principle.

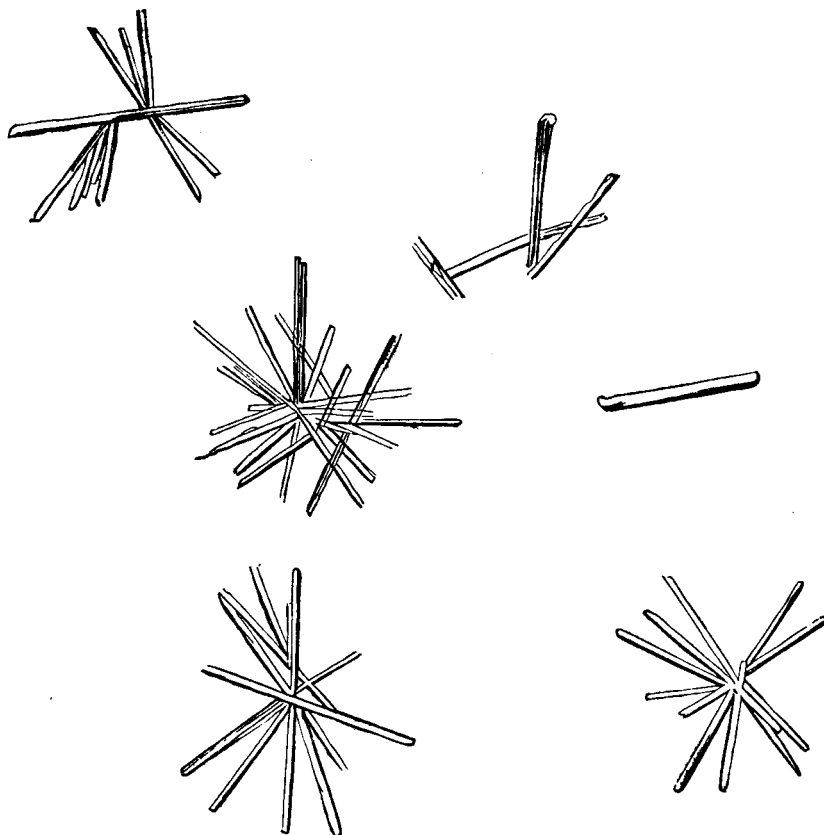
It may be obtained by coagulating the albumen with alcohol, filtering, driving off the alcohol at a gentle heat, concentrating the liquid to a small bulk, precipitating with basic acetate of lead, collecting the precipitate, washing it, and subsequently decomposing it in the usual way by SH_2 , removing the sulphide of lead, evaporating to a small bulk at a gentle heat, and finishing the evaporation spontaneously or in a vacuum, or it may be obtained by coagulating and separating the albumen as before, shaking up in a tube with ether, removing the ether in the usual way, evaporating the ether off, redissolving in water and passing through a wet filter to separate fat, and evaporating as before; in either case the result is microscopic needles, dissolving in water with an acid reaction and possessing highly poisonous properties; they appear to be identical with the needles obtained by sublimation.

For this substance I provisionally propose the name of *cobric acid*. I have not been able to go as yet any farther in the investigation of this interesting substance, for the simple reason that my two very small supplies are now exhausted, and I must wait for a third packet, but it will not be uninteresting to pause for a moment to consider what a terribly active substance this *cobric acid* must be, for supposing Nicholson's data are correct, and that the whole of the average quantity of the venom (that is 6 grains. containing 2 grains of solids,) is injected into a man, it then follows, since the solid residue contains 10 per cent. of *cobric acid*, that one-fifth of a grain would be fatal so that we have here a rival to aconitia weight for weight in its power of destruction.

I may add, in conclusion, that as first noticed by Dr. Shortt, a dilute solution of potash added to the liquid poison, or a solution of it, destroys its poisonous properties, and there is very shortly a fine blue colour developed, and after standing, flakes like Prussian blue collect at the bottom of the liquid, while the supernatant fluid is clear.

I find that out of the body a weak solution of alkaline permanganate of potash destroys at once and for ever the poison, and renders it as harmless as water; a wound of course may be washed advantageously with such an agent, but, as might be expected, it is of no use to inject it into the body as a true antidote.

I hope to have further opportunities of continuing the study of the poisonous saliva of the Cobra, and to return to this subject at some future day.



COBRIC ACID MAGNIFIED 250 DIAMETERS.

ON THE COMPOSITION OF COMMERCIAL SAMPLES OF WHITE LEAD.

BY G. W. WIGNER, F.C.S., AND R. H. HARLAND, F.C.S.

Read before the Society of Public Analysts at Burlington House, on 14th February, 1877.

THE white lead of commerce is used chiefly for the purpose of manufacturing white paint, and it is essential that this white paint should possess two distinct although compatible properties, viz. :—1st, the power of covering or laying on to wood, or other substance, in such a way as to cover every atom of the surface painted; and secondly, opacity, or the power of hiding any colour, whether paint or other substance, which may have been beneath the paint thus being applied. Nine-tenths of the white lead manufactured in England, or indeed on the Continent, is made by what is called the Dutch method, that is by subjecting metallic lead to the action of the fumes arising from acetic acid, heated in beds of tan or other similar decomposing organic material.

In "The Analyst" of 30th September last year, we published a paper showing approximately the composition of the gases which were evolved in these stacks, but we did not on that occasion make any reference to the action which these gases have upon the metallic lead. We now propose to take a second step in the consideration of the subject, and to see the character of the compound which is produced; at another time we may consider the way in which the gases act.

Many of the older text books state that the white lead paint of commerce consists of the anhydrous meta-carbonate of lead, but this is practically disproved by the fact that the native white lead ore or cerusite is quite incapable of being ground up with oil to form a paint which shall be of any commercial value whatever. We may, therefore, leave entirely out of the question this native product, and consider only the manufactured article.

Now there are two different ways in which white lead has been manufactured, first, the Dutch process, by which at least nine-tenths of the total quantity consumed is made; and secondly, precipitation, by which a small quantity, certainly not so much as one-tenth is made.

Quoting from Watts, showing as he doubtless does, an epitome of nearly all the published statements on the subject, we find that when the precipitation process is used and an excess of carbonate of ammonia is added to a solution of lead, the anhydrous meta-carbonate of lead is precipitated, while, according to Lefort, the hydrated salt, consisting of hydrated meta-carbonate of lead is thrown down, therefore, according to both these views, the precipitation consists of carbonate of lead anhydrous in the one case, and hydrated in the other case.

H. Rose, however, mentions that the precipitate always contains hydrate of lead, and this is the first time that we find any mention of this compound occurring in any white lead, particularly in that obtained by precipitation, but it is clearly to be noted that the proportions which Rose directs for the admixture of the solutions of salts of lead and carbonate of soda, are not such as to give an excess of the alkaline base, and he further states that the composition of the precipitate thrown down was six equivalents of carbonate of lead and two equivalents of hydrate of lead + one equivalent of water.

Rose also states that, under some conditions, which he specifically details, another compound may be obtained, consisting of five equivalents of carbonate of lead and two equivalents of hydrate of lead; and, under other conditions, another precipitate may be obtained, consisting of three equivalents of carbonate of lead and two equivalents of hydrate of lead; our experiments lead us to doubt both these results.

Watts further goes on to say that "hydrated carbonates of lead are also formed by the direct action of carbonic acid on hydrate of lead, and the compounds thus obtained differ from the precipitated carbonate in being amorphous and perfectly opaque, while the precipitated carbonate is an aggregate of minute, transparent crystalline grains."

We differ entirely from both these statements. We do not believe that the direct action of carbonic acid ever produces hydrated carbonate of lead, but, on the contrary, it produces either an admixture or a slight chemical combination of carbonate of lead and hydrate of lead, both of these compounds, however, preserving most of their original chemical properties; and when the carbonate of lead and hydrate of lead are precipitated in the proper manner, they do possess the characters, or, rather, to speak more correctly, the character, of an amorphous and opaque precipitate, and not "an aggregate of minute transparent crystalline grains."

As the result of the examination of some hundreds of samples of commercial white lead (in all nearly 1000), we must decidedly express our opinion that the material consists not of a basic carbonate, but of a mixture of a neutral carbonate, with a hydrate, and that the value of the white lead as a paint, whether it be prepared by the Dutch process or by precipitation, depends almost entirely upon the relative proportions of these two different ingredients. To put it in general terms, if lead is either by the dry or wet process converted into a hydrate, it is perfectly true that it will combine with oil, and form a kind of paint or varnish, but this paint or varnish, although it will spread over the surface of the wood or other material to be covered, will not really cover it in such a way and with such a degree of opacity as to hide the natural colour of the substance over which it is spread, but, on the contrary, it will appear like a muddy film of varnish or lacquer spread over it; or, taking the other extreme, if the compound, whether formed by the dry or wet process, consists entirely of carbonate of lead, it will form an emulsion with the oil resembling to some extent the emulsion which chalk will form with water or with syrup, and although it will possess a certain degree of opacity, it will not cover the wood or other material in such a way as to render it suitable for paint.

We have therefore come to the conclusion that the combination or mixture of the two compounds, viz.:—carbonate and hydrate of lead, is necessary in order to secure a good and servicable paint, that is the hydrate of lead must be present in order to enable the mixture to form a paint instead of an emulsion, and the carbonate of lead must be present in order to give covering power.

We will consider this subject in two ways—

- 1st. We have tested samples of pure carbonate of lead and have made them into paint with the greatest care, and have found that although it was possible to spread them over the surface of the substance to be painted, and to secure a certain degree of opacity, the paint never really dried or hardened, or became, in the sense a painter would use the term, a full paint, that is to say, the surface of the colour over which the paint had been

spread was never entirely obscured, and the paint itself, even after some days of drying, was so pulverulent that ordinary washing was sufficient to remove a large portion of it.

2nd. We took commercially pure samples of hydrate of lead and we ground them up into paint in the ordinary way with linseed oil. These samples when so ground possessed comparatively no covering power, that is they spread over the substance painted, and formed a varnish-like film, similar to that which would be formed by linseed oil alone, although with a greater degree of opacity, but they did not really cover or hide the colour beneath. The chemical combination of the hydrate of lead with the linseed oil sets free a certain amount of heat, sufficient to prove that it is really a chemical combination and not a mere admixture or emulsion.

Having experimented on these substances, viz., carbonate of lead and hydrate of lead, separately, we experimented upon mixtures of them in various definite proportions. Our experiments here may be numbered by hundreds, and as the result of the whole, we have come to the conclusion that a white lead paint to be efficient, and to possess both the powers of laying on readily and easily, and by its opacity, hiding the colour beneath, must consist of an admixture of hydrate and carbonate of lead, and that this admixture must be within certain moderate limits in a definite proportion.

The results of the analysis of a very large number of the best brands of commercial white lead show that the percentage composition found, corresponds in most cases with admixtures which are between those limits, and the results of several experiments which we have made, prove to us conclusively that this is the true composition of all the best paints.

Muter in his recent book on "Pharmaceutical Chemistry," appears to have practically hit upon the true proportion, which he puts down as three equivalents of carbonate of lead and one equivalent of hydrate of lead, and this corresponds very fairly to the proportion, which we find by experience is essential to the formation of good white lead paint.

Difficulties connected with the patent law, prevent us for the present stating all the experiments which have led us to arrive at this conclusion, but we may mention one fact—if a sample of ordinary white lead paint of good quality is ground in a mortar, and dilute sulphuric acid added in small quantities from a burette, it will be found that no effervescence is produced until a sufficient quantity of sulphuric acid has been added to decompose all the linoleate of lead present, corresponding to the percentage of hydrate of lead present in the original lead; and that if the mixture be then diluted with warm water, the fatty acids corresponding to the percentage of oil present, will be liberated, and will rise to the surface, and can be separated so as to determine by that means the amount of oil which has been chemically combined with the hydrate of lead. Many other experiments confirm us in this view; having formed this opinion we have made a large number of experiments to determine what proportion of hydrate of lead was most desirable, in order to form a thoroughly good white lead paint, and have come to the conclusion that this proportion should be within small limits of 25 per cent., corresponding to an actual percentage of 12.30 per cent. of carbonic acid, or somewhat less than the percentage of carbonic acid which is found in the average. In these

commercial samples, however, the variation is very great. We have had samples containing as much as 16.33 per cent. of carbonic acid, or as little as 10.39 per cent., and in both these cases the paint, if not useless, would, at any rate, have been of the most inferior quality, and we are not surprised that some of these samples should have been returned as quite useless as paints, although they proved to be perfectly pure white lead, accepting the ordinary interpretation of the term.

The facts which we have brought forward this evening, seem to us to give ample evidence of the reasons why zinc white, carbonate of magnesia, oxyde, and other metallic carbonates and similar substances, have not been able to be used as paints with any degree of success. In the case of the white lead, a positive chemical compound has been formed, and the 75 per cent., or thereabouts, of carbonate of lead present has been dissolved in the chemical compound, and so a paint has been formed which possesses an unquestionable covering power in excess of any other compound known. Until some means can be devised by which oxyde of zinc or some other substance can be dissolved in the same way in a chemical compound, so as to form a paint possessing characters somewhat different from those of a mere emulsion, it seems useless to argue that, as regards durability or covering power, they can equal a good well manufactured sample of white lead, and, still further, while inventors will attempt, in order to increase the yield of paint from a ton of lead, to precipitate the whole of it in the form of carbonate, it is perfectly useless for them to think that that paint can possess a covering power to be compared with that of a genuine article.

Dr. Muter was very pleased Mr. Wigner confirmed him in his view, because at the time he was writing his book he kept it back six weeks on that account, as he was not satisfied with it, but after some trouble and experiments he made out that formula to be the right one, and he was very pleased to be confirmed.

Mr. Dyer asked Mr. Wigner if he had made experiments on the properties of white lead paint mixed with small quantities of baryta, or adulterated about 7 to 10 per cent. with chalk; it did not seem to him to make much difference in paint.

Mr. Harland had examined several samples of white lead manufactured by precipitating oxychloride of lead by a current of carbonic acid. This process appears to produce a very inferior paint. He examined some samples by the manufacturer's test, which was simply to mix a little ultramarine with the paint; this test certainly gave a good indication as to the body of the paint. As to Mr. Dyer's idea of adding baryta to white lead, it not only decreases its power, but makes it apt to wash off; 5 per cent. does not hurt it much, but 10 per cent. does.

Mr. Wigner in reply to a question from Dr. Dupré, said his opinion was that white lead was not a combination of the carbonate and hydrate, but that the carbonate was left totally unchanged. They had taken 75 per cent. of lead, 25 per cent. hydrate of lead, mixed them together, ground them up with 7 per cent. of linseed oil, which made a good thick paint, too thick to lay on with a brush, but adapted for thinning in the ordinary way. If this paint is kept for any length of time the oil does not separate. The same thing occurs if we take white lead made by the ordinary Dutch method, and containing the same proportions. It seemed that the two are identical.

Dr. Dupré said that some time ago he was consulted with regard to antimony paint. It was said that there was some made in London, and in certain books it is stated as being an exceedingly good covering paint.

REVIEW.

THE DIGESTION AND ASSIMILATION OF FAT IN THE HUMAN BODY.*

By DR. BARTLETT.

AFTER such an amusing introduction as this book has in reference to the views of the late Baron Liebig, we naturally turned to the body of the pamphlet with some misgiving. We will, however, say at once, that the substance is better than the introduction. Dr. Bartlett describes some experiments on the digestion and assimilation of fat which, if extended and verified by others, cannot fail to advance our knowledge on this subject considerably. It has been known for a long time that the pancreatic secretion has the power not only of producing an emulsion with fats, but also that of splitting them up into fatty acids and glycerine. Dr. Bartlett now adds this further property, viz: the power of splitting up the higher into lower fatty acids, and thus rendering them soluble in water. It is this latter splitting up which, according to the author, renders the fat capable of assimilating the soluble fatty acids in some way not as yet explained, during their absorption, carrying the emulsified fat along with them. Some experiments described by Dr. Bartlett certainly seem to favour this view, and, as before stated, should it prove to be the correct one, it will mark an important step in advance in our knowledge of the process of the digestion and assimilation of fats. It might be well, however, if Dr. Bartlett furnished us with some of the analytical data on which his conclusions are based, and, if he would, at the same time, state his views with somewhat less verbiage.

RETURNS OF ANALYSES MADE UNDER THE SALE OF FOOD
AND DRUGS' ACT.

WE are preparing a return of the amount of work which has been done by the Analysts appointed under the Act during the years 1875-6. We have received a large number of returns from the following places:—

M. A. ADAMS ... Kent.	E. W. T. JONES ... South Staffordshire.
A. H. ALLEN ... North Derbyshire.	Wolverhampton.
Sheffield.	E. H. MOORE ... Brighton.
R. APJOHN Cambridge (Borough).	East Sussex.
Cambridge (County).	W. MORGAN ... Swansea.
Ely (Isle of).	C. O'KEEFE ... Cork City.
Huntingdon (County).	Cork County.
W. BAKER Rotherham.	W. PROCTER ... Beverley.
Upper Swafforth and Tickhill.	E. SERGEANT ... Bolton.
J. J. BANCROFT Denbighshire.	W. W. STODDART Bristol.
T. B. BLUNT ... Shrewsbury.	Somerset.
Shropshire.	R. R. TATLOCK Govan.
Mongomeryshire.	J. W. THOMAS Cardiff.
J. BRIERLY Southampton.	J. W. TRIPE ... Hackney.
J. C. BROWN ... Lancaster (County).	WALLACE, TATLOCK
Liverpool.	& CLARK Glasgow.
Preston.	WM. WALLACE... Ayr.
J. H. COLLINS ... Cornwall.	Kilmarnock.
M. CORNER Mile End Old Town.	Rutherglen.
C. ESTCOURT ... Manchester.	J. WIGGEN Ipswich.
J. H. GRAMSHAW Gravesend.	Colchester.
C. HEISCH Hampstead.	East Suffolk.
Lewisham.	G. W. WIGNER Greenwich and Deptford.
A. HILL Birmingham.	Plumstead.
J. F. HODGES ... Belfast.	Woolwich.
G. JARMAN ... Huddersfield.	

* The Digestion and Assimilation of Fat in the Human Body, by H. C. Bartlett, Ph.D., F.C.S. London: J. & A. Churchill, 1877.

The net result of these returns is that in these 49 districts 6,748 samples have been examined, of which 1,537, or 22·77 per cent. have been adulterated.

Of course the largest number of adulterated articles have turned out, as usual, to be samples of milk.

We hope, next month, to be able to publish the list for the entire kingdom, and to show, in a satisfactory manner, what the working of the Act has been; and shall be glad if all Public Analysts, whether members of the Society or not, will forward us their returns before the 15th of March. We have received a few since the above list was made up which we will acknowledge next month.

Mr. J. Baynes has been appointed Public Analyst for Hull, at a salary of £50 a year, by 42 votes. Mr. Penny received 7 votes.

RECENT CHEMICAL PATENTS.

The following specifications have been published during the current month, and can be obtained from the Great Seal Office, Southampton Row, Chancery Lane, London.

1876. No.	Name of Patentee.	Title of Patent.	Price.
1944	W. T. Henley... ..	Electric Telegraph Conductors	8d.
2039	W. S. Williamson	A treatment of Slags	6d.
2073	J. Mactear	Furnaces for the Manufacture of Alkaline Carbonates	6d.
2089	A. J. Morrison	Apparatus for Evaporating Liquids	8d.
2124	W. Webb	Separating Sewage	6d.
2143	C. Solvay	Manufacture of Carbonates of Soda	6d.
2285	R. W. Wallace	Manufacture of Sulphuric Anhydride	6d.
2350	J. H. Johnson... ..	Manufacture of Gas	8d.
2387	T. Lovell	Purifying Sewage	4d.
2620	G. J. Wells	Manufacture of Soda and Potash	4d.
2630	Kingsett & Zingler	Preparing and Applying Albumen	4d.
2632	R. J. Hutchings	Manufacture of Tin, Terne, and Metal Plates	6d.
2661	R. Dickson	Dressing, Dyeing, and Coloring Furs, &c.	2d.
2677	J. Ireland	Reducing Oxide Ores	2d.
2680	A. M. Clark	Waterproofing Compound for Skins and Leather	4d.
2690	Duncan Newlands & Newlands	Manufacture of Sulphate of Alumina	4d.
2707	Ditto	Ditto ditto	4d.
2737	J. Calderwood... ..	Utilizing Sulphuric Acid Tar	2d.
2742	Mackie, Faure & French	Explosives	4d.
2748	J. Morton	Preparing Fabrics, &c., for Dyeing or Printing	4d.
2793	E. H. C. Monckton	Medicinal Compounds	2d.
2886	J. Dewar	Electro Meters, &c.	2d.
2893	J. Thellot	Treating Petroleum for mnftr. of Candles and Soap	2d.
2923	N. D. Spartali	Apparatus for convrtng. Peat into Coke or Charcoal	2d.
2928	Bickerdike & Bowdler	Manufacture of Varnish	2d.
2938	J. Steele	Apparatus for Purifying Gas	2d.
2950	Wallace & Claus	Manufacture of Salts of Barium	4d.
2951	Ditto ditto	Ditto, &c., of Sulphate and other Salts of Zinc	4d.
2971	J. H. Johnson	Coating Metals or Surfaces with Platina	4d.
2973	W. Morgan Brown	Photography in Colors	8d.
3003	R. H. Ridout	Galvanometers	2d.

BOOKS, &c., RECEIVED.

The Miller.
The Sugar Cane.
The American Chemist.
Dr. Bartlett's Digestion and Assimilation of Fat in the Human Body.
The Chemist and Druggist.
The Brewers' Guardian.
The British Medical Journal.

The Medical Examiner.
The Medical Times and Gazette.
The Pharmaceutical Journal.
The Sanitary Record.
The Telegraphic Review.
The Anti-Adulteration Review.
The Medical Record.
The Geological Society's Proceedings.

MILK WITHOUT CREAM.

IMPORTANT APPEAL CASE.

At the Liverpool Sessions, on 24th February, before the Recorder (Mr. J. B. Aspinall, Q.C.), a case of some importance to milk dealers and buyers was heard, in which the question arose whether the usual method of ladling milk from a large vessel to customers deteriorated the article so as to make it skimmed milk. The appellant was John Simpson, milk dealer, 53, Laxey Street, Toxteth Park, and he appealed against a conviction by the stipendiary magistrate (Mr. Raffles) for selling as new milk, milk from which had been abstracted part of its cream so as to affect injuriously its quality, substance, or nature.

Mr. Segar appeared for the appellant, and Mr. Samuell for the respondent.

The conviction took place under the 9th section of the act, which says that "no person shall, with the intent that the same may be sold in its altered state without notice, abstract from an article of food any part of it so as to affect injuriously its quality, substance, or nature; and no person shall sell any article so altered without making a disclosure of the alteration." The penalty in each case not to exceed £20. The facts of the case were that in January, a person from the nuisance inspector's office purchased at appellant's house, from a female, a pint of milk, asking to be supplied with new milk. The sample was taken to Dr. Campbell Brown, the public analyst, who found that "the milk was skimmed milk, having been deprived of nearly all its cream." The respondent fined appellant 5s. and costs, but said he believed there was no fraudulent intention. Evidence in support of the respondent's case was given.

Dr. Campbell Brown cross-examined by Mr. Segar.—Supposing 18 gallons of milk had been deposited in a vessel at six o'clock in the morning, and customers were served with milk from the vessel from that hour until about three o'clock in the afternoon, when the milk in question was sold would not the milk sold last be very much thinner than that served earlier? Witness: It ought not to be, because every one who knows his business stirs up the milk before taking it out. Mr. Segar: But the act of Parliament does not say we are to do that; Suppose we go upon the principle, first come first served, and each gets his "dollop" from the top, what would be the result then? Witness: I should say the appellant had skimmed the milk in serving his customers. If they do not stir it up but leave the can standing for a whole day, the first customers would get very much more cream, undoubtedly.

Mr. Segar, on behalf of the appellant, said it might appear strange to be fighting about a five-shilling conviction, but it was a matter of very great importance to the appellant, and also to other milk dealers who sold their milk exactly in the same way as the appellant did. The milk was put in an 18-gallon pot, and was sold in the ordinary course to customers as they came for it from time to time. No cream was abstracted from the milk, and if there had been any deterioration it was the result of the cream coming naturally to the top of the vessel and being ladled out to earlier customers, thereby weakening the quality of the milk.

The Recorder.—You say that the fact of selling to customers out of an 18-gallon vessel weakens the milk until it gets to the condition of skimmed milk, and that is so obvious that every milk dealer must know it. Mr. Segar: Yes. The Recorder: If that is so, has he, knowing it, the right to sell the milk in that condition as new milk? Mr. Segar: It is new milk until it has been skimmed deliberately.

The Recorder.—But knowing that the milk was skimmed in this way, do you think he is doing right to go on selling the residuum as new milk? Mr. Segar: Clearly. In the market new milk is new milk from the moment it is put into the can until it has been deliberately skimmed. It must be proved not only that the milk is reduced in quality, but that a portion of it has been abstracted with intent that the same may be sold in its altered state without notice.

The Recorder.—Nobody will convince me that a milk dealer could not, if he liked, take care that each of his customers should get a fair proportion of the cream. Mr. Segar said he would call evidence to show that the milk had never been skimmed, but was sold in the ordinary way, and that in the trade milk which had not been skimmed was considered new milk.

The Recorder said it was unnecessary for Mr. Segar to do so. He was perfectly certain that the milk had not been skimmed, but that it had been weakened by the process of selling to the earlier customers. He was certain that when the appellant sold the milk to the earlier customers he knew he was abstracting the cream from it—not skimming the milk, but abstracting the cream, but with no fraudulent intention. He was equally certain also that the appellant sold the residuum of the milk knowing that it had been reduced to the condition in which it was when he sold it. He was quite satisfied, therefore, that an offence had been committed against the act of Parliament, but at the same time he thought it right to say that he thought Mr. Simpson had not the least fraudulent intention. Mr. Raffles had practically expressed the same opinion, when he only inflicted a penalty of 5s., though he might have imposed one of £20. While he believed Mr. Simpson had been perfectly honest in the transaction, he could not alter his view that the mode in which he sold the milk constituted an offence against the act of Parliament. Mr. Simpson was pursuing, no doubt, what he thought the ordinary course of business, and which was, no doubt, the ordinary, but mistaken, course of business of a great many milkmen. A man had a right to sell to his

earlier customers in any way he liked, but when the milk was reduced by that process to the condition in which he knew it was no longer new milk, he had no right to sell it as new milk. He would, therefore, confirm the conviction, with costs. It might satisfy Mr. Simpson to know that although this litigation had cost him some money, nobody said, and nobody thought, he had done anything fraudulent in the offensive sense of the word. The conviction was then confirmed.—*Liverpool Daily Courier*.

PROSECUTIONS UNDER THE SALE OF FOOD AND DRUGS' ACT.

At the Birmingham Police Court, on 16th Feb., Richard Genge, milk seller, Cromwell Street, was summoned for selling adulterated milk. George Leaton, inspector, purchased at defendant's house a pint of new milk for 2d., which, on being analysed by Dr. Hill, borough analyst, was found to contain 24 per cent. of water. The defendant was fined 20s. and costs.—George Owen, Railway Terrace, Nechells, was charged with a similar offence, the sample containing 25 per cent. of water. It was stated that the defendant had supplied the milk to the previous defendant. The defence was that the milk that had been sold to the inspector was some that was kept for a baker for making buns, at 6d. a gallon. A fine of £1 and costs was imposed.—William Jones, Hampton street, was fined £1 and costs for selling to the inspector a pint of new milk adulterated with 27 per cent. of water.

Joseph Day, provision dealer, Hill Street, was charged with adulterating mustard. On the 1st inst. he sold to the inspector 2oz of mustard adulterated with 30 per cent. of wheaten flour. Mr. Goodman, a magistrate, said they should only impose a small penalty, as the mixture was not calculated to do any harm, the defendant would be fined 5s. and costs.

Alfred B. Parker, "Leather Bottle" Inn, Digbeth, was charged with selling gin 49 deg. below proof. Mr. Herbert, in opening the case, said that in an appeal case in the Court of Exchequer, before Baron Cleasby and Justice Grove, it was laid down that 20 degrees below proof was the lowest degree at which it was permissible to adulterate gin for commercial purposes. If it was weaker than that it was adulterated. Leaton proved that he bought a pint of the gin for 1s. 8d., and in cross-examination admitted that when he stated the purpose for which he required it, the waitress told him it was not their best gin. Mr. Hebbert, magistrates' clerk, explained that anything said after the sale would not affect the case.—Dr. Hill, the borough analyst, stated that the sample was 49 degrees below proof. He explained that 1 per cent. of alcohol represented two degrees under or over proof as the case might be; the specific gravity of good gin should be 944. The sample was heavier than it should be, gin being lighter than water. Extracting the alcohol, in 100 parts he found that the gin contained 23½ parts of alcohol, the remaining 76½ parts being water. Gin of the specific gravity of 944 would contain 45 per cent. of alcohol, and 55 of water. In cross-examination, Dr. Hill said he was not aware that publicans were not permitted to sell gin unless it was 30 degrees under proof. There was no Excise law or any other law to that effect—nor did he know that they are not permitted to sell raw gin; gin delivered from the distillers was 20 degrees over proof, whereas this sample was 49 under proof, and was the weakest he had ever examined. His authority was based upon cases previously decided in law courts and superior courts. In defence Mr. Bickley urged that it was the first case of the kind that had been heard in Birmingham, and said it was the commonest custom in this town for publicans to sell gin of that quality. The great point in his argument was, whether the gin had been sold to the prejudice of the purchaser, considering that it had been sold at a reduced price and without any stipulation on the part of the purchaser as to the quality of the article required. Mr. Goodman observed that a case in the Superior Court had established a standard for the guidance of the trade. Gin ought not to fall below 20 degrees under proof, while the one before them was 49 degrees. The defendant would be fined 20s. and costs; but it was advisable that the trade in Birmingham should know that if any other case came before they would be fined more heavily.

Alfred W. Bradley, "Rose and Crown," Lichfield Street, was summoned for selling beer, adulterated with 147.6 grains of salt per gallon. Mr. Herbert said that excise ale was allowed to contain 50 grains of salt per gallon, but here there was almost three times that quantity. The Brewers' Association, a few years ago, took up the question of the adulteration of beer with salt, and the Home Secretary suggested that in cases where the total quantity of salt in beer did not exceed 50 grains, the officers of Inland Revenue need not enquire whether any part of the amount had been artificially added, for the salt might be contained in the water. Dr. Hill said he had analysed large quantities of beer, and as a rule the quantity of salt was very much below 50 grains per gallon, sometimes not more than 7 or 8, while in the sample there was the large quantity of 147.6. Burton ales had about 9 grains of salt. Mr. Bickley admitted that there was the quantity named in the beer. Salt improved beer, and made it keep better. His client sold the beer as he had purchased it from a brewery. Dr. Hill said that he never found beer quite free of salt, but salt was not necessary for the keeping of beer. The best Burton ales consumed in this country, and in India, contained very little salt. He had tested Burton ales that had been brewed more than a month. Mr. Goodman said he regarded this case in a different light to the previous one, as an injurious ingredient had been added to the beer, no doubt wilfully, and fined the defendant £5 and costs.—*Abridged from the Birmingham Daily Post*.

PRESERVED PEAS.

On the 19th inst, at Marlborough Street, the adjourned summons against a number of foreign provision dealers in Soho for selling French preserved peas, alleged to be adulterated with copper, was again before Mr. Knox. Mr. Philbrick, Q.C., attended on behalf of the Strand Board of Works, to prosecute; Mr. Edward Lewis for the defence. Mr. Lewis asked the magistrate to give his decision in the case of Louis BARRON, which had been fully argued on the last occasion, before proceeding with the other cases. It was understood that the matter stood over for the magistrate to consider his decision. Mr. Knox said the matter had been practically exhausted in Barron's case; but it would be the better course to take another case, as he understood many scientific persons were now prepared to give evidence. The evidence for and against Barron was so evenly balanced that he should adjourn that case *sine die*, and Mr. Lewis, if he thought fit, could apply for a *mandamus* to compel him to give a decision. Mr. Lewis was not desirous of taking such a course, although he confessed to some disappointment in not having a decision as anticipated. It was then arranged that the summons against another defendant named DELMAT should be taken. Formal proof having been given of the purchase of a tin of Briant's French preserved peas, Dr. Piesse, official analyst for the Union, stated that he had analyzed the sample of peas submitted to him, and found 0.56 of a grain of copper. On the application of Mr. Lewis, the certificate of the Government analyst at Somerset-house was produced. From the certificate it appeared that the quantity of copper found in a similar sample of peas from the same tin was returned at 0.23. Mr. Lewis pointed out that, in the case of Barron, the Government analyst had found much less copper than Dr. Piesse had declared to be present. And in the present case there was a great disparity between the result of the analyses of the Government analyst and that of Dr. Piesse. The summons against another of the defendants, William Lingner, was taken. Mr. Philbrick said the proceedings were taken under the Sale of Food and Drugs' Act, 1875, in respect of a tin of preserved peas sold by the defendants to the inspector appointed by the Board of Works, Strand Union, and which on being analyzed were found to contain copper to the extent of .088, of metallic copper, equal to $2\frac{1}{2}$ grains of sulphate of copper. The amount of copper might be small, but it was sufficient to be dangerous. Mr. F. Taylor, inspector to the Strand District Union, and Mr. Piesse, analyst to the Strand District Board of Works, gave evidence in support of the summons. Dr. Conway Evans, M.D., medical officer of health, said he had been in practice for upwards of 20 years, during which time he had held several important appointments. He considered that the larger quantity of salt of copper spoken of in a 1lb tin of peas, if eaten daily or repeatedly would be injurious to health, and would produce chronic poisoning, but many persons might eat a quantity of these peas several times without apparently suffering any injurious effects, the period varying in accordance with difference of vigour, age, health, &c. Two or three doses might affect some persons and not others. From 14 to 15 grains of copper was sometimes given as an emetic, and sometimes in aque or chronic diarrhoea $\frac{1}{2}$ to 3 grains were given as a tonic. It was a well-known medical fact that in respect of some poisons—such, for instance, as mercury—certain persons were peculiarly susceptible to their influence, and it was possible that these peas containing copper, if swallowed by persons ignorant of their own susceptibilities, might, even in a single dose or a few doses, lead to injurious consequences. He believed copper was more fatal in a smaller dose than salts of lead. The heightening the colours of preserves with copper was once a common practice. Cases of poisoning by copper were formerly very common, but copper utensils in cooking had given place to tin and iron saucepans. Such cases were of rare occurrence. Pure metallic copper he believed to be harmless, but it was dangerous when in contact with other substances, and when dissolved. In France 20.4 of deaths were caused by copper poisoning. Mr. Philbrick here read the symptoms of chronic poisoning by copper; they were very slow and insidious, as described by Tardieu. Dr. William Guy, M.B., F.R.C.P., and Vice-President of the Royal Society, said that cases of poisoning by copper had occurred in which the quantity swallowed must have been small. He had studied the question of poisons particularly. The fact of a trace of copper in the human body would not prove its existence in a poisonous form. He had made inquiries for Government into the effects of poisoning in certain trades. Palsy followed from poisoning by copper. Two cases had come under his knowledge of poisoning by green paper in a room. The poisoning, in his opinion, came from the copper, not the arsenic. Salts of copper he considered more poisonous than lead. The small quantity of copper contained in the peas in question from France might prove injurious, and slowly undermine health. On a nervous person copper was more likely to produce dangerous symptoms than on anyone else. With regard to the presence of 3.6 of copper, if taken one-third at a time it would not affect a healthy person, and if repeated in small doses it would, in his opinion, be ultimately injurious to health. He considered that any article containing the amount of copper spoken to by Mr. Piesse should not be allowed to be sold for one moment. Sulphate of copper in its virulence ranked fourth in the class of poisons. Dr. Charles Tidy, M.D., Professor of Chymistry and Medical Jurisprudence, and Medical Officer of Health for Islington, gave similar evidence. He had studied poisons, had experimented on fresh peas and pods, and found not even a trace of copper. If copper—that is, sulphate of copper—were constantly taken to the extent of the amount of copper found in the French peas it would be injurious to health. Dr. August Duprè, Ph.D., F.R.S., Lecturing Chymist at the Westminster Hospital, and

President of the Society of Analysts of Great Britain, stated that copper was present in traces only in animal and vegetable tissues. The quantity of copper found by Mr. Piesse was far beyond that quantity normally in any vegetable. Dr. Guy said he considered the sale of an article containing such a quantity of copper as that found in the French peas ought not to be tolerated. Small doses of copper were more dangerous than large ones, as the latter would cause vomiting. The defendant said the peas were sent to him as quite natural peas. Mr. Jenkins said the defendant had been convicted of a similar offence. Mr. Knox said that, having been informed that the defendant has been before convicted for selling peas injurious to the public health, he saw nothing to cause him to mitigate the fine, which, he believed, went up to £50. He did not want to be oppressive, but the heads of the chymical and analytical kingdom had said there was not only a traceable quantity of copper in the peas, but a dangerous quantity. Mr. Philbrick said the prosecution was instituted for the public benefit, and not with the view of punishment. The defendant said he did not sell three dozen tins in a year, and would discontinue the sale. Mr. Knox, after cautioning the defendant and expressing a wish that publicity might be given to the fact that persons would not be permitted to bring to this country goods deleterious to the health of the inhabitants, and that in future real and substantial fines would be inflicted, fined the defendant the nominal fine of 1s. and £5 5s. costs. Mr. Detmar having wished his case dealt with, he was similarly fined, and the other cases were adjourned.—*The Times*.

KICKING AN INSPECTOR.

WILLIAM NEALE, Chemist, of 21, George Street, Woolwich, was summoned for assaulting John Carty, inspector under the Adulteration Act. Mr. W. Farnfield prosecuted for the Woolwich Local Board of Health. Mr. Carty said he went into defendant's shop and asked a young man behind the counter if he sold castor oil lozenges? He replied that he did, and witness asked for a dozen, which were supplied at a charge of 9d. Witness then said that he had bought them for analysis, when the young man called the defendant, who tried to regain possession of the lozenges, saying that they did not contain castor oil, and that they were not the article required. Witness offered to divide them, so that defendant might retain a sample, but the defendant got very much excited and caught hold of witness's coat. He also raised a chair, and as witness was leaving the shop, kicked him. Defendant denied the assault, and his statement was confirmed by his assistant, who said that the lozenges, though called castor oil and other names, were simply aperient, and had no castor oil in them. It was stated that they were now being tested by the public Analyst. Mr. Balguy said he believed the inspector's statement, but the assault was not a serious one, and he fined defendant 5s. and costs.