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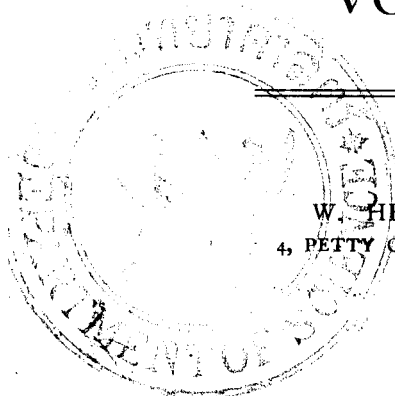
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THE ANALYST

PROCEEDINGS OF THE SOCIETY OF PUBLIC ANALYSTS AND OTHER ANALYTICAL CHEMISTS.

AN ordinary Meeting of the Society was held on Wednesday, December 7, in the Chemical Society's Rooms, Burlington House. The President, Mr. Alfred Smetham, was in the Chair.

Certificates were read for the first time in favour of Messrs. Charles March Caines, F.I.C., John Leonard Lizius, B.Sc., A.I.C., Harry Malkin Mason, M.Sc. (Sheffield), F.I.C., Thomas McLachlan, A.I.C., and Girija Nath Mukerjee, B.Sc. (Cal.).

Certificates were read for the second time in favour of Messrs. Jack Cecil Drummond, D.Sc. (Lond.), F.I.C., Alfred William Long, John Charles Mellersh, and Charles Harold Wright, M.A. (Cantab.), F.I.C.

The Council's nominations of Officers and Council for 1922 were read.

The following papers were read: "The Estimation of Small Quantities of Antimony in Copper and Brass," by B. S. Evans, M.B.E., M.C., B.Sc., F.I.C.; "The Inks of Ancient and Modern Egypt," by A. Lucas, O.B.E., F.I.C.; and "Notes on the Analysis and Use of Red Squill in Rat Poisons," by C. L. Claremont, B.Sc., F.I.C.

The Estimation of Small Quantities of Antimony in Copper and Brass.*

BY B. S. EVANS, M.B.E., M.C., B.Sc., F.I.C.

(Read at the Meeting, December 7, 1921.)

THE determination of small amounts (say 0.01 to 0.10 per cent.) of antimony in copper, is a matter of some importance owing to the effect of these traces on the mechanical properties of the copper and also the lowering of the electrical

* Communication from the Research Department, Woolwich.

conductivity. On reference to text-books, the position, so far as analytical processes are concerned, is seen to be very unsatisfactory; in the first place, no two books seem to give the same method, and those that are given are either very lengthy, or else inadequate. Most books seem to favour separation as sulphide after the copper has been eliminated in some way; some of these separations involve three separate precipitations of the antimony with hydrogen sulphide at various stages of the process, generally accompanied by elimination of the arsenic by distillation. Other methods attempt to distil off the antimony as chloride after the arsenic has been distilled, which process (obviously needing ground glass apparatus), according to one author, requires at least three distillations, and is then somewhat doubtful. One author recommends the evolution of anti-moniuretted hydrogen in a Marsh apparatus and the comparison of the mirrors obtained, after subliming off the arsenic, with standard mirrors; this process, which is rather lengthy, though capable of use as a sorting test, is so unsound theoretically as to be most undesirable in practice.

For the above reasons, the following process was worked out to provide a reasonably rapid and accurate method capable of estimating quantities of antimony of the order of 0.003 to 0.10 per cent. in copper or brass.

Briefly the process consists in obtaining the sample in sulphuric acid solution; precipitating the copper as metallic sponge with sodium hypophosphite; adding hydrochloric acid and precipitating the arsenic with more hypophosphite; separating the antimony from the solution on copper foil by Reinsch's method; stripping the latter with sodium peroxide solution; removing the trace of copper, also brought into solution, with zinc sulphide; and estimating the antimony colorimetrically as sulphide. Details of the process are as follows:—

(A) IN THE ABSENCE OF ANY CONSIDERABLE AMOUNT OF TIN.—Five grams of the sample are dissolved in about 60 c.c. of nitric acid (sp. gr. 1.2) and 10 c.c. of concentrated sulphuric acid, and the solution evaporated until the sulphuric acid fumes strongly (care is necessary in the later stages to avoid spitting); the resulting solid is dissolved in about 100 c.c. of water. About 14 grms. of solid sodium hypophosphite are added to the solution, and the beaker is covered with a watch glass and heated on the plate; when the solution is almost at the boiling point there is an evolution of gas, generally violent enough to carry the copper sponge up to the surface; at this point the beaker is removed from the plate and the liquid filtered through a rapid filter into a 700 c.c. flask, the copper sponge being washed two or three times with hot water. About 2 grms. of sodium hypophosphite and 100 c.c. of strong hydrochloric acid are added to the filtrate, and the whole boiled for about 15 minutes to precipitate the arsenic (if a large amount of arsenic is present it may require more hypophosphite and longer boiling); the flask is then cooled somewhat, about 10 c.c. of benzene added, and the flask well shaken to mix the benzene with the water; the liquid is then filtered through a wet filter into a 700–800 c.c. flask, the contents of the filter (i.e. the benzene with the colloidal arsenic suspended in it) being washed once or twice with hot water. The filtrate is now heated to boiling, and if there is a further

separation of arsenic, more sodium hypophosphite must be added and the boiling and treatment with benzene repeated, but with ordinary amounts of arsenic it should now remain clear. A strip of copper foil, about 15 by $1\frac{1}{2}$ cm., coiled into a flat spiral, is cleaned by warming in nitric acid (sp. gr. 1.2), washed in water and dropped into the boiling liquid. The boiling is continued for $1\frac{1}{2}$ to 2 hours, the solution is poured off the strip, and the latter washed rapidly with cold water and then quickly placed in a small beaker and covered with water; about one gram of sodium peroxide is at once added, and the whole is warmed until the deposit is completely dissolved; the solution is then poured off the strip and the latter rinsed once or twice with cold water. The strip, which is stained with copper oxide, should be tested by immersion in dilute hydrochloric acid (1 : 1) to ensure that all the deposit has been dissolved off; the copper should be perfectly bright after this immersion; if any deposit remains on it the sodium peroxide treatment must be repeated.

About 0.5 gm. of zinc sulphide is added to the solution containing the antimony, and it is allowed to stand for $1\frac{1}{2}$ to 2 hours; it is then filtered, and the residue washed two or three times with cold tap water. Tap water is used instead of distilled water from this point on, unless the distilled water is free from all colour after hydrogen sulphide has been passed through it.

The filtrate is made just acid with hydrochloric acid, sulphur dioxide is passed into it for a minute or two, and the solution then boiled down to about 10 c.c. Five c.c. of a standard solution of antimony containing 0.0001 gm. Sb. per c.c. are placed in a flask, about 80 c.c. of tap water and a few drops of concentrated hydrochloric acid added, sulphur dioxide is passed into it, and the solution boiled down to about 10 c.c. The flasks are cooled, 5 c.c. of 1 per cent. gum arabic solution added to each, and the two solutions are each made up to 100 c.c.

Hydrogen sulphide is passed for a few seconds through the two solutions, which are then placed in Nessler glasses; they should both be perfectly bright. Liquid is poured out of the glass with the greater depth of colour until the colours match, and the heights of the two columns of liquid are measured.

Then if x is the height of liquid in the sample tube, and y is the height of liquid in the standard tube, $\frac{y}{x} \times 0.0005 =$ amount of antimony in the weight of sample taken plus any blank on the chemicals. This blank (determined in the same way omitting the sample) is subtracted from the above figure, and the result multiplied by 20 gives the percentage of antimony in the sample.

The standard solution is made up by dissolving 0.2764 gm. of tartar emetic in water, adding 100 c.c. of hydrochloric acid, and making the solution up to 1000 c.c. with water.

The following results were obtained by this method. Five grms. of electrolytic copper were taken and varying amounts of arsenic and antimony added. In all cases the blank has been subtracted from the result. The last column contains

the actual figures obtained in the colour matching without any correction for the blank.

TABLE I.

	Antimony added Grm.	Antimony added Per Cent.	Arsenic added Grm.	Arsenic added Per Cent.	Corrected for Blank.		Fraction of 0.0005 Grm.
					Antimony found Grm.	Antimony found Per Cent.	
Blank of Chemicals without copper —			—	—	0.0001	0.002	30/115
Blank using 5 grams electrolytic copper —			—	—	0.0001	0.002	8/33
(a)	0.0002	0.004	0.0012	0.024	0.0002	0.004	24/33
(b)	0.0005	0.010	0.0012	0.024	0.0005	0.010	32/28
(c)	0.0010	0.020	0.0012	0.024	0.0009	0.018	32/15
(d)	0.0020	0.040	0.0012	0.024	0.0019	0.038	32/8
(e)	0.0030	0.060	0.0036	0.072	0.0029	0.058	$\frac{32 \times 5}{27}$
(f)	0.0040	0.080	0.0036	0.072	0.0038	0.076	$\frac{32 \times 5}{20.5}$
(g)	0.0050	0.100	0.0036	0.072	0.0049	0.098	$\frac{32 \times 5}{16}$
(h)	0.0005	0.010	0.025	0.500	0.0006	0.012	33/24
(i)	0.0010	0.020	0.025	0.500	0.0010	0.020	33/15
(k)	0.0015	0.030	0.025	0.500	0.0016	0.032	33/9.5
(l)	0.0005	0.010	—	—	0.0005	0.010	103/85
(m)	0.0020	0.040	—	—	0.0020	0.040	103/24
(n)	0.0050	0.100	—	—	0.0044	0.088	$\frac{103 \times 5}{57}$

In (e), (f), (g), and (n) the test solution was diluted and an aliquot part taken for matching.

In (n) the deposit flaked badly from the copper during washing, and a considerable amount was lost.

(B) PROCESS IN THE PRESENCE OF CONSIDERABLE AMOUNTS OF TIN.—In the presence of any material quantity of tin, the antimony results are low, the antimony presumably being dragged down as hydrolysed sulphate together with the tin when the sulphuric acid solution is boiled with sodium hypophosphite.

The process is accordingly modified as follows when an appreciable amount of tin is present:—After the fuming off with sulphuric acid the beaker is completely cooled, 100 c.c. of cold water added, and the solid allowed to dissolve in the cold. When solution is complete about 5 grms. of potassium bitartrate are added and allowed to dissolve, then the 14 grms. of sodium hypophosphite, and the process is carried out from this point as before. Under these conditions the copper does not precipitate so readily, and it is advisable to use a full amount of hypophosphite, remove the beaker from the plate immediately the froth mounts and shake it until the froth subsides, and then filter the liquid.

The following results were obtained with electrolytic copper to which 2 per cent. of tin had been added:—

TABLE 2.

	Antimony added Grm.	Antimony added Per Cent.	Corrected for Blank.		Fraction of 0·0005 Grm. Sb.
			Antimony found Grm.	Antimony found Per Cent.	
(a)	0·0005	0·010	0·0006	0·012	104/73
(b)	0·0009	0·018	0·0008	0·016	103/56
(c)	0·0010	0·020	0·0010	0·020	104/48
(d)	0·0015	0·030	0·0014	0·028	103/35
(e)	0·0015	0·030	0·0013	0·026	104/39
(f)	0·0020	0·040	0·0016	0·032	104/30

It will be observed from these results that with quantities of antimony greater than about 0·001 to 0·0015 gm. the results are distinctly low; therefore it is advisable, when the percentage of antimony is greater than 0·025 in the presence of tin, to carry out the estimation on less than 5 grms., to bring the amount of antimony present below 0·0012 gm.

As bismuth has been found to deposit on copper in Reinsch's method in the same way as arsenic and antimony, a few trials were made with varying proportions of this metal to find out if it interfered in the process.

Five grms. of electrolytic copper and 0·0005 gm. of antimony were taken in each case. The results were as follows:—

TABLE 3.

	Antimony added Grm.	Antimony Per Cent.	Bismuth added	Bismuth Per Cent.	Corrected for Blank.		Fraction of 0·0005 Grm. Sb.
					Antimony found	Antimony Per Cent.	
(a)	0·0005	0·010	0·0001	0·002	0·0005	0·010	103/87
(b)	0·0005	0·010	0·0002	0·004	0·0005	0·010	103/86
(c)	0·0005	0·010	0·0003	0·006	0·0005	0·010	103/85
(d)	0·0005	0·010	0·0004	0·008	0·00056	0·011	103/77

From these figures it is evident that bismuth is completely removed.

It occasionally happens that the final colour is brownish, due possibly to a very slight separation of sulphur; under these circumstances the matching is difficult, and the results tend to be slightly high, but they are still good. Examples of this bad colour are to be found in Table 1. (h) and (k). Table 2 (a), and Table 3 (d).

It is necessary to add a few words as to the chemistry of this process.

The proposal to precipitate five grms. of metallic copper in a boiling solution strongly acid with sulphuric acid, and yet to leave, say, 0·0002 gm. of antimony completely in solution, needs perhaps some justification.

An extensive examination into the chemistry of the Reinsch test was made, as a preliminary to the work for this paper, with interesting and rather surprising results, which it is hoped to publish shortly.

In so far as they affect the present work they amount to this: Arsenic and antimony in anything like small amounts are not deposited on copper, even from boiling, strongly acid, solution, unless halogen acids or their salts are present. It is possible to boil a solution of 1 grm. of antimony in 100 c.c. of 1:3 sulphuric acid, and enough tartaric acid to keep the antimony in solution, with a slip of pure copper for one hour without the slightest visible deposit being formed; an addition of 0.05 grm. of sodium chloride causes the copper to be blackened in ten minutes. For this reason there is no fear of loss of antimony due to deposition on the precipitated copper.

The same may be said of the hypophosphorous acid reaction with arsenic, halides being essential to the precipitation; hence the fact that the copper is precipitated, leaving the arsenic in solution, when the precipitation is carried out in sulphuric acid solution; on the addition of a large excess of hydrochloric acid the state of things is reversed, any trace of copper which remains being kept in solution, whilst the arsenic is precipitated; consequently there is no danger of loss of antimony deposited on precipitated copper (in presence of hydrochloric acid), if traces of that element escape the first precipitation, for the simple reason that no copper is precipitated.

Possibly considerations of this kind explain the greater sensitiveness of the Marsh test for arsenic when hydrochloric acid is used than when sulphuric acid is employed.

The addition of benzene is to coagulate the fine suspension of colloidal arsenic; it acts apparently by preferentially wetting the surface of the precipitate, the latter being afterwards prevented by surface tension from again entering the aqueous layer. This principle, which would seem to have many applications in analytical chemistry, is being investigated further.

It is absolutely necessary, in work with the Reinsch test, that the copper should be cleaned with nitric acid (sp. gr. 1.2); at the start of this work hydrochloric acid was used, which gave beautifully clean looking strips of copper. When, however, these were boiled with arsenic or antimony solutions, the deposit obtained was invariably patchy, and, in extreme cases, the copper remained bright. The statement of Beam and Freak (*ANALYST*, 1919, **44**, 196) as to the antimony deposit assuming an insoluble form on standing, has been confirmed, and this appears to happen slowly, even in the boiling acid liquid; hence it is undesirable to continue boiling the slip for over two hours.

In removing the antimony from the copper, use was at first made of the alkaline permanganate method described by Schidrowitz and Goldsbrough (*ANALYST*, 1911, **36**, 101) as modified by Beam and Freak (*loc. cit.*). This was, however, found unsatisfactory, as it was impossible to watch the progress of solution, owing to the colour of the permanganate and to the copper oxide produced, and sometimes, for a reason not ascertained, the colour of the permanganate was not destroyed by boiling; in addition to this, no precaution that was tried ensured the freedom of the filtrate from copper (or some other metal which gave a coloration with hydrogen sulphide). A search was made for something to take the

place of alkaline permanganate, and sodium peroxide was found to give very good results, both as regards speed or solution and the possibility of watching its progress; it, however, always dissolves a certain amount of copper, but it was found that solid zinc sulphide would completely remove all trace of copper and leave the antimony entirely in solution. The reaction takes place rapidly, and in some cases the solution can be filtered at once; but as a rule a colloidal solution of copper sulphide appears to be formed, which only gradually precipitates; for this reason a stand of two hours is desirable.

It was found that all the large copper stills available supplied water which gave a faint brown coloration with hydrogen sulphide; the tap water was free from this objection and was therefore used for all operations subsequent to the zinc sulphide treatment.

A Duboscq colorimeter was tried in the colour matching, but, as it gave actually less concordant results than the simple Nessler glasses, it was abandoned.

A steel calliper graduated in mm. was used for measuring the relative depths of the liquids after matching, the measurement being made from the bottom of the liquid to the bottom of the meniscus. As the copper strip used for the Reinsch test loses very little weight in the process, it can be used repeatedly if fairly thick to start with.

If the antimony deposit is too thick it flakes off the copper when washed prior to treatment with sodium peroxide; this effect is clearly seen in the low result of (*n*), Table 1. If, therefore, more than 0.1 per cent. of antimony is present, it is necessary to use a smaller amount of sample.

Attempts have been made to apply this method to the simultaneous estimation of arsenic and bismuth, as well as antimony, but all the difficulties with regard to these two elements have not yet been removed.

In view of the fact that bismuth will separate on copper in the Reinsch method, it is worthy of note that the presence of this element may completely vitiate any attempt at estimating antimony by direct comparison of copper slips as suggested by Beam and Freak (*loc. cit.*).

DISCUSSION.

Mr. L. ARCHBUTT said Mr. Evans's paper was one of considerable practical interest, and presented a great many points of distinct novelty. It was very interesting to know that simply by varying the solvent copper and arsenic could be precipitated one after another in a pure state, and that by merely adding a little benzene the colloidal arsenic sulphide could be caused to coagulate. Those who had to make frequent analyses of copper knew that antimony and even bismuth in small quantity were not always harmful. It depended upon the class of copper and the purpose for which it was intended to be used. For some purposes they were extremely harmful, and then one had to determine very small quantities of bismuth and antimony, which involved considerable difficulties in manipulation. He considered Mr. Evans's method a distinct advance on that generally used at the present time. Although there was little to criticise in the

paper, there were one or two things to which he would like to refer; for instance, the use of the word "Reinsch" as a verb was rather unusual; also he was not quite clear why distilled water, even obtained direct from the still, should give a precipitate with hydrogen sulphide. He questioned whether copper was carried over; if so, in what form could it be; was it not rather some other metal which caused the discoloration? Referring to Mr. Evans's suggestion that, since low results might be obtained when the quantity of tin exceeded 2 per cent., one should work with smaller quantities, he thought a more scientific method would be to find out the cause of the low results, so as to avoid the multiplication of errors involved in working with small quantities. With regard to the estimation of bismuth, he considered it better to work on a separate quantity and use Rowell's method, with which the author was no doubt well acquainted.

Mr. G. N. HUNTLY said that no previous method described had been entirely satisfactory, and certainly the distillation method was not so. The method described in the paper was novel. He asked whether there was any danger of antimony being dissolved out of the copper slip and redeposited.

Mr. E. M. HAWKINS alluded to the difficulty of matching colours owing to the difference in the height of the columns in the test, and thought it inadvisable to compare greatly differing depths of liquid. It was convenient to use different heights for a rough matching test, but for a final test the depth of liquid for a standard tube should be the same as that in the tube to be matched.

Mr. THOS. TICKLE remarked that a common fault of still heads was that they were tinned with impure tin. He had himself experienced this difficulty, but after having had the head re-tinned with pure tin, there was no further trouble.

Mr. A. CHASTON CHAPMAN, referring to the purification of hydrochloric acid, said it could be made almost absolutely pure for the Marsh method by distilling it with hydrobromic acid, and separating the first portion. He had never had any difficulty in obtaining hydrochloric acid perfectly pure, even when using badly contaminated hydrochloric acid in the first place. Speaking of the Reinsch method, he mentioned that when beer was contaminated some years ago he had used the method very extensively and most successfully, the Marsh method, with its present refinements, being at that time unknown. By the Reinsch method arsenic was not entirely deposited on the copper, but formed an alloy. He suggested "cuprolysis" as a better word than "Reinsching." As to the presence of copper in water; if one had a still with a proper top and the condensation portion of the condenser were made of pure tin one would have no trouble at all.

Mr. EVANS, replying, said that there was certainly a lack of beauty in the word "Reinsch," but there was a whole group of metallic deposition reactions for which there was no generic term; a new word was really what was wanted. As regards distilled water, he could not pass hydrogen sulphide through distilled water without getting a brown colour; he imagined it might be due to tin, not copper, but, as had just been suggested, it might be lead derived from impure tin used for lining. In reply to Mr. Archbutt, he said that it was not so much a question of the amount of tin as of antimony that seemed to matter, and, referring to table 2,

he pointed out that the tin remained constant, whilst the antimony varied, and that when the latter exceeded a certain figure, low results were obtained. It was certainly desirable to eliminate the tin, but up to the present he had found no means of doing so. He considered that the ordinary method of estimating bismuth was satisfactory so long as tin was absent, but that tin upset it badly. Benzene certainly coagulated colloidal arsenic sulphide, but the coagulation to which he had referred in the paper was that of colloidal *arsenic* (the element). He quite agreed with what Mr. Huntly had said about distillation; the apparatus was too involved, and he did not believe it to be accurate. There was no risk of the antimony being dissolved out of the copper slip and redeposited. Referring to colorimetric methods, he asked whether anyone would be perfectly satisfied to weigh, say, 1/10th mgrm. of a substance undoubtedly very impure on a balance and return the result as a good estimation; he thought that, with such small quantities, a colorimetric method (if it were a good one) made possible estimations which were beyond the scope of gravimetric methods. Replying to a question of Mr. Chapman, he said that sodium peroxide would dissolve arsenic off copper equally as well as antimony, and in either case the amount of copper which went into solution was very small; he was inclined to think that in the cold the copper dissolved was roughly proportional to the antimony, but when warmed more copper was dissolved. With regard to Mr. Hawkins' remarks on the accuracy of matching different depths of liquid, he considered that when you were dealing with a straightforward colour uninfluenced by ionisation changes such as this, the comparison was accurate, as the absorption of the water was very small.

The Inks of Ancient and Modern Egypt.

By A. LUCAS, O.B.E., F.I.C.

(Read at the Meeting, December 7, 1921.)

THE profession of scribe in ancient Egypt was one of considerable importance, and the scribe with the implements of his craft is frequently portrayed on the inscriptions in the tombs. In some instances the scribe is shown with a pen behind his ear.

The pens used, as proved not only by the pictures of them, but also by actual specimens which have been preserved, were made from reeds; they were about ten inches long and from one-sixteenth to one-eighth of an inch in diameter, and the end used for writing was bruised to make the fibres flexible (*The Mummy*, E. A. Wallis Budge, Cambridge, 1894, p. 352). Strictly speaking, however, such an article is a brush and not a pen. Budge states that after the 26th dynasty (about the 7th century B.C.) the end of the reed was cut like a quill (Budge, *loc. cit.*). No specimens of this later type of pen exist in the Cairo museum, but the fact that something different from the bruised reed was employed is very manifest from an

examination of the writing, the difference between that done with a brush and that done with a pen being very marked. A noteworthy example of fine pen work is the illustrated account of the Weighing of the Soul exhibited in the Cairo museum. This is on papyrus and is of Ptolemaic date (B.C. 305 to B.C. 30).

A broad reed with the end cut and shaped like a steel pen is employed to some extent in Egypt and the East at the present day. The date of the first use of ink in Egypt is not known, but Flinders Petrie is stated to have discovered a papyrus bearing written characters as old as 2500 B.C. (*Ency. Brit.*, 1910, Vol. XIV., Article "Ink").

Inkstands containing dried ink have been discovered in the tombs, and generally the ink is of two colours, black and red, though yellow, blue, green and white have also been found. Colours other than black and red, however, were employed by the artist for illustrated scenes and not by the scribe in writing. The red ink was used at the beginning of a subject and for the division of certain sentences. The black ink is always described as being made from carbon, and it is stated that the red is oxide of iron and the blue and green copper compounds, the mineral matter being suspended in water by means of gum (*Budge, loc. cit.*, p. 352). The composition of the various inks is probably as stated, the black being most certainly carbon, but only one record of any scientific examination or chemical analysis can be traced. This is by J. Wiener in his account of the papyri from the Fayum province of Egypt in the collection of the grand duke Rainer (*Die Faijumer und Uschnuineiner Papiere*, J. Wiener, *Mittheilungen aus der Sammlung der Papyrus Erzherzog Rainer*, Wien, 1887, pp. 239, 240), which date from the 3rd to the 7th century A.H. (9th to 13th century A.D.). Wiener states that the papyri referred to are written with two different kinds of ink, one a carbon ink and the other an iron ink. The carbon ink is black and is not affected by the action of hydrochloric acid, nitric acid or chromic acid. The iron ink is brown, and gives a blue coloration with hydrochloric acid and potassium ferrocyanide. Schubart also mentions two kinds of ink used on papyrus, one very black and one brown, which latter he states is found about four centuries A.D., but the nature of the ink does not appear to have been determined (*Einführung in die Papyruskunde*, W. Schubart, Berlin, 1918).

Through the kindness of several friends I have been enabled to examine various specimens of ancient Egyptian ink. I am indebted to Mr. Quibell, the Curator of the Cairo Museum of Antiquities, for a small quantity of black ink taken from an inkstand of the time of Amenhotep III. (16th century B.C.), which means that the ink is almost 3500 years old. I am also indebted to Mr. Quibell for several potsherds bearing written inscriptions and for fragments of papyrus and parchment documents. Mr. C. C. Edgar, Inspector of the Department of Antiquities, Cairo, has also been good enough to give me fragments of papyrus and parchment. These specimens will now be described.

DRIED INK.—The total weight of this was 0.05 gm., and of this a part consisted of sand, which had become mixed with the ink probably in the tomb. The ink was first treated with ether, which, however, failed to extract any

colouring matter; it was then ground up with water and the sand separated by decantation. The residue was black; it burnt like carbon; it was not bleached by a solution of sodium hypochlorite, and gave negative tests with all the other reagents applied: when strongly heated in a small tube with lead chromate, it gave off a gas which turned lime water milky, and it was therefore undoubtedly carbon. The remains of the powder were eventually mixed with gum and water and used for writing. The writing, when tested for iron, gave negative results.

POTSHERDS.—Papyrus was a government monopoly and was expensive, and cheaper materials, therefore, such as fragments of broken earthenware vessels (known as Ostraka) and pieces of stone were frequently employed instead. The ink on all the potsherds seen in the Cairo museum and on the few pieces examined is black in every case, though writing on Ostraka in red is not unknown. The writing examined was not bleached by sodium hypochlorite and was destroyed by heating, and the ink is certainly carbon.

PAPYRUS.—The specimens of papyrus examined date from Roman times (30 B.C. to A.D. 395) to the 9th century A.D. The ink is largely black, but in a few cases is brown, though not a very definite brown. The black was not bleached by sodium hypochlorite, and gave negative results with all the other reagents employed, and is therefore carbon. The brown gave similar negative results to the black.

PARCHMENT.—Some of the specimens are undated, while others vary in date from the 7th to the 12th century A.D. The ink in all instances is brown, and gave the reactions for iron when tested with potassium thiocyanate, potassium ferrocyanide and with caustic soda, and therefore is an iron compound and not carbon. In the case of two manuscripts dated 609 and 620 respectively of the Coptic era (A.D. 893 and 904), which were shown to me by Mr. Henri Munier (the Librarian of the Department of Antiquities and author of the volume on Coptic Manuscripts in the general catalogue of the museum), but which I was unable to test, the ink was very brown and had all the appearance of being an iron ink.

If the date of the earliest specimen tested which is given as the 7th to 8th century A.D. be accepted, then iron ink was known and used at that time, which is several centuries earlier than is generally supposed.

OLD ARABIC AND COPTIC BOOKS.—I have also had an opportunity of examining the ink in several old Arabic and Coptic books. These are as follows:

A. An account book written in Arabic and dated 1181 A.H. (A.D. 1767) received from the Government Archives, Cairo.

The ink in this book is of two colours, one being that in which the body of the book is written and the other that used for certain notes and totals of figures. The former is generally black, but where the film of ink is thin, the colour is grey with sometimes a slight suggestion of brown. The ink of the notes and of many of the totals is brown, but this brown is largely, though not entirely, due to the fact that the ink lines are partly covered with scales of a brown glittering material which, under the microscope, are suggestive of mica, and which are almost certainly

the remains of the powder used to dry the ink. Both inks are carbon, and both give a slight reaction for iron.

B. An account book written in Arabic and dated 1216 to 1218 A.H. (A.D. 1801 to 1803) received from the Government Archives, Cairo. The ink in this book is largely of a dark-grey colour. It is a carbon ink, and gives a slight reaction for iron.

C. A portion of the Old Testament written in Arabic and bearing the Coptic date 1028, which corresponds to A.D. 1312.

This book has manifestly been repaired at some time and the paper of a number of pages at each end is newer-looking and of a different quality from that of the rest of the book. The ink in the greater part of the book is brown, and is an iron ink, but on some pages the ink is black and is carbon. This carbon ink contains sufficient iron to give the usual reactions when tested. On the newer pages at the ends of the book the ink is also in some instances an iron ink which has turned brown and, in some cases, a carbon ink which is black.

D. A large prayer book written in both Arabic and Coptic which unfortunately is undated, but which is manifestly old.

The ink as a rule is a very good black with occasionally a little grey where the film is thin. There is a slight suggestion of brown on a few pages. The ink is a carbon ink which, however, contains a little iron. At the end of the book there are a few separate pages of a slightly smaller size, the paper and ink of which are on the whole similar in appearance to those of the body of the book, but occasionally the ink is slightly brown. The ink, whether black or brown, is carbon except for that used for an ornamentation at the beginning of the separate pages, which is brown and is an iron compound.

E. A small prayer book written in both Arabic and Coptic, which unfortunately is undated, but which undoubtedly is old.

The ink is brown and is an iron compound. In many places there are holes in the paper along the ink lines caused apparently by some corrosive agent in the ink. Haerting states that this effect is not due to acid, but to the fact that ferric oxide is produced and forms a brittle mass of small crystals with cellulose* (Haerting, *Kolloid Zeitsch.*, 1919, **25**, 74-79; *Chem. Abstr.*, 1920, 886).

For the Bible and prayer books, I am indebted to Abdu Effendi Yussef, of the Government Analytical Laboratory, Cairo.

The paper of the books mentioned has been examined and is linen in each of the five cases.

One point already mentioned requires special consideration, namely, the fact that carbon ink is sometimes brown. This was first stated in my book on Legal Chemistry published in 1920, and the following facts may be given in support of this statement:

(1) That the ink on many old manuscripts which are dated earlier than

* A coarse woven fabric in the Cairo museum on which there is writing in large characters, the ink being now brown, shows this corrosion along the ink lines in a very marked manner.

any known use of iron ink is sometimes brown.* Thus, the ink on manuscripts of papyrus exhibited in the Sultania Library, Cairo, and dated between A.D. 622 and A.D. 719 is brown in some instances, as is also the ink on manuscript Korans exhibited in the same library and dated between A.D. 719 and A.D. 912.

(2) That ink which has been tested and found not to be an iron compound is brown or partly brown (*Legal Chemistry*, A. Lucas, p. 81; also the present communication).

It is true that, in many instances, the ink which has become brown has not been tested, but in view of its age and of the fact that in some cases only part of the ink on any one page or even part of a word or letter is brown, the rest being black, whereas iron ink becomes wholly brown, and in view too of the further fact that in a few instances the ink has been tested and proved not to be an iron compound, it must be accepted that what has been originally a black ink of the carbon type does sometimes become brown. This, at first sight, seems extraordinary and even impossible, since one of the characteristics of carbon is its black colour and unalterability, carbon ink being always regarded as the best type of a permanent black ink.

In this connection, it may be mentioned that Lehner states that "most European-made Indian inks are distinctly brown when diluted to any great extent" (S. Lehner, *Ink Manufacture*, London, 1914, p. 119).

It is of course not contended that ink in which such a colour change as that described has taken place was ever a good quality of carbon ink, for this is manifestly not the case, since many carbon inks of very early date are still an intense black, and could not have been blacker even when first employed. It is stated, however, that some ink now brown is not an iron compound, but has been originally a black or practically black ink of the carbon type, and that it has become brown. How then is this colour change to be accounted for? Before offering any suggestion as to the cause of this change, I would mention the fact that while the best quality of carbon for ink is obtained as a deposit during the partial combustion of organic materials such as oil and resin, there are other methods of manufacture which must give a product of very inferior quality. Thus, in an old Arabic book in the Sultania Library, Cairo, unfortunately anonymous and undated, there is a recipe for making carbon ink, which is to take date stones, put them in an earthenware vessel stoppered with clay, heat the vessel for about twenty-four hours, then allow it to cool, grind and sift the contents, and make into ink with gum and water. Such an ink would be of poor quality, and would contain very little free carbon. As an example of a good quality carbon ink, the method of manufacture kindly supplied by a priest of the Coptic Church may be mentioned.† The recipe is as follows: Put a quantity of incense on the ground, and round it place three stones or bricks, and resting on these an earthenware dish, bottom upwards, covered with a damp cloth; ignite the incense.

* The use of iron ink would seem to be older than is generally supposed, and it is at least as early as the 7th or 8th century A.D., and if it can be shown to have been employed as early as A.D. 622, this argument is no longer valid.

† Through Abdu Effendi Yusef, of the Government Analytical Laboratory.

Carbon is formed and is deposited inside the dish, from which it is removed and made into ink by mixing with gum arabic and water.

The suggestion put forward as a possible explanation of the colour change from black to brown in a carbon ink is that the ink has contained very little free carbon in the first place, but has contained compounds, possibly of a tarry nature, which have turned brown, and also, in some cases, a small proportion of iron compounds, which have also turned brown, and that this brown colour has masked any small amount of carbon present. In some instances, the carbon of the ink may have been rubbed off the paper, leaving a brown stain due to a small proportion of some ingredient other than carbon that was present.

Irvine states that carbon black made from natural gas contains bodies of a dirty brown colour which show as a kind of halo surrounding the letters when the black is used for printing ink.* Some such bodies may be present in carbon produced by other methods than from natural gas.

The modern Egyptian inks comprise carbon ink, iron-gall ink and aniline ink, and may either be imported or made locally. A number of different specimens of carbon ink have been tested with the following results:—

SAMPLE.	TOTAL SOLIDS.	
	Grms. per 100 c.c.	Ash. Grms. per 100 c.c.
A. Marked: Best black writing ink, Tabrizy ..	16.1	0.9
B. Stated to be of good quality	11.4	1.9
C. Stated to be of fair quality	12.0	1.9
D. Stated to be of best quality, Turkish	13.5	2.9
E. Marked like "A." Stated to be of first quality ..	14.6	1.3
F. Marked like "A." Stated to be of second quality	14.1	1.2
G. Stated to be of ordinary quality	8.9	1.2

The first three samples were kept in the original bottles in the laboratory for eight years, and were then re-examined. In each case there was a deposit of carbon at the bottom of the bottle. "A" was still a fairly good black ink; both "B" and "C" were acid, and had a disagreeable smell, due apparently to decomposition of the gum; "B" gave a very thin, poor, grey writing; while "C" was of a light brown colour, and contained no carbon at all, the whole of the carbon having been deposited in the bottle. The results of the analysis were as follows:—

SAMPLE.	TOTAL SOLIDS. Grms. per 100 c.c.
A } after 8 years ..	15.2
B }	7.8
C }	6.2

The writing made with all the seven specimens of ink enumerated was tested for iron in the usual way. "A" gave a very slight reaction, "B" and "C" also gave a slight reaction, but more marked than "A," while "D," "E" and "F" gave no definite reaction.

GOVERNMENT ANALYTICAL LABORATORY,
CAIRO, EGYPT.

* On the Preparation of Carbon Black from Natural Gas in America. R. Irvine. *J. Soc. Chem. Ind.*, 1894, p. 131.

DISCUSSION.

Mr. J. F. BLIGHT said he would be interested to have some information about the quality of the material upon which the ink was used. In some cases the material was other than papyrus, and he wondered whether this would account for the variation of tint in the colour of the writing, which was a point dwelt upon by the author.

Mr. T. TICKLE mentioned that he had noticed on specimens of paper 3000 years old that some of the strokes were more glazed than others, and he wondered whether this was due to old or new gum arabic, or whether this was material in which carbon was suspended.

Mr. CHASTON CHAPMAN enquired what condition of iron caused the red colour, and whether tannin had been used.

Mr. A. MORE stated that there were two iron inks—red iron oxide (rouge) and black iron tannate, but questioned whether the red on some of the specimens shown might not be due to cinnabar.

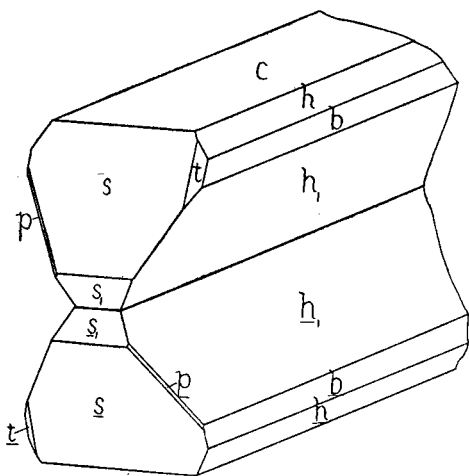
Mr. C. A. MITCHELL, replying for the author of the paper, said the matter was of importance from a practical point of view, apart from the antiquarian interest, since carbon inks were used not only for writing, but also sometimes in forged documents to make modern ink appear old. He was indebted to Mr. Lucas for the opportunity of examining the original specimens shown to the meeting, and could confirm all the results. It was interesting to note that some of these inks contained not only carbon but also iron, probably derived from impurities in the vegetable material from which they were prepared, and not from the paper on which they were written, since the paper only gave a faint reaction for iron. The brown colour was probably due to impurity in the carbon, for lampblacks always contained more or less oil, soluble in ether, and in the case of certain commercial samples this might be as high as 8 per cent. The quality of the material could not have had much influence on the colour in the specimens exhibited, since in some places the ink was a good black, and in other places quite brown—so that the difference was due to the ink rather than the material. The glazed appearance of some of the strokes of the specimens exhibited was probably due to the gum or other medium with which the original carbon had been mixed; in other cases talc was present. In answer to Mr. Chapman's question, the speaker remarked that the iron was probably originally in combination with tannin; and the examples to which Mr. Lucas had referred were, probably, the first known instances of the use of an iron tannin ink. The inks used in the manuscripts recently unearthed in Westminster Abbey—dating back to 700 or 800 A.D.—were in all probability carbon inks.

Note on an Occurrence of Struvite in Canned Shrimps.*

BY C. S. PURCELL AND C. H. HICKEY.

IN May, 1920, the writers had occasion to examine some canned Barataria shrimps, packed at Biloxi, Miss., for what the buyer of the product suspected to be particles of glass. Careful microscopic study revealed the presence of a crystalline body in the liquid surrounding the shrimps and on the surface of the shrimps themselves. In later samples, similar crystals were easily detected by examining the sample, in a glass vessel, in the sun's rays. The quantity available for examination was minute, probably about 0.01 grm. The crystals were water-white in colour, and varied in size, the smallest being microscopic and the largest 1/16 to 1/8 inch in length, and 1/64 to 1/32 inch in diameter. Chemical examination of the crystals showed reactions for magnesium, ammonia, and phosphoric acid. The form was orthorhombic and sphenoidal, twinning in some cases. The foregoing facts led to the belief that the substance was struvite, $\text{MgNH}_4\text{PO}_4 \cdot 6\text{H}_2\text{O}$.

This suspicion was confirmed by Prof. Charles Palache, of Harvard University, who examined one of the twin crystals (see illustration). It was shown by him to be identical in form with the mineral struvite. The forms were as follows: c , (001); h , (021); s_1 , (101); b , (010); h_1 , (021); t , (121); p , (120); s , (101). The crystal is a twin on the basal plane and shows the usual hemimorphism with respect to the vertical axis.



Some of the angles which established the identity of the crystal with struvite were as follows:

	Measured.		Calculated.	
(001) to (101)	58°	25'	58°	09'
(001) to (021)	61	29	61	16
(010) to (120)	48	33	48	34

* Published by permission of The Secretary, U. S. Department of Agriculture.

Struvite may also be identified by the method employed by Dr. Edgar T. Wherry, of the Bureau of Chemistry, who makes use of the fact that the refractive indices of struvite and xylene (or toluene) are essentially the same ($n=1.495$). Using this method, which has the advantage of being simple and rapid, he has been able to demonstrate the presence of struvite in canned fish, and it would appear to be generally applicable.

This method is as follows: A few minute crystalline fragments of the unknown substance are immersed in a drop of xylene (or toluene) on a microscope slide, and a cover-slip then placed over the drop. This is then examined under a microscope—it is not even necessary that this be provided with nicol prisms—the substage diaphragm being partly closed. On raising or lowering the tube of the microscope slightly, peculiar yellow and bluish bands of light will be seen to mark the boundary of the crystals against the liquid (on raising the tube, it was noted that the edges of the crystals were bounded by a yellow band, with an outer blue band, while on lowering the tube the reverse was the case), showing that the refractive indices of the substance and of the liquid are essentially the same.

The method was found to be equally successful when applied to the struvite crystals obtained from canned shrimps, and to the crystals prepared in the laboratory by mixing a dilute ammoniacal solution of ammonium chloride with a dilute solution of magnesium sulphate, and then adding a dilute solution of sodium phosphate, the crystals taking some time to form.

The possibility of the (NH_3) group being wholly or partly replaced by $\text{NH}_2(\text{CH}_3)$, monomethylamine, which is known to exist to a considerable extent in shrimps (see *Circ.*, No. 79, *Bureau of Chemistry*, "Tinned Salts in Canned Foods of Low Acid Content, with Special Reference to Canned Shrimp," by Bigelow and Bacon) was considered by the writers, but a careful examination for the presence of carbon gave negative results.

It is of interest to the food chemist to record the known occurrences of struvite: Fine crystals of this substance were noted by Solly (*Mineralogical Magazine*, 1889, Vol. 8) in tubes of nutrient gelatin and agar-agar, in which he was growing pure cultivations of various micro-organisms. He identified the crystals by the aid of the goniometer and polarising microscope.

Rodillon (*Bull. Sci. Pharmacolog.*, 1913, Vol. 20) observed that in urine which had become highly ammoniacal from decomposition of urea, twinned crystals of struvite were liable to form on diplococci as nuclei. In this case, the crystals were twinned prisms formed by two quadrangular pyramids. Each pyramid penetrated the other, as was shown by the presence of a table with inclined sides in the base of the pyramid. When the crystals have grown on diplococci, the deposit is at first amorphous, and later crystalline.

Arzruni (*Zeitsch. Kryst. u. Mineralogie*, 1890, Vol. 18) noted the presence of a small amount of struvite in a bottle of Koch's Peptonized Meat, but in this instance, however, it was of entirely different crystalline form.

The Monthly Review of the Bureau of Chemistry, Vol. 2, No. 2 (Feb. 1918)

contains a reference to an occurrence of crystals of magnesium ammonium phosphate in canned tuna fish.

Hammarsten (*Physiological Chemistry*) makes the statement that while this substance may separate from an amphoteric urine in the presence of a sufficient quantity of ammonium salts, it is, however, generally characteristic of a urine which is ammoniacal through alkaline fermentation.

The same author notes the occurrence of struvite in intestinal calculi, rarely found in the human intestine, but quite common in herbivora.

Struvite has also been found in urinary calculi; in guano from Salhanha Bay, Coast of Africa; in bat guano from Victoria, Australia; and under an old church in Hamburg, Germany, where quantities of cattle dung existed in the soil above a bed of peat which contained the crystals.

This, however, is the first instance of which the writers have any knowledge of its occurrence in canned shellfish.

The writers wish to express their acknowledgment to Prof. Palache, of Harvard University, for his assistance in the identification of the crystals; also to Dr. Alsberg, of the U.S. Bureau of Chemistry, for his suggestions.

FOOD AND DRUG LABORATORY,
BUREAU OF CHEMISTRY,
BOSTON, MASS.

Note.

The Editor desires to point out that the pages of the Journal are open for the inclusion of short notes dealing with analytical practice and kindred matters. Such notes are submitted to the Publication Committee in the usual manner.

SOME years ago (ANALYST, 1913, 38, 450) one of the writers and another drew attention to the presence of nitrates in milk; a similar case has again come to their notice. Samples of milk obtained in the usual way were noticed to give an unusual golden brown coloration when shaken up with sulphuric acid for the Gerber test, and the milk gave the Griess-Ilosway reaction for nitrites. Subsequent work on other samples of milk revealed the fact that these samples did not give the nitrite reaction until they were about two days old, and it was further shown that nitrates had been originally added to the milk. Subsequent investigation revealed the fact that potassium nitrate had been added to the milk by the farmer with the idea of destroying objectionable odour, in the proportion of "half a teaspoonful" to seventeen gallons of milk. The proportions actually found varied between one and two parts of potassium nitrate to 10,000 parts of milk.

The farmer appeared to be surprised that the matter had been discovered, and in an interview the impression was obtained that the practice was not so uncommon as might be thought. It is suggested that it might be of value to pay particular attention to the possible presence of nitrates in samples of milk taken under the Food and Drugs Acts.

G. D. ELSDON.
P. SMITH.

MUNICIPAL LABORATORY,
SALFORD.

Notes from the Reports of Public Analysts.

The Editor would be glad to receive the Annual or other Reports of Public Analysts containing matter of interest to the Society. Notes made from such Reports would be submitted to the Publication Committee.

REPORT OF THE BIRMINGHAM CITY ANALYST FOR THE THIRD QUARTER, 1921.

"BEES' WINE."—A sample of "bees' wine" which had been fermented for some time contained 21 per cent, of proof spirit. Some of the ginger-beer plant was taken from it, and used to ferment a solution of treacle and sugar. After 26 days it contained 12·1 per cent. of proof spirit.*

BORIC ACID IN MILK.—Four informal samples, taken at one time, contained 47, 51, 37, and 40 grains of boric acid per gallon. The vendor was cautioned, and eight samples subsequently taken were free from preservative. At one time preservatives were very common in Birmingham milk, but none have been detected during the last eight years.

BORIC ACID IN CAKE.—Twenty informal samples of cake were taken as the result of a suggestion made by the Ministry of Health that liquid eggs, which contain boric acid, were being used in its manufacture. Each of the samples contained boric acid, but the Ministry of Health was unable to suggest what the permissible quantity should be. Since one of the constituents of cake may be margarine, which usually contains boric acid, cake may legitimately contain a small amount of boric acid. From a consideration of the analyses of these samples the conclusion was drawn that the amount of boric acid in cake should not exceed 0·1 per cent., and the following four samples were therefore classified as adulterated: Genoa cake, containing 0·12 per cent.; seed cake and Madeira cake (from the same vendor), 0·26 and 0·22 per cent. respectively; and Madeira cake, 0·31 per cent. of boric acid.

MILK AND CREAM REGULATIONS.—CREAM: Eight samples of cream were free from boric acid, seven contained 0·2 to 0·4 per cent., and should therefore have been sold as preserved cream; and one sample contained 0·9 per cent. Only one of the five of preserved creams complied with the Regulations as to labelling. None of them exceeded the limit of 0·4 per cent. of boric acid.

ANNUAL REPORT OF THE SOMERSET COUNTY ANALYST, 1920.

The total number of samples examined was 1057, of which 56 were reported as adulterated. The dairy products included 546 samples of milk.

NON-ALCOHOLIC WINES.—Four of the seven samples examined contained salicylic acid (2·9 to 5·0 grains per pint); a conviction was obtained in the case of a sample containing 5 grains per pint. Action was taken against the vendor of a sample containing 7 per cent. of alcohol, but the case was dismissed; a fine of £2 was inflicted for the sale of a non-alcoholic wine containing 11·2 per cent. of alcohol.

* The so-called "bees" consist of a ginger-beer yeast in symbiotic growth with lactic acid organisms. During the past year such cultivations have been extensively sold for preparing home-made wine; a few crushed raisins are usually added to the sugar solution to give a flavour to the fermented product.—EDITOR.

BORIC ACID.—Of 24 samples of butter, 14 contained boric acid (0.02 to 0.3 per cent.); two samples of margarine contained 0.2 and 0.23 per cent.; 14 samples of sausages out of 18 examined contained 0.08 to 0.62 per cent.; five samples out of 10 of brawn contained 0.11 to 0.5 per cent.; and eight out of 13 of potted meat and fish contained 0.15 to 0.03 per cent.

BACTERIOLOGICAL WORK.—The 7870 samples examined included 469 drinking waters, 5101 swabs for diphtheria, 1308 of sputum for tubercle bacilli, 116 of blood for typhoid and paratyphoid, 526 of hair and skin for ringworm, 130 specimens for venereal disease, 36 of fæces for typhoid, paratyphoid and dysentery; 55 of wine, and 21 of blood and meat for bacterial food poisoning. The year 1920 was an epidemic year for diphtheria, and 1013 of the swabs examined showed the presence of diphtheria bacilli. Ringworm fungi were found in 65.8 per cent. of the samples of hair, and gonococci in 25.4 per cent. of the venereal specimens.

DENYS R. WOOD.

INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY.

SECOND CONFERENCE.

THE second conference of the International Union of Pure and Applied Chemistry was held in Brussels from June 27th to 30th, 1921, under the presidency of Professor Moureu. The countries represented were: Argentina, Belgium, Canada, Czecho-Slovakia, Denmark, France, Great Britain, Greece, Holland, Italy, Japan, Jugoslavia, Monaco, Norway, Poland, Portugal, Roumania, Spain, Switzerland, United States, and Uruguay. There were in all 82 delegates; the British representatives were Sir William Pope and Messrs. Lowry and Miall.

Chemical Elements.—On the motion of Sir William Pope a Commission for Chemical Elements was nominated for three years, its objects being: (1) To draw up tables of atomic masses, isotopes and radioactive elements; (2) to fix and apply the rules according to which modifications may be made in these tables; (3) to make arrangements for research. The Commission, which was restricted to 12 members, will ask the countries within the Union to appoint Co-operating National Commissions.

Chemical Nomenclature.—A similar organisation was formed to deal with chemical nomenclature, and this was sub-divided into three separate commissions for mineral chemistry, organic chemistry and biological chemistry respectively, each having delegates from each country; in each case working committees were formed and charged with the duty of organising national committees to study the subject.

Bibliographic Abbreviations.—A motion was accepted that enquiries should be made whether the principal chemical journals of the countries in the Union would be willing to accept the abbreviations used in *Chemical Abstracts* published by the American Chemical Society, and that the result should be communicated to the Union at their session in 1922. The offer of M. P. Pondal, of the Argentine Chemical Society, to make these enquiries, was accepted.

Chemical Abstracts.—The Dutch National Council presented a report, in which it was recommended that the Bureau of the International Union should take the initiative in bringing together representatives of the various chemical journals which publish abstracts, with a view to discussing the possibility of producing a central publication, and the expense of establishing an international organisation for the purpose. These recommendations were adopted.

International Institute of Chemical Standards.—It was decided that, in order to prevent confusion, the following titles should be reserved for the three sections of the Institute: (A) Bureau of Physico-Chemical Standards (with headquarters in Brussels); (B) Pure Products for Research (with headquarters in England); (C) Bureau of Publications on Industrial and Technological Products (headquarters in Paris. The National Committee of each country in the Union is invited to nominate among its members a correspondent for each of the three Sections. The Conference requested the Council of the Union to obtain an annual subsidy of 10,000 francs to facilitate the work of the Bureau of Physico-Chemical Standards.

Commission on Thermo-Chemical Standards.—A recommendation was adopted that in all publications on thermo-chemistry the substance used to standardise the calorimeter should be given; it was decided that the methods of determining the heat of combustion of the substance chosen as the standard should be made the subject of a separate report.

Tables of Constants.—A report on the arrangement of tables of constants was adopted.

International Laboratory for the Analysis of Foods.—It was announced that the French Parliament had passed a bill ratifying the international conventions signed by the International Union at its first Conference in 1912, comprising: (1) Unification of the methods of presenting the results of the analysis of products intended for food for man or animals; (2) Establishment in Paris of a permanent bureau concerned with the analysis of such products. The Conference requested the Bureau of the Union to communicate these facts to all the officially associated organisations, with the object of each of them obtaining the same ratification by the Governments of their respective countries.

Ceramic and Combustible Products.—The Commission recommended that a national laboratory for the study of combustible products should be established in each country of the Union, and pointed out that it was possible and desirable for questions relating to ceramic or refractory products to be investigated by a special section connected with this laboratory. These recommendations were adopted.

International Patents.—The recommendation of the Commission that the Union should take the initiative in calling a conference to establish an international patent was accepted.

Hygiene in Chemical Industry.—A recommendation was made to the effect that instruction in hygienic questions as affecting industry, and especially chemical industry, should be given to doctors, chemists, and engineers attending the higher technical classes. The Commission was also of opinion that the methods of protection to be adopted in works should be brought to the notice of the public, and recommended the *Revue Internationale d'Hygiène Publique* as a suitable journal for the purpose.

It was decided that the third Conference should be held in 1922 in a French town, to be announced later by the *Fédération Nationale des Associations de Chimie*, the official French organisation in the Union.

GOVERNMENT ANALYTICAL LABORATORY, CAIRO.

REPORT OF THE DIRECTOR FOR THE YEAR 1920.

THE Director of the Laboratory, Mr. A. Lucas, O.B.E., F.I.C., states that nearly 90 per cent. of the total laboratory staff of 165 are Egyptians. The higher technical

posts are still held by Europeans, but in 1920 a scheme for training Egyptian chemists received official sanction, and the classes were started in the autumn of this year. This is the first step towards making Egypt independent of outside aid in the practical applications of chemistry.

CHEMICAL AND PHYSICAL INSPECTION OF MATERIALS.—The total number of samples examined was 4721, as compared with 5138 in 1919, the decrease being more than accounted for by the great reduction in the tests for gas (a result of strikes and difficulties of fuel supply). Gross adulteration of Government stores was less frequent than in the past, but in most classes of goods there was a noticeable absence of samples of first rate quality, so that it would appear that Egypt is still being made the dumping ground for a good deal of low grade material.

Stationery.—In the annual adjudication of the Stationery Office there was relatively less competition by European firms than before the war, and locally-made materials were frequently better and cheaper than European products. The quality of paper, however, was distinctly below pre-war standard. In all 532 samples were examined.

Building Materials.—The number of cement samples tested was more than double that of the previous year. Practical tests of various proprietary articles claimed to render cement waterproof showed that any slight improvement in the water-resisting quality of the cement or cement mortar was usually accompanied by a considerable reduction in the tensile and "crushing" strength. Of the 413 samples of paint examined a large proportion was unsatisfactory. Many contained heavy mineral oil, and others were excessively thin. The problem of finding a suitable green paint which will withstand the Egyptian sun still remains unsolved. At present paints of the Brunswick green type, composed of lead chromate, iron blue and barium sulphate, are almost exclusively employed, and usually there is an excessive proportion of barium sulphate. Stone from various parts of the country was examined to ascertain its suitability for the headstones of soldiers' graves. The Laboratory was also consulted on the best method of making a new design of boundary mark in cement concrete.

Kerosene.—Fifty-four samples were examined. Although the average flash-point was above the Government Specification (100°F.), there were several for which the figures were too low. There is, as yet, no means of controlling the quality of the oil sold to private consumers.

Alcoholic Liquors.—Sixty-four per cent. of the samples of brandy and 6 per cent. of the samples of whiskey taken by the police from retail establishments were not genuine, whilst 25 per cent. of the samples of wine were adulterated with artificial colouring matters. Various convictions were obtained, and, as a rule, the adulterated liquors were destroyed. Essences and extracts intended for use in the manufacture of alcoholic beverages were taken by the Customs Administration at Egyptian ports. These were generally of artificial chemical origin, and, as it was obvious that many of them were intended for addition to plain spirit, their admission to the country was refused under the terms of the prohibition contained in the Military Proclamation of May, 1915.

Minerals.—Various specimens of Egyptian minerals were analysed, including red and black iron oxide, raw and burnt umber and sienna, and red and yellow ochre from Aswân. These were all of good quality, and the deposits would be worth working if the cost of transport and treatment were not excessive.

Legal Chemistry and Criminal Investigation.—Investigations were made in connection with 62 cases involving firearms, projectiles and bombs (including the examination of the fragments of bombs thrown at four different Ministers during the year), 17 seal impressions, 75 questioned documents, 9 forged banknotes, and 5 cases of counterfeit coins (305 articles).

The investigation of the documents included chemical and microscopical examination of the paper, inks and stains or discolorations, and, in some cases, a comparison of handwriting. There was evidence that some of the forged bank-notes had been manufactured abroad.

Miscellaneous Samples.—Other samples examined included 177 of textile materials, 14 of tobacco, 227 of industrial waters, 55 of soap, candles and waxes, and 132 of a miscellaneous character.

TECHNICAL RESEARCH CONSULTATIONS.—The greater part of the consulting work was in connection with the investigation and development of the petroleum resources in Egypt. Questions relating to the safe storage and handling of petroleum were also dealt with. Other consultative work had reference to fire outbreaks and risks, and to the conditions under which certain explosives were stored.

EXPERIMENTAL RESEARCH.—A special staff was occupied with research work on Egyptian crude petroleum, and the methods of producing refined products from it. Some research was also undertaken on a process for the simultaneous production of Portland cement and sulphuric acid from gypsum and clay, in accordance with a scheme developed in Germany in 1914–1918.

PHARMACY ACTS AMENDMENT BILL.

A BILL “to regularise the position of all persons trading as chemists and druggists or pharmacy store proprietors in the sale of drugs, the dispensing of doctors’ prescriptions, and the sale of patent medicines” was ordered by the House of Commons to be printed, November 3, 1921. It consists of 16 Clauses.

1. Clause 1 restricts the use of the word “Chemist” to such persons as shall be Chemists within the meaning of this Act, provided that any person now entitled to describe himself as a Chemist and Druggist, Pharmacist or Dispensing Chemist shall continue to be entitled to use so much of such title as does not include the word Chemist.

2. (1) “On and after January 1, 1925, the Incorporated Society of the Institute of Chemistry shall alone possess the power to authorise any person to assume or use the title “Chemist,” and shall from time to time appoint competent persons to conduct examinations for the purpose of granting persons permission or authorising persons to assume or use the title of “Chemist.”

Persons granted certificates by the Examiners shall be entitled to register as “Chemists.”

(2) An officer appointed by the Privy Council may be present at such examination.

(3) Examination and registration fees to be fixed by bye-laws made by the Council of the Institute of Chemistry.

Clause 5 provides that there shall be a Central Council of 16 members, four of whom shall be appointed by the British Medical Association, four by the Institute of Chemistry, four by the Pharmaceutical Society, and four by the Incorporated Society of Pharmacy and Drug Store Proprietors of Great Britain, Ltd., together with a chairman who shall be appointed by and be a member of the Privy Council.

Clauses 6 and 11 provide for the examination and registration of pharmacists by the Central Council, and the other clauses deal with the power of the Pharmacy Society to conduct examinations, with provisions for the sale of poisons, with restrictions on advertisements, and with penalties for failure to observe the regulations of the Act.

Referring to this Bill the Registrar and Secretary of the Institute of Chemistry has sent the following letter to the press:

PHARMACY ACTS AMENDMENT BILL.

22nd November, 1921.

SIR.—I am instructed by the Council of the Institute of Chemistry of Great Britain and Ireland to direct your attention to the following letter which

has been addressed to Capt. James O'Grady, J.P., M.P., Col. D. Watts Morgan, D.S.O., M.P., and Mr. Thomas W. Casey, M.P.—I am, Sir, your obedient servant,

RICHARD B. PILCHER.

PHARMACY ACTS AMENDMENT BILL.

17th November, 1921.

SIR,—The attention of the Council of the Institute of Chemistry of Great Britain and Ireland has been directed to "a Bill to regularise the position of all persons trading as chemists and druggists or pharmacy store proprietors in the sale of drugs, the dispensing of doctors' prescriptions, and the sale of medicine."

The official print states that the Bill was presented by Captain O'Grady, and supported by Colonel Watts Morgan and Mr. Casey.

In this Bill reference is made to "the Incorporated Society of the Institute of Chemistry" and to "the Institute of Chemistry."

The Institute of Chemistry of Great Britain and Ireland is the only body in this country incorporated by Royal Charter whose title contains the words "Institute of Chemistry," and the Council of the Institute desire me to inform you that they have not been consulted with regard to the provisions of this Bill and have not had any information regarding its promotion.

The Institute of Chemistry is established to examine and register persons found competent to practise chemistry in its applications to the arts and manufactures, as distinct from those who practise pharmacy and are engaged in the sale of drugs and medicines, and in the dispensing of prescriptions.

The Council of the Institute deplore the confusion which arises through the application of the term "chemist" to two distinct callings, and they would welcome any legislation which would tend to remove this confusion. They hold that the use of the distinctive titles of "chemist" and "pharmacist" to denote these callings would tend to the general recognition of the difference between them and to the removal of a confusion which exists in no other country.

The Council wish to dissociate themselves from the suggestion that they should be represented on the Central Council, which it is proposed in the Bill shall be concerned with the Pharmaceutical Register, and from taking any part in the examination and registration functions, vested by Royal Charter and the Pharmacy Acts in the Pharmaceutical Society of Great Britain. The Council do not feel called upon at present to comment upon the other provisions of the Bill.—I remain, Sir, your obedient Servant,

(Signed) RICHARD B. PILCHER, *Registrar and Secretary.*

ABSTRACTS OF PAPERS PUBLISHED IN OTHER JOURNALS.

Food and Drugs Analysis.

Citric Acid Content of Milk and Milk Products. G. C. Supplee and B. Bellis. (*J. Biol. Chem.*, 1921, 48, 453-461.)—Citric acid in milk may be estimated by the following method: Ten c.c. of 50 per cent. sulphuric acid are added to 50 c.c. of the milk, the mixture shaken, 2 c.c. of 40 per cent. potassium bromide solution, and 20 c.c. of phosphotungstic acid are added, and the solution thoroughly mixed and filtered. The clear filtrate is treated with an excess of fresh bromine water, the liquid then heated to 50° C. for 5 minutes, and 5 per cent. potassium permanganate solution added, drop by drop, with vigorous shaking, until the supernatant liquid is brown. When the manganese peroxide begins to settle, a solution of ferrous sulphate is added, drop by drop, until the manganese peroxide and excess of bromine are removed, after which the solution is allowed to cool and left overnight. The precipitate is then collected on a Gooch asbestos

filter, washed twice with water slightly acidified with sulphuric acid then twice with water, and dried in a vacuum desiccator over sulphuric acid. The weight of the dry precipitate multiplied by 0.424 gives the weight of anhydrous citric acid present in the sample. The above method may be used for dried milks, 5 grms. of the sample being dissolved in 45 c.c. of warm water; but for sweetened condensed milks a preliminary treatment with alcohol and baryta is necessary. Test analyses showed that the maximum errors in the results obtained with normal milks and duplicate samples to which citric acid had been added did not exceed 0.006 per cent. The average amount of citric acid in normal milk is about 0.144 per cent., but is liable to vary according to the particular animal from which it is obtained and the food ration given. Heating during the preparation of evaporated and dried milks has no effect upon the citric acid present. The ageing of milk, with production of high acidity, leads to a diminution of the citric acid content, which is more marked with raw than with pasteurised samples. Owing to the destruction of vitamin occurring during some processes for concentrating and drying milk the parallelism between antiscorbutic properties and citric acid content no longer holds for these products. T. J. W.

Alcohol Test for Grading Milk. A. O. Dahlberg and H. S. Gardner. (*U.S. Dept. Agr., 1921, Bull., 944, 1-13.*)—Forty-six samples of raw milk out of 90 examined showed curdiness after sterilisation and shaking, whilst the remainder did not show any separation of curd. The alcohol test would have rejected 43 out of the 46, whilst the acid test would have rejected 18 out of the 46, as well as 21 of the 44 which withstood the sterilisation. The alcohol test consisted in mixing a given volume of the milk with an equal volume of 75 per cent. alcohol. The formation of a curd in this test generally indicated that the milk would not withstand the sterilising conditions of the factory in question.

Estimation of Caffeine in Maté, Coffee, Tea, Kola-nuts and Guarana. T. Ugarte. (*J. Pharm. Chim., 1921, 24, 387-389.*)—The finely powdered material (0.5 gm.) is placed in a dry 500 c.c. Kjeldahl flask and carefully heated over a very small flame until completely carbonised. The flask is cooled and its contents boiled three times successively with 5 c.c. of water; the liquid is filtered, evaporated to dryness on the water-bath, and redissolved in 2 c.c. of water containing ammonia. Caffeine is extracted by treating the solution three times successively with 5 c.c. of chloroform, and the chloroform extract filtered through a paper (previously moistened with chloroform), and evaporated to dryness. The crystalline residue is heated three times successively with 2 c.c. of water for 2 minutes on the water bath and filtered, the united filtrates are evaporated to dryness on a weighed watch-glass and the residue dried for 5 minutes at 100-105° C., and weighed. The following results were obtained by this method (1), and by Paul and Cownley's method (2):—Maté, (1) 0.98, (2) 1.097; Coffee, (1) 0.973, (2) 1.200; Kola-nuts, (1) 2.36, (2) 2.00; Guarana, (1) 3.74, (2) 3.40 per cent. R. G. P.

Estimation of Tannins and Pigments in Wine. W. Fresenius and L. Grünhut. (*Zeitsch. anal. Chem.*, 1921, **60**, 406–416.)—After reviewing the various processes for the estimation of the tannins and pigments in wine, the following method is recommended: Solutions required: (1) Permanganate solution. 1.33 grms. of potassium permanganate are dissolved in one litre of water. The number of c.c. of this solution required by 10 c.c. of 0.1 N oxalic acid divided into 0.0416 gives the tannin value per one c.c. (2) Indigo solution. Three grms. of finely-ground synthetic indigo are digested for five hours with 20 c.c. of concentrated sulphuric acid at 40° to 50° C., and the mixture diluted to a litre, and filtered. The titration value of this is determined under the same conditions as the wine, and it is then diluted so that 20 c.c. require between 7 c.c. and 9 c.c. of the permanganate solution. (3) Animal charcoal. This is finely powdered, extracted with acid, washed free from acid, and made into a thin paste with water. For the estimation, 50 c.c. of red wine or 100 c.c. of white wine are evaporated on the water bath to remove the alcohol, cooled and made up to 100 c.c. Fifty c.c. of this are mixed with one c.c. of the charcoal cream in a litre flask and allowed to stand for several hours, then filled up to the mark with water and filtered. If the supernatant liquid is not completely decolorised a further quantity of the charcoal is added. To a litre of water in a large basin are added 10 c.c. of sulphuric acid (sp. gr. 1.11) and 20 c.c. of the indigo solution for a white wine, or 30 c.c. for a red wine; to this are added 20 c.c. of the non-alcoholic solution of the wine which has not been treated with the charcoal. This mixture is titrated with the permanganate solution, added drop by drop with constant stirring, until a bright yellow colour is obtained. The decolorised wine is then similarly titrated, for which purpose 400 c.c. of the filtered liquid in the litre flask are diluted to 1000 c.c. acidified, and indigo solution added as before. The difference between these two titrations is the measure of the tannins and pigments in the wine, and is multiplied by the tannin value of the permanganate solution. H. E. C.

Occurrence of Methyl Anthranilate in Grape Juice. F. B. Power and V. K. Chesnut. (*J. Amer. Chem. Soc.*, 1921, **43**, 1741, 1732.)—Natural grape juice contains a small quantity of methyl anthranilate, the quantity being not more than 0.0002 grm. per litre in light-coloured juices, and not more than 0.002 grm. per litre in red juices. Methyl anthranilate possesses a decided grape-like odour, and there is a possibility that it may be added to natural grape juice to improve the flavour of the latter. W. P. S.

The Odorous Constituents of Peaches. F. B. Power and V. K. Chesnut. (*J. Amer. Chem. Soc.*, 1921, **43**, 1725–1739.)—The odorous constituents of peach pulp consist chiefly of the linalyl esters of formic, acetic, valeric and caprylic acids, together with a considerable proportion of acetaldehyde and a very small quantity of a higher aldehyde; no trace of hydrocyanic acid or benzaldehyde is present. By extracting the concentrated distillate from peach pulp with ether a small quantity of yellow coloured essential oil is obtained; the oil has a fragrant odour

and, when cooled, solidifies to a transparent mass which contains minute crystals of a paraffin hydrocarbon; the yield of oil is 0.00074 per cent. of the weight of the pulp. Cadinene, or a substance giving a similar colour reaction, is present in the oil.

W. P. S.

Quantitative Estimation of Reducing Sugars by Fehling's Solution. Elimination of Certain Errors. F. A. Quisumbing and A. W. Thomas.

(*J. Amer. Chem. Soc.*, 1921, **43**, 1503-1526.)—The chief factors affecting the accuracy of the estimation of reducing sugars by means of Fehling's solution are temperature of the digestion operation, difficulty in observing the exact time of boiling, surface oxidation, auto-reduction of the reagent, and reducing action of sucrose. The following procedure is recommended with the object of reducing these errors to a minimum. Twenty-five c.c. each of the copper sulphate solution and the alkaline tartrate solution are placed in a beaker 9 cm. in diameter, 50 c.c. of the sugar solution are added, and the beaker is covered and placed in a water-bath at 80° C. After exactly thirty minutes the cuprous oxide is collected on an asbestos filter, washed in the usual way, and the copper then determined, preferably by the electrolytic method. The copper sulphate solution should contain 82.4 grms. of crystallised copper sulphate per litre; the alkaline tartrate solution is prepared by dissolving 346 grms. of crystallised Rochelle salt in water, adding 130 grms. of sodium hydroxide (in the form of a concentrated solution made by dissolving purified sodium hydroxide in a small quantity of water and separating the clear solution from settled carbonates, etc.) and diluting the mixture to 1 litre. Tables are given showing the quantities of various reducing sugars corresponding with different weights of copper.

W. P. S.

Lumbang Oil. A. P. West and Z. Montes. (*Philipp. J. Sci.*, 1921, **18**, 619-633.)—Lumbang oil is derived from the nuts of *Aleurites moluccana*, which consist of about 66 per cent. of shell and 34 per cent. of kernel. The kernels, which contain a purgative principle, yield 50 to 60 per cent. of oil. A sample of the oil obtained by pressing the kernels had sp. gr. at 31¼° C. 0.9206; saponification value, 214; and iodine value (Hubl) 140. On separation of the acids by the lead-salt ether method, and examination of the bromo-derivatives of the liquid acids the composition of the oil was found to be:—Linolenic glyceride, 6.5; linolic glyceride, 33.4; oleic glyceride, 56.9; and glycerides of solid acids, 2.8 per cent. The oil dries quickly, but does not polymerise on heating to 200° C. as does China wood-oil; it was found to be free from elaeomargaric acid. On oxidation in a current of dry air at 80° C. the rate of oxidation increased up to a period of thirty-one hours, and then decreased, probably owing to increase in the viscosity of the oil; oxidation appeared to be an auto-catalytic reaction. On continued oxidation the oil became slightly darker in colour and very viscous, and the specific gravity increased considerably.

R. G. P.

Vitali's Reaction for Cocaine. P. Hardy. (*J. Pharm. Chim.*, 1921, **24**, 325-330.)—Conflicting statements have been published on the colour obtained

on applying the Vitali test for cocaine. The best technique is that of Barthe (*Toxicologie Chimique*, 1918, 482), which is as follows: One c.c. of nitric acid (sp. gr. 1.4) is added to a little of the cocaine, and the mixture evaporated to dryness on the water bath. When cold, a drop of alcoholic potassium hydroxide solution is added (preferably amyl alcoholic); no coloration appears, but on warming the liquid on the water bath an intense violet coloration is produced. Atropine produces a similar coloration in the cold. It is shown, however, that this test is not given by perfectly pure cocaine, but is due to the presence of iso-atropylcocaine, and is a specific test for this substance. Pure cocaine gives no coloration in the cold, and only a feeble yellow tint on warming; tropococaine, benzoyl- or cinnamyl-ecgonine, and cinnamyl-cocaine, if present, give a yellow coloration in the cold, which turns brown on heating. Any violet coloration in the cold, or on heating, is evidence of the presence of iso-atropylcocaine in the sample. H. E. C.

Investigations of Polish Foxglove. J. Muszynski. (*Pharm. J.*, 1921, 107, 443-444.)—The pale foxglove, *Digitalis ambigua*, produces a drug which is as active physiologically as that obtained from *D. purpurea*, and ought to be accepted by the pharmacopoeias as a substitute for the latter. The garden foxglove, *D. purpurea*, var. *gloxiniaeflora*, also produces a good drug. From the results of experiments described in detail it is recommended that the requirements of pharmacopoeias to the effect that "only the dried leaves of *D. purpurea*, Linn., collected from plants commencing to flower" (*British Pharm.*, *U.S. Pharm.*, *Convention Internationale*, etc.) should be supplemented by permission to collect the flowers and leaves of the first year. Physiological assay is necessary for the control of foxglove preparations.

Estimation of Mercury in Mercurial Pills. M. François. (*J. Pharm. Chim.*, 1921, 24, 369-379.)—The method depends on the separation of metallic mercury, which is then converted into mercuric iodide by treatment with standard iodine solution, the excess of which is titrated with standard thiosulphate. A weighed quantity of the material, containing up to 0.25 gm. of mercury, is heated for 2 hours on the water bath with 20 c.c. of nitric acid (sp. gr. 1.37) to destroy most of the organic matter, after which the liquid is allowed to cool for two hours and is then filtered through a wad of cotton-wool into a conical beaker (150 c.c.). Oxidation is completed by adding 2 c.c. of bromine solution (bromine, 20 c.c.; potassium bromide, 40 grms.; water, up to 200 c.c.) and allowing the mixture to stand for 10 minutes; the liquid is then rendered strongly alkaline with sodium hydroxide, and the mercury is precipitated by adding 2 grms. of potassium iodide and 5 c.c. of formaldehyde solution. After standing for two hours the aqueous liquid is decanted carefully through a small filter paper, and the precipitated mercury is washed three times with sodium hydroxide solution (5 per cent.), the filter retaining small amounts of mercury carried over in decantation is added to the bulk of the mercury which is then agitated with 10 c.c. of acetic acid (50 per cent.) and 25 c.c.

of 0.1 *N* potassium iodide solution until completely converted into mercuric iodide and dissolved, the excess of potassium iodide is finally titrated with 0.1 *N* sodium thiosulphate solution. In the case of pills containing mercurous iodide it was found that crystals of a mercury iodo-nitrate ($\text{HgI}_2\text{Hg}(\text{NO}_3)_2$) separated on cooling the liquid after treatment with nitric acid. The treatment with bromine was therefore omitted, and 5 grms. of potassium iodide and 40 c.c. of water were added; the crystals disappeared, and the liquid was rendered alkaline and treated in the manner already described.

R. G. P.

Bacteriological, Physiological, etc.

Formation of the Red Pigment of *Beta vulgaris* by Oxidation of Chromogens. A. Kozłowski. (*Comptes rend.*, 1921, 173, 855-857.)—By treating white sugar beet with 95 per cent. alcohol and shaking the extract with ether, chromogens are obtained which, after purification by means of neutral lead acetate, form an amorphous yellow substance; the chromogens similarly prepared from *Beta maritima* crystallise in more or less triangular, white plates. In certain of their physico-chemical characters, both products resemble saponins; they have a bitter, soapy taste, they rapidly decolorise, but do not completely dissolve red blood corpuscles, they yield an abundant, persistent froth when dissolved in pure or slightly acidified water, and with sulphuric acid they form successively yellow, pink, red, and violet colorations, and a deep violet precipitate; they reduce Fehling's solution only after hydrolysis by 3 per cent. sulphuric acid solution at 120° C. Oxidation with 65 per cent. sulphuric acid solution and a little manganese dioxide as catalyst, converts these chromogens into pigments perfectly similar in spectroscopic properties to the natural pigments of the red beet.

T. H. P.

Determination of the Value of Seeds by Biochemical Means. A. Němec and F. Duchoň. (*Comptes rend.*, 1921, 173, 933-935.)—It has previously been found that the activity of the glycerophosphatase of resting seeds varies greatly as the latter undergo change with age. The authors have now examined seeds of various kinds and origins in order to ascertain if any relationship exists between the vitality of a seed and the activity of the contained amylase, invertase, glycerophosphatase, lipase, urease, uricase, phytotrypsin and catalase. The results show that the action of the hydrolysing enzymes may survive the loss of the germinative power of the seed, but that loss of catalytic activity is closely connected with loss of vitality. It is evident that measurement of the catalytic activity, which may be effected in a few minutes by determining the volume of oxygen disengaged under standard conditions, may be used as a convenient means for judging rapidly of the value of seed.

T. H. P.

Self-Heating of Hay. G. Laupper. (*Landw. Jahrb. Schweiz*, 1920, 34, 1-54; *Chem. Abstr.*, 1921, 15, 2680.)—Micro-organisms play no part in the heating of stacked hay, the chemical action and heating being attributable to the activation

of oxidases in dried green hay by moisture from withered hay. In a series of observations it was found that the heating process began at 20° to 35° C.; at 35° to 45° there was caramelisation of sugar, and at 45° to 70° C., evolution of ammonia and formic acid. Acceleration of the exothermic reaction took place at 60° to 70° C., and decomposition of pectins (with pungent odour) at 70° to 90° C. The first decomposition of proteins, with formation of hydrogen sulphide and furfural occurred at 90° to 100° C., whilst at 110° to 170° C. the ammonia was oxidised to nitric acid, and there was then explosive union between the ammonium nitrate and the caramel carbon. At 170° to 250° C. the exothermic reaction proceeded rapidly; at 250° to 280° C. there was decomposition of cellulose and protein, with formation of hydrogen sulphide and furfural, and ignition of pyrophoric iron. The region of inflammability through access of oxygen was reached at 300° C., whilst at 320–340° C. the final decomposition of carbohydrates occurred, with the formation of furfural and pyrophoric manganese. The danger of fire is not obviated by injecting carbon dioxide into the stack.

Estimation of the Monoamino Acids formed by the Hydrolysis of Lactalbumin. D. B. Jones and C. O. Johns. (*J. Biol. Chem.*, 1921, **48**, 347–360.)—Lactalbumin was prepared by heating fresh-skimmed milk to 35° C., adding 0.1 N hydrochloric acid to give a P_{H} value of 4.6 and filtering to separate the precipitated casein. The filtrate was boiled for 10 minutes, and the coagulated protein washed with hot water, and suspended in dilute alcohol, absolute alcohol, and finally in anhydrous ether, after which it was dried at 110° C. The product contained: Moisture, 5.85, ash, 0.91; and nitrogen (calculated on the dry ash-free substance), 15.39 per cent. The lactalbumin was hydrolysed by boiling for 40 hours with hydrochloric acid (sp. gr. 1.10). For details of the separation and estimation of the resulting aminoacids the original paper should be consulted. The total quantity of monoamino acids obtained amounted to 61.02 per cent., consisting of glycine 0.37, alanine 2.41, valine 3.30, leucine 14.03, proline 3.76, phenylalanine 1.25, aspartic acid 9.30, glutamic acid 12.89, hydroxyglutamic acid 10.00, serine 1.76, and tyrosine 1.95 per cent. Glycine, serine and hydroxyglutamic acid have not previously been estimated in the hydrolytic products of lactalbumin, and the percentage of aspartic acid found is approximately nine times the amount previously recorded. The value given for tyrosine is too low, since indications of its presence were found in several fractions from which it was found impossible to separate it in a pure form for weighing. T. J. W.

Vitamin Content of Honey and Honeycomb. P. B. Hawk, C. A. Smith and O. Bergein. (*Amer. J. Physiol.*, 1921, **55**, 339–348; *Chem. Abstr.*, 1921, **15**, 2516.)—Honeycomb contains moderate amounts of fat-soluble vitamin A, but no appreciable quantities of vitamin A or the water-soluble vitamins B or C appear to be present in strained honey.

Effect of Heat upon the Antiscorbutic Vitamin in the Presence of Invertase. E. Smith and G. Medes. (*J. Biol. Chem.*, 1921, **48**, 323–327.)—

The suggestion having been made in several recent papers that enzymic activity causes the destruction of the antiscorbutic vitamin, the authors prepared an extract of the vitamin by treating orange juice with 96 per cent. alcohol. To 100 c.c. of the clear extract 25 mgrms. of invertase were added, and different portions were heated to 38°, 55° and 76° C. for four hours. Guinea pigs were fed on a basal diet of alfalfa meal, wheat flour and dried milk which had been heated to 95° C. for one hour, to which the heated and unheated orange extracts with invertase were added. No evidence was obtained that the vitamin is destroyed to a greater extent by heating in the presence of invertase than in its absence. In both cases the action of the vitamin is inhibited more rapidly at 76° C. than at 55° C., but no greater diminution is observed at 38° C. than at the ordinary temperature. The animals provided with the vitamin heated in presence of invertase showed less severe symptoms of scurvy than those to which was given the vitamin heated alone to the same temperature.

T. J. W.

Studies on Experimental Rickets. E. V. McCollum, N. Simmonds, P. G. Shipley, and E. A. Park. (*Amer. J. Hygiene*, 1921, 1, 482-525.)—Rats fed on diets which are low in calcium, but contain a sufficient supply of the fat soluble vitamin A, and have an approximately normal content of phosphate, develop a pathological condition of the bone resembling human rickets. This condition never develops if the animal is allowed to receive cod liver oil, but butter fat has only a very slight influence in protecting the animals.

Microscopic Study of Bacteria in Cheese. G. C. Hucker. (*J. Agric. Research*, 1921, 22, 93-100.)—Microscopic examination of sections of cheese, embedded and cut by the usual histological method, renders possible a study of the organisms as they actually occur in the cheese mass, and enables observation to be made of the groupings and relationships during the ripening process. The sections may be stained by the Gram method and with an aqueous solution of methylene blue. The method may be standardised so as to allow of an estimation of the organisms per grm. when only a small amount of the original section is examined. For example, with the diameter of the field measuring 0.14 mm. (140 μ), the microtome adjusted so as to cut sections of 0.005 mm. (5 μ), and a sp. gr. for the cheese of 1, the amount of cheese examined per microscopic field would be 1/13,000,000 grm.—that is, each organism observed in a single microscopic field represents 13,000,000 per grm. This factor may be calculated by the formula—
$$\frac{1000}{\pi r^2 a} b = \text{factor per grm.}$$
—where r represents the radius of the field in mm., determined by actual measurement with a stage micrometer; a , the thickness of the section in mm., and b , the sp. gr. of the cheese. For all practical purposes the sp. gr. of Cheddar cheese may be taken as 1, the variations being so slight as not appreciably to affect the total count. The cultural method does not give as high a count as the microscopic method, this being due primarily to the selective action of the medium used and the difficulty of liberating the organisms

from the cheese mass prior to the plate cultivation. For example, a sample of cheese three months old was found by the microscopic method to contain 14,650 cocci, 5200 short rods, and 21,450 *Streptococci lactis*, total 14,300 millions per grm.; whereas by the plate count method the numbers found were 264 *Streptococci lactis*, and 284 miscellaneous organisms; total 548 millions per grm. It is advisable, however, to use a combination of the two methods.

Fusaria Rots of the Potato. R. W. Coss. (*J. Agric. Research*, 1921, **22**, 65-77.)—Comparative tests with *Fusarium oxysporum*, *F. trichocheციoides* and *F. radiculicola* at temperatures of 5° to 25° C., and relative humidities of 1 to 100 per cent., showed that *F. trichocheციoides* was capable of causing rot at much lower temperatures (5° C.) than the other species. All three species can live and sporulate at 9° C., and with low relative humidities, but cannot produce rot under these conditions. It is probable that a rotting of the tubers initiated at high temperatures and relative humidities could be completely checked by submitting the tubers to lower temperatures and humidities.

Use of Dyes as Standards in Colorimetric Methods. M. Takata. (*Tohoku J. Exp. Med.*, 1920, **1**, 460-474; *Chem. Abstr.*, 1921, **15**, 2457-2458.)—The following solutions may be used as colour standards:

	A	B	C	D
	c.c.	c.c.	c.c.	c.c.
Water blue (Grübler), 0.01% ..	20	3	3.5	1
Hydrochloric Acid, sp. gr. 1.050 ..	20	10	10	10
Copper Sulphate, 10 grms. per 100 c.c. ..	12	5	5	4
Nigrosine (Grübler), 0.001% ..	10	10	0	0
Water	100	100	100	100

Standard A in a Dubosc colorimeter at 10.5 mm. matches Bogert's standard for uric acid in urine, and B at 24.5 mm. matches Folin and Wu's standard at 20 mm. Standard C for uric acid in blood exactly matches Folin and Wu's 0.1 mgrm. standard, and D the 0.2 mgrm. in 50 c.c. standard. The same colours may be used for the estimation of adrenaline by the method of Folin, Cannon and Denis. Bloor's cholesterol standard 0.5 mgrm. in 5 c.c. of chloroform solution may be matched by a standard consisting of 10 c.c. of copper sulphate solution (20 grms. per 100 c.c.) and 22 c.c. of sodium chloride solution (30 grms. per 100 c.c.).

The Reaction of Blood with Nascent Hydrogen Peroxide. A. Patzauer. (*Chem. Zeit.*, 1921, **45**, 1056.)—On account of the instability of hydrogen peroxide it is preferable to use magnesium peroxide in the guaiacum or the benzidine test for blood. For the guaiacum test a minute quantity of magnesium peroxide is dissolved in water, a drop of acetic acid added, and when the effervescence has subsided the tincture of guaiacum and ethereal extract of blood are added. For the benzidine test, the benzidine is dissolved in acetic acid, with the aid of heat, and, when cold, a similar procedure is adopted.

H. E. C.

Agricultural Analysis.

Estimation of Amino Acids in Foodstuffs. T. S. Hamilton, W. B. Nevens, and H. S. Grindley. (*J. Biol. Chem.*, 1921, 48, 249–272.)—The material is finely ground and extracted with anhydrous ether, absolute alcohol and 1 per cent. trichloroacetic acid solution, by shaking it in the cold for several hours. These extractions, which remove the non-protein nitrogenous constituents, are repeated six or seven times with each solvent, the extracts being centrifuged and the liquids decanted. The residue is extracted six times with 0·1 and 0·2 per cent. sodium hydroxide solution, washed with water and heated with 2 per cent. trichloroacetic acid solution, by which starch is removed, and, after filtration, the residue is boiled with 20 per cent. hydrochloric acid and finally shaken three times for 24 hours each time, with 50 c.c. portions of 5 per cent. sodium hydroxide solution. After suitable treatment the various extracts are hydrolysed by boiling them with 20 per cent. hydrochloric acid for 20 hours, and the products then mixed and analysed by the van Slyke method. The results given in the original paper from numerous estimations made with oats, maize, cottonseed meal and alfalfa show that the percentage of total nitrogen accounted for is more nearly correct than that previously obtained by other methods, owing probably to the more complete removal of substances interfering with the van Slyke estimations and avoidance of the formation of humin. T. J. W.

Chemical Composition of Starfish Meal. G. Hinard and R. Fillon. (*Comptes rend.*, 1921, 173, 935–937.)—Starfish of the species *Asterias rubens* have been converted into a brownish-yellow meal, which keeps well if it contains less than 10 per cent. of moisture, has an odour like that of fish meal, and may be used as a calcareous nitrogenous fertiliser, and perhaps also as poultry food. The dry matter of two samples of the meal had the following percentage compositions: Proteins ($N \times 6.25$), 36·75, 34·50; oil, 6·80, 8·27; mineral matter, 54·26, 51·65; and extractive matters (by difference), 2·19, 5·58. Carbohydrates are not present in appreciable proportion, and about 90 per cent. of the mineral matter consists of calcium carbonate. The oil is limpid, deep brownish-yellow, and highly oxidised, has a faint odour resembling that of cod-liver oil, and behaves towards Halphen's reagent like marine animal oils. A sample had: Sp. gr. at 15° C., 0·9372; refractometer reading (Amagat and Jean) at 22° C., + 47°; iodine value, 132·7; saponification value, 159·1; and unsaponifiable matter, 38·94 per cent. T. H. P.

Organic Analysis.

Test-Paper for the Detection of Acetylene. G. Denigès. (*Bull. Soc. Pharm. Bordeaux*, 1921, No. 2; *Ann. Chim. Anal.*, 1921, 3, 345.)—Ammoniacal cuprous chloride gives a red-brown coloration with acetylene, but the solution oxidises so rapidly that it is not possible to keep test papers impregnated with it. A solution of 50 grms. of ammonium chloride, 25 grms. of copper sulphate, and 0·5 c.c. of hydrochloric acid in 250 c.c. of water keeps indefinitely, and is reduced

immediately before use by boiling 4 to 5 c.c. with 0.3 to 0.4 grm. of copper turnings until colourless, adding about 1 c.c. of water and cooling. Filter paper is impregnated with this solution and used while still moist.

R. G. P.

The Orcinol Test for Furfurol. E. J. Mueller. (*J. Pharm. Chim.*, 1921, 24, 334-336.)—This test is more sensitive than the aniline acetate method, and will detect one part of furfural in 600,000. Five c.c. of the solution to be tested are heated just to the boiling point with 5 c.c. of hydrochloric acid and 0.2 grm. of orcinol, a blue or green coloration being formed in the presence of furfural. When only traces are present the reaction is made more sensitive by shaking the mixture with amyl alcohol, which takes a bluish-green colour, slowly changing to emerald. To test for pentoses 10 mgrms. of orcinol are boiled with 5 c.c. of hydrochloric acid and one drop of ferric chloride solution, 5 drops of the solution to be tested are added, and the mixture is extracted, when cool, with amyl alcohol. The reaction cannot be applied by means of filter paper as in the case of the aniline acetate test, but is of particular value when, as sometimes happens, the latter gives unsatisfactory results.

H. E. C.

Influence of Hydrogen Peroxide on the Decomposition of Plant and Animal Substances by Kjeldahl's Method. Kleeman. (*Chem. Zeit.*, 1921, 45, 1079.)—The Kjeldahl digestion can be materially shortened by the addition of hydrogen peroxide. It is possible to reduce starch, cereals, or grass, to a clear liquid in a few minutes without any heating. The following procedure is recommended: Five grms. of material, a globule of mercury, and 25 c.c. of 30 per cent. hydrogen peroxide are put into a 500 c.c. round-bottomed flask. Then 40 c.c. of concentrated sulphuric acid are poured in, a little at a time, and when the reaction has abated in vigour the flask is heated for 15 minutes; then 15 to 20 grms. of potassium sulphate are added, and the heating continued until the contents of the flask are quite clear. There is no troublesome frothing with this process.

H. E. C.

Presence of Manganese in Raw Caoutchouc and the Origin of Tackiness. G. Bruni and C. Pelizzola. (*Giorn. Chim. Ind. Appl.*, 1921, 3, 451-453.)—If a mixture of caoutchouc with 1 per cent. of colloidal manganese dioxide is left at the ordinary temperature, it rapidly becomes tacky, and in a few weeks almost liquid. Eleven samples of sound caoutchouc, seven of material exhibiting uniform and profound tackiness, and five slightly and irregularly tacky samples have been examined, the numbers of mgrms. of manganese per 100 grms. of caoutchouc being found to be 0.0625-0.250, 3.75-20 and 0.625-3.75 in the three classes. In the majority of cases the determining factor in tackiness appears to be the presence of manganese in sufficient proportion. The small amounts of manganese found in sound caoutchouc are probably derived from manganous salts contained normally in the latex, the larger proportions resulting from adulteration. The manganous oxide formed by hydrolysis of the manganous salts acts as an auto-oxidising agent, $\text{MnO} + \text{O}_2 \rightarrow \text{MnO}_2 + \text{O}$, the oxygen liberated and also the

manganese dioxide then exerting oxidising effects, and manganous oxide being re-formed. This detrimental action of manganese on caoutchouc is also observed with fabrics dyed or mordanted with manganese salts and subsequently coated with caoutchouc.

T. H. P.

Benzidine Hydrochloride as a Reagent for Lignocellulose. C. van Zijp. (*Pharm. Weekblad*, 1921, **58**, 1539–1542.)—Although a solution of benzidine hydrochloride not containing free hydrochloric acid gives a more intense (red-orange) coloration than an acidified solution (orange) with lignocelluloses, it is preferable to have free hydrochloric acid present, since it renders inactive other constituents of woody fibre which give a brown coloration with the reagent. The solution is prepared by dissolving 0.2 gm. of benzidine in 19 c.c. of water and 1 c.c. of 25 per cent. hydrochloric acid, and will keep well in a bottle of brown glass. The test may be applied directly to sections, preferably washed with alcohol containing 1 per cent. of hydrochloric acid, to remove any iron derived from the microtome. In testing wood meal for lignified substances the preparation is treated first with the benzidine reagent, and then, without washing, with a drop of iodine and potassium solution, and exposed until all the iodine has evaporated; the blue-black coloration given by benzidine hydrochloride with iodine and potassium iodide solution disappears, whilst the wood meal nucleus remains dark blue and the lignified constituents orange.

Inorganic Analysis.

New Method for Estimating Fluorine in the Cold. Travers. (*Comptes rend.*, 1921, **173**, 836–838.)—This method, which is the counterpart of that recently given (*ANALYST*, 1921, **46**, 522) for the estimation of silica, consists in precipitating the fluorine in the cold as potassium silicofluoride and in estimating the latter volumetrically. This process gives excellent results with soluble fluorides, calcium fluoride or potassium borofluoride, but has not yet been rendered applicable to fluorine compounds containing aluminium. The fluorine is first brought into the condition of soluble alkali fluoride, the solution, usually alkaline, being then treated with about twice as much silica, in the form of potassium silicate, as is required to convert the fluorine completely into potassium silicofluoride. The resulting solution is rendered neutral to methyl orange by means of hydrochloric acid, an excess of about 2 c.c. of the acid being added. Sufficient solid potassium chloride is introduced to give a concentration of about 20 per cent. of this salt, the potassium silicofluoride being collected on a hard filter, washed with 20 per cent. potassium chloride solution until the washings fail to react acid towards methyl orange, and titrated while boiling with 0.2 *N* potassium hydroxide solution: 1 c.c. of the latter corresponds with 0.0057 gm. of fluorine. The whole of the procedure may be effected in glass vessels, if neutral fluorides in low concentration form the starting material.

T. H. P.

Rapid Electro-analysis of Brass. A. and Mme. A. Lassieur. (*Comptes rend.*, 1921, 173, 772-775.)—The electro-deposition of copper requires the presence in the liquid of nitric acid, which, however, lowers the cathodic potential so that the subsequent electro-deposition of zinc from the solution is rendered impossible. This inconvenience is obviated if the nitric acid is reduced electrolytically to ammonia in presence of ordinary compact electrolytic copper, the spongy copper catalyst recommended by Sand (*J. Chem. Soc.*, 1907, 385) being unnecessary; owing to the comparatively large quantity of electricity required to reduce nitric acid, no more of the latter should be used than is needed to give a good copper deposit. For the analysis of brass, 0.5 gm. of the sample, if possible as thin foil, is heated in a small flask with 20 c.c. of 50 per cent. sulphuric acid and 1 c.c. of nitric acid of 36° Bé. to incipient boiling, complete solution requiring about 5 minutes. The solution is transferred to a beaker, diluted to 70 c.c. with water, and electrolysed, rotating electrodes and a current of 4-5 ampères being used. After the lapse of 40 minutes, the copper is completely deposited and the nitric acid wholly reduced. The solution and the rinsings of the electrodes, making up about 100 c.c. in all, are treated successively with 25 c.c. of sodium hydroxide solution of 36° Bé., 15 c.c. of glacial acetic acid, and 10 c.c. of saturated sodium fluoride solution, the last to annul the retarding influence of any iron on the deposition of the zinc. The liquid is cooled to the ordinary temperature, and the zinc deposited electrolytically on a coppered cathode, a current of 4 ampères being used. At the end of 30 minutes the cathode is washed, dried and weighed. The whole analysis occupies 90 minutes. In exceptional cases deposition of the zinc sets in at the completion of the reduction of the nitric acid; if, however, the current is interrupted, the deposited zinc redissolves immediately. T. H. P.

Reaction of Manganese, Iron and Cobalt. D. Baralew. (*Zeitsch. anal. Chem.*, 1921, 60, 392-393.)—The dark brown compound formed by manganese, cobalt, or ferrous salts, with an ammoniacal solution of silver oxide, Ag_2O , can be used to detect small quantities of manganese in the presence of iron, ferrous in the presence of ferric iron, and cobalt in the presence of nickel. The reaction is partially inhibited by ammonium salts, and is not given by nickel, aluminium, zinc, titanium, or uranium, or other metal of group III. In making the test, a drop of sodium hydroxide solution is added to the manganese solution, then silver nitrate, and ammonia or dilute acetic acid in excess; an insoluble black or yellowish brown precipitate remains. To detect manganese in the presence of iron a portion of the well-washed precipitated hydroxides is oxidised by warming with nitric acid, neutralised with soda, then treated as above. The first precipitate of silver oxide is dissolved, leaving a black residue if ammonia has been used, or a brown residue if acetic acid has been used. H. E. C.

Iodimetric Estimation of Iron. I. M. Kolthoff. (*Pharm. Weekblad*, 1921, 58, 1510-1522.)—The ferric chloride content of pharmacopoeial preparations may be rapidly estimated by treating 10 c.c. of an approximately 0.25 mol. solution in 0.1 N hydrochloric acid with 1.5 gm. of potassium iodide, and, after 5 minutes,

titrating the iodine. The presence of sulphates or free sulphuric acid reduces the speed of the reaction. Phosphates interfere with the reaction in a weak acid medium, but, in the presence of strong acid do not interfere, whilst oxalates have a disturbing effect both in dilute and strong hydrochloric acid solution. Nitric acid affects the speed of the reaction. A sufficient excess of potassium iodide must always be present; it should be about 1000 mols. in a 0.0022 mol. solution of iron.

Estimation of Iron and Vanadium after Reduction by Hydrogen Sulphide. G. E. F. Lundell and H. B. Knowles. (*J. Amer. Chem. Soc.*, 1921, 43, 1560–1568.)—The estimation of iron or vanadium by reduction with hydrogen sulphide, followed by titration with permanganate or bichromate solution, yields high results owing to the fact that polythionic acids are formed; these acids are not destroyed by boiling in moderately concentrated sulphuric acid solution, and volatilise slowly from dilute and more rapidly from concentrated solutions. If the volume of the solution is kept below 100 c.c., fairly accurate results may be obtained by treating the solution with 2.5 per cent. of its volume of sulphuric acid, reducing with hydrogen sulphide first for thirty minutes in the cold, then for fifteen minutes at 100° C., adding 15 c.c. of sulphuric acid (1:1) and boiling the solution, while a current of carbon dioxide is passed through it, until the volume is reduced to 50 c.c.; the solution is then diluted to 200 c.c. and titrated. To estimate iron and vanadium in solutions containing platinum (as in the analysis of rocks), a preliminary separation of the hydrogen sulphide group, followed by expulsion of the excess of the hydrogen sulphide, complete oxidation with permanganate and reduction with sulphur dioxide is recommended. W. P. S.

Detection of Magnesium in Presence of Manganese and Phosphoric Acid. A. Purgotti. (*Gazz. Chim. Ital.*, 1921, 51, ii, 265–266.)—Even from a solution containing a large proportion of ammonium chloride, manganese is precipitated in presence of phosphoric acid almost completely as tertiary manganous phosphate, which is converted slowly or, on heating, more rapidly, into pale pink crystals of manganous ammonium phosphate, this being analogous in composition and properties with magnesium ammonium phosphate. In order to avoid confusion of the manganese precipitate with the magnesium precipitate, the hydrochloric acid solution, from which ammonia removes the cations accompanying magnesium, is treated simultaneously with ammonium sulphide, the whole of the manganese being thus eliminated as sulphide; the filtrate may then be safely tested for magnesium. When, according to the ordinary procedure, the acid solution is treated with ammonia, a considerable amount of manganese is precipitated as phosphate, together with a certain quantity of calcium, barium and strontium phosphates, a little manganese and much calcium, barium and strontium passing into solution. A mixture of magnesium phosphate with a manganese salt behaves similarly, but the quantity of magnesium passing into solution is less, and that of manganese precipitated as phosphate still less. If the

manganese salt greatly exceeds the calcium, barium and strontium phosphates in amount, the equilibrium, $\text{Ca}(\text{PO}_4)_2 + 3\text{Mn}(\text{OH})_2 \rightleftharpoons \text{Mn}(\text{PO}_4)_2 + 3\text{Ca}(\text{OH})_2$, is displaced towards the right, and calcium, barium and strontium pass almost completely into solution.

T. H. P.

Volumetric Estimation of Sulphide by Oxidation to Sulphate. H. H. Willard and T. E. Cake. (*J. Amer. Chem. Soc.*, 1921, 43, 1610-1614.)—Soluble sulphides are readily oxidised to sulphate by sodium hypobromite in alkaline solution, the reaction proceeding according to the equation: $4\text{NaBrO} + \text{Na}_2\text{S} = 4\text{NaBr} + \text{Na}_2\text{SO}_4$. The sulphide solution is treated with sodium hydroxide solution in quantity sufficient to make the concentration at least 2.5 *N*, an excess of sodium hypobromite solution is added, and, after about five minutes, the mixture is treated with potassium iodide, diluted, acidified with hydrochloric acid, and the liberated iodine titrated with thiosulphate solution. The hypobromite solution is prepared conveniently by adding 160 grms. of bromine to 60 grms. of sodium hydroxide dissolved in 1600 c.c. of water; since the presence of iron, copper and other metals increases the rate of decomposition of the hypobromite solution, the sodium hydroxide solution used should be allowed to stand for a day or two and the clear liquid then decanted before adding the bromine.

W. P. S.

Volumetric Estimation of Sulphur in Burnt Pyrites. F. Chiò. (*Giorn. Chim. Ind. Appl.*, 1921, 3, 453.)—For the estimation in burnt pyrites of sulphur existing as sulphate, which is more abundant especially in the residues from cupriferos pyrites, and of that present as sulphide owing to incompleteness of the combustion, the following procedure is recommended: (a) Three grms. of the pyrites, finely ground in an agate mortar, are digested with 20 c.c. of *aqua regia* in a 250 c.c. flask for 15 minutes on a water-bath, and then for 10 minutes over a naked flame. The solution is cooled, made up to volume and filtered, 200 c.c. of the filtrate, corresponding with 2.4 grms. of the sample, being treated with just sufficient ammonia solution to precipitate the iron completely, and dilute hydrochloric acid added to redissolve the precipitate. Sufficient powdered sodium acetate (10 grms. or more) to give a persistent red coloration and 5 c.c. of acetic acid is then added, the liquid heated on a water-bath and the sulphate precipitated by means of standard barium chloride solution. (b) Twenty-five grms. of the burnt pyrites, pounded in an iron mortar so as to pass through a 1 mm. mesh, are treated in a 500 c.c. flask with 10 c.c. of dilute hydrochloric acid and 250 c.c. of boiling water, and the liquid allowed to cool, made up to volume and filtered. One hundred c.c. of the filtrate, corresponding with 5 grms. of the sample, are neutralised with ammonia solution, and the precipitate redissolved in dilute hydrochloric acid; the further procedure is that described under (a). To ascertain the end of the precipitation in either case, *a* or *b*, the beaker with the solution is kept hot on a water bath, a few c.c. of the barium chloride solution being run in from a burette and the liquid stirred well with a rubber-tipped rod;

two small filtered samples are then tested with 10 per cent. barium chloride solution and 10 per cent. sulphuric acid solution respectively. In this way the amount of barium chloride solution required may be determined with sufficient accuracy to give the percentage of sulphur in the pyrites correct to 0.1. The solution contains 61 grms. of barium chloride per litre, 1 c.c. corresponding with 0.008 grm. of sulphur. By (a) the total sulphur, and by (b) the sulphur as sulphate is found, the difference being sulphur as sulphide. T. H. P.

Action of Potassium Ferrocyanide on Silver Halides. G. B. Bonino. (*Gazz. Chim. Ital.*, 1921, 51, ii, 261-265.)—Whereas potassium ferrocyanide exerts no apparent action on silver bromide or iodide, it reacts with the chloride in accordance with the equation: $3\text{AgCl} + \text{K}_4\text{Fe}(\text{CN})_6 = \text{Ag}_3\text{Fe}(\text{CN})_6 \text{K} + 3\text{KCl}$. On this observation is founded a method for the estimation of the chlorine ion in presence of iodine ion; the reaction has not yet been studied quantitatively in presence of bromine ion. A solution of a known weight of sodium chloride is slightly acidified with nitric acid and treated with excess of silver nitrate, the precipitate being then thoroughly washed and treated with a known volume, in excess, of 0.1 *N* potassium ferrocyanide solution for about an hour. After further filtration and washing of the precipitate, the filtrate is acidified with 30 c.c. of pure sulphuric acid diluted with 90 c.c. of water, and the residual potassium ferrocyanide estimated by titration with 0.1 *N* potassium permanganate solution. In test experiments the calculated amount of chlorine agreed exactly with that in the sodium chloride taken. T. H. P.

Qualitative Tests for Pyro-Phosphoric Acid in the Presence of Ortho- and Meta-Phosphoric Acids. D. Balarew. (*Zeitsch. anal. Chem.*, 1921, 60, 385-392.)—Examination of the methods for detecting pyro-phosphoric acid in the presence of ortho-phosphoric acid shows that the reaction with silver, zinc, cadmium, or copper salts, is sensitive to 0.01 per cent. of the pyro-phosphate; luteo-cobalt chloride will detect 0.03 per cent., and Berthelot and Andre's method will detect 0.02 per cent. Of these the copper or silver tests, or the Berthelot-Andre method are the most reliable. The tests with copper and silver are carried out as follows: About 20 c.c. of the solution made alkaline to phenolphthalein are treated with 4 or 5 drops of a 5 per cent. solution of copper sulphate, and then with an excess of dilute acetic acid, added slowly, to redissolve the precipitate which first forms; the mixture is then inoculated with a minute crystal of copper pyrophosphate and allowed to stand for not more than 18 hours, by which time small grey crystals of copper pyrophosphate will appear. The composition of these crystals should be confirmed by the silver test. The neutral solution to be tested is heated with silver nitrate, then an excess of strong acetic acid is added, which dissolves the yellow precipitate of ortho-phosphate and leaves the white silver pyrophosphate. Several varieties of meta-phosphoric acid exist in solution, a fact which renders the Berthelot and Andre method unreliable in the presence of this acid, as some of the forms are precipitated under the conditions of the

reaction. The barium chloride test of Holt and Myers is also invalidated for the same reason. To test for the pyro-acid in the presence of the meta- and ortho-acid, the precipitate obtained by the above test with silver or copper is examined, as it may be due to a variety of the meta-acid. The precipitate is washed with water, acidified with acetic acid, dissolved in the minimum quantity of nitric acid, and the solution neutralised, acidified again with acetic acid, and tested with a solution of albumin, which is coagulated if the original precipitate was due to metaphosphoric acid.

H. E. C.

Determination of the Degree of Oxidation of Coal. G. Charpy and G. Decorps. (*Comptes rend.*, 1921, 173, 807-811.)—The action of oxygen on coal appears to comprise: (1) Direct fixation of the oxygen, producing increase in the total weight and also in the proportion of volatile matters and diminution in the ash content; and (2) Formation of carbon dioxide, which is disengaged, possibly with hydrogen and water vapour, causing decrease in the total weight, slight reduction in the content of volatile matter and augmentation of the proportion of ash. When the oxidation occurs at a low temperature, the former reaction plays the more important part, and yields those products soluble in sodium hydroxide solution with brown coloration. The following method has been devised to give a measure of the quantity of such products actually existing in any given coal: The powdered and sifted sample is heated for 2 hours at 100° C. with 10 c.c. of 50 per cent. sodium hydroxide solution per gm. of the coal, the solution being afterwards diluted, filtered, acidified with sulphuric acid, and made up to a definite volume. An aliquot part of this liquid, the volume depending on the intensity of its colour, is treated for 2 hours in the cold with sufficient excess of standard potassium permanganate solution to give a distinct pink coloration, the excess of permanganate being afterwards estimated by titration with ferrous ammonium sulphate solution. From the result is calculated the "oxidation index," which the authors define as the weight in grms. of oxygen necessary to oxidise the organic matter soluble in sodium hydroxide solution, yielded by 1 kilo. of coal. For coals capable of yielding hard coke, the value of this index is often below 1 and exceptionally above 2. For other coals, distinctly higher numbers are obtained, and if a good coal remains exposed too long to the air, its coking properties decline as its oxidation index increases. If the index exceeds 5-6, the coal is suspect as regards its suitability for coking purposes.

T. H. P.

Apparatus.

New Type of Sodium Lamp for Polarimetry. H. A. Fales and J. C. Morell. (*J. Amer. Chem. Soc.*, 1921, 43, 1629-1630.)—An alundum crucible containing sodium chloride is supported above a burner of the Meker type; the molten sodium chloride passes through the pores of the crucible and is vapourised in the flame, affording a continuous source of light over a period of hours. The burner should be provided with a shade carrying a dichromate light filter.

W. P. S.

Reviews.

AN INTRODUCTION TO BIOPHYSICS. By D. BURNS, M.A., D.Sc. Pp. x+435.
London: J. and A. Churchill. Price 21s.

At the first glance the reader of Dr. Burns's book will find his interest aroused by the novelty of its title. For so accustomed have we become to the idea of Physiology and Biochemistry forming the two great fields into which the study of the animal mechanism is divided, that it comes almost as a surprise to us to find that there is a path lying between the two, namely, that of Biophysics.

But we have only to read a few chapters of the book to realise how apt the title is; we find moreover that the path is quite well known to us, we have been along many parts of it before, it was possibly the existence of a right of way along it that we had forgotten. While therefore it cannot be claimed that the subject matter of the book is entirely new, there is little doubt that the point of view is novel. In no other book that we know are the boundaries and landmarks of this new trend of thought more clearly defined. The title of the book suggests also other more subtle ideas, namely, by what means much of the knowledge described has been acquired and the debt we owe to Physics. We can readily visualise, as we read, the start of the pioneer physicist along some new paths of discovery, and hard on his heels the physiologist widening the track and applying the discoveries made by the other to the problems of life—Lavoisier followed by Priestley, Joule by Attwater and Benedict.

Two facts about the book itself cause us surprise, one is the wide range of ideas that it covers and the other is the relative absence of mathematical formulæ which many writers would have felt themselves forced to include in order to justify the title.

We will now briefly deal with the six sections into which the book is divided. In the first section we find the laws and properties of energy considered. The author describes how energy is stored, and liberated and the various physical manifestations which it can produce. In particular he describes the absorption of light by chlorophyll and the probable chemical reactions by which the plant makes that energy available for animal consumption. The measurement of potential energy of different kinds of "food" is described together with an account of the methods by which the efficiency of the animal machine has been estimated. The principles of osmotic and surface tension energy are also given, the latter acting as a kind of introduction to what is written later about the theory of muscular contraction.

Section 2 begins with the ions, "the cells workmen" and deals with such fundamentally important themes as dissociation of salts and hydrogen ion concentration. The properties of colloids, optical, electrical and mechanical are next considered. A consideration of enzymes and polarimetry follows, then radioactivity and its medical applications. When dealing with the latter the author remarks that by the operation of Le Chatelier's principle matter exposed to the

radio-active elements should develop some protective mechanism against them. This remark is most suggestive from the point of view of the attempt to cure cancers by such exposure to radio-active substances.

Section 3 deals with muscular contraction and pays a tribute to the research work of the Cambridge School of Physiology, namely, Hopkins and Fletcher, Hill and Hartree. The author reminds us that while we know little or nothing of the actual mechanism of the muscle, yet we have a convincing and nearly complete story of the temperature changes, the oxygen absorption and carbon dioxide output, during and following contraction, and the part played by lactic acid.

Excretion and secretion follow in turn, then come bones, joints and tendons. In this part occurs one of the few errors that we have noticed in the book, for on page 170 the stresses at the elastic limit of various materials, vegetable and metallic, are given in "grams per sq. mm." whereas the values should be in kilograms per sq. mm.

The central nervous system with its outposts the ear and eye is now described, and of the whole book this is the only part which we have read with any feeling of disappointment. In the chapter on the eye, how much we had hoped to learn about the absorption of light by pigments, about photo-electric effects and about light reactions. But what did we find instead? Only a brief description of such well-known features of the eye as the extrinsic muscles and binocular vision. The chapter on the ear was to me equally disappointing. How fitly would a description of the properties of resonators, of damping, and of beats have found a place in a book on Biophysics! We must content ourselves with the hope, however, this book being but "an introduction," that one day Dr. Burns will write the large complete work, and that these subjects which we have mentioned will be found there.

Section 4. In dealing with this section on the transport system of the body, the author describes the circulation of the blood and the corpuscles which it contains.

The respiratory function of the blood and the laws which govern the transport of oxygen and carbon dioxide are briefly considered, together with certain practical applications such as decompression rate. There follows a description of the heart mechanism, the hydraulics of the vascular system, and the electro cardiogram. The "overseas" transport of lungs, alimentary canal, locomotion and voice come next in this section, one feels, somewhat artificially. Just as in dealing with a telephone one would naturally consider both sending and receiving instruments together, so "phonation" would, we think, more naturally find itself associated with hearing than with the digestive organs and the limbs.

Section 5, which concerns the animal as a whole, is in many ways the best in the book.

Taking, for example, the chapter on growth, in one table we find given the water content at different ages, in another the weight and length at different ages. Amongst other factors which govern rate of growth, sex, race, temperature and

seasonal variations are all described, the whole making a very concise account of very great interest. A chapter follows dealing with development and another on death and dissolution. Lastly, we find an essay on the efficiency of the organism written by Prof. Cathcart, a fitting ending to this fascinating section. Prof. Cathcart points out in the first place the difference between "gross" and "net" efficiency, and then by means of two tables shows how very constant are the net efficiencies obtained by different observers, using different methods of measurement on different human muscles. The mean of these measurements shows that the net efficiency equals 27 per cent. He then considers the important factors which must be taken into consideration when measuring efficiency, and he shows that under the best conditions the net efficiency of the animal as a whole rises above 30 per cent. If isolated muscles are taken and the conditions made as ideal as possible efficiencies of 50 per cent. are obtainable, as Hill showed. That the body used as a whole should perform less well than a single isolated muscle under ideal conditions would be expected, in fact, it is to us at all events, astonishing that the body performs as well as it does.

Section 6 briefly describes certain experiments and methods of measurement. We find, for example, measurements of osmotic pressure by Barger's method of freezing points, viscosities and conductivities. The preparation of collodion membranes is described. Then follow experiments showing electrical diffusion, electro-poresis and electrical change of surface tension. Methods of gas sampling and analysis are now given and the determination of alkali reserve by three different methods. Four experiments are devoted to the special sense organs. We think they had better be omitted from subsequent editions.

H. HARTRIDGE.

SOIL CONDITIONS AND PLANT GROWTH. By E. J. RUSSELL, D.Sc., F.R.S. Fourth Edition. London: Longmans, Green and Co. 1921. Price 16s.

This book, which originally appeared in 1912, as one of the Monographs on Bio-chemistry, has passed through three editions in that series, and now, in its fourth and enlarged edition, forms the first of the Rothamsted Monographs on Agricultural Science, which are to be contributed by the Heads of the various Departments at that Institution, the whole to be under the editorial care of Dr. Russell, the Director of Rothamsted.

A comparison of the third and fourth editions will amply justify the change that has been made. From 190 pages in 1915 the work has grown to 406 at the present time, and, incidentally, the price has gone from 5s. to 16s. But the enlargement of the subject by the inclusion of such branches as Soil Physics and Colloids very rightly necessitated the removal from the separate domain of Bio-Chemistry.

While practically all the matter of the earlier editions has been retained, fresh chapters have been added, and much fuller and later information has been given, the whole being brought up-to-date. A portrait of Boussingault, whom the author regards as the founder of modern Agricultural Chemistry, forms a frontispiece, and four other plates are given. More important, as regards the

special objects of the work, are, however, the series of curves illustrative of different points, and which figure so freely and usefully throughout the volume.

A perusal of the work will give the reader an idea of the immense development that has taken place of late years in the study of the soil, and of the many and varied conditions which play a part in the growth of the plant. We were perhaps first introduced to a recognition of this in A. D. Hall's *The Soil* (John Murray, 1903); but the work has extended greatly since, and this is due in no small measure to Rothamsted, where the study of the soil in relation to plant growth is the primary object.

But Dr. Russell has done much more than put us in possession of the latest researches of Rothamsted; he has brought together in the present volume the result of the labours of workers not only in this country, but on the continent, in America, India, and elsewhere. Indeed, it is almost bewildering to the man of an earlier generation (as it is likely to be to the student) to find out how much has been done by workers on the subject in different parts of the world. In his anxiety to give them all credit for their contributions to the advance of knowledge, Dr. Russell has perhaps been somewhat too liberal, and one might have looked for rather more discrimination and sorting out of what was likely to remain of permanent value.

In every case, however, the references to the original papers have been given, and a most complete and admirable Bibliography, together with Index of Authors and Index of Subjects, forms a special feature of the book, and will prove a valuable adjunct.

The keynote of Dr. Russell's treatment of his subject will be found in what has been the guiding principle in the later Rothamsted work, viz. that there must be co-operation between the workers in the several individual branches of science pursued; that plant growth is not dependent on one factor only, but on many; that the effect of each has to be studied, and then the joint results of one and the other. This is the plan that has been pursued at Rothamsted, the chemist, the soil physicist, the bacteriologist, the plant physiologist, the botanist, and even the statistician, all contributing their share.

The present volume well illustrates the result of such co-operation, and, as stated, it forms a valuable summary of the present knowledge, gathered, as it is, from many and widely scattered sources. The student of agricultural science must indeed be grateful to Dr. Russell for bringing together, as he has done, the chief points emerging from such work.

The book opens with an historical account of the dawn and progress of Agricultural Science, which is at once useful and interesting. The reviewer, indeed, does not know where this has been better done. Starting with the early "search for the principle of growth," Dr. Russell deals in succession with the primitive ideas of Water, Saltpetre, etc., till, with de Saussure, came in the modern period, the discovery of the decomposition of carbonic acid and the explanation of plant respiration. Then followed Boussingault (the first to make field trials), and after him Liebig, Lawes and Gilbert, and others. After this, with the coming

in of Bacteriology, followed, in quick succession, numerous other factors, all having an influence on plant growth, and the bearing of which it is the object of Dr. Russell's book to explain. The influence of such factors as water supply, air supply, temperature, soil constituents, electricity, radio-activity, etc., are separately and jointly considered in detail, and the necessity is very rightly pointed out of considering these not as single factors alone, but as working the one with and on the other.

Passing to the composition of the soil, mechanical analysis, soil acidity, soil solution, and kindred matters, are dealt with very fully. Under soil acidity there is given an excellent account of "lime requirement" and the P_H value. In this connection it may be observed that Dr. Russell, like many others, only takes account of the lime present in the soil as carbonate of lime, though he observes, on page 119, that "this is not a permanent constituent of the soil." May it not well be that, when converted into other forms, say, as sulphate or even as silicate, the lime may yet exercise an influence on the "lime requirement" of soils? Mechanical analysis is treated at length, but there is far from any general agreement as to its signification, and its practical application is hardly feasible as yet. As an Appendix a full statement of Methods of Soil Analysis is set out. Chapters follow on the colloidal properties of soil, the Biological conditions that prevail in the soil, and on the nature of the bacterial life found, and then there is a summary of the different conditions that affect the soil, and a discussion of the amelioration of soils of particular kinds, closing with the admirable Bibliography and Indices already referred to.

The volume contains an immense amount of information, the collection of which must have entailed great labour, but which will be found invaluable to the student, especially as it is simplified by the copious references, and without which the mass of information would be almost bewildering. For it must be said that the book is not at all an easy one to follow, and it is concerned rather with the getting together of facts than the setting out of these as attractive reading. This makes the grouping of information under any one heading a matter of considerable difficulty, and such subjects as soil acidity, water supply, etc., will be found referred to in several different sections, and not treated in any one place as a whole. This is perhaps inevitable, where one has numerous factors to deal with, but it causes frequent reference to other sections.

The book is wonderfully free from error, and has evidently been carefully revised. It is well printed and in clear type. As the first of the Rothamsted Monographs on Agricultural Science it is a most welcome and valuable statement of our present knowledge of Soil Science, and makes us look expectantly to the issue of further volumes of this Series.

J. A. VOELCKER.

THE CLAYWORKER'S HANDBOOK. By ALFRED B. SEARLE. Third Edition. Pp. viii+381. London: Charles Griffin and Co. Ltd. 1921. Price £1 1s. 0d.

The Clayworker's Handbook, first published about 15 years ago, has now reached the third edition, which, to quote the preface, the publishers have "reset

upon a larger page suitable to the standard position the book had attained," thus allowing for parts that have been re-written and enlarged since the last edition appeared in 1911. Considering the large amount of attention that has been given to all branches of Ceramics, especially during the past seven years, the additions are not conspicuous for either their novelty or their extent.

The first chapter deals with clays and other raw materials employed in the pottery industry, water supply and its suitability for steam raising and for clay-working, fuels, oils and lubricants. The second chapter treats of the winning and purifying of clay and the various processes of grinding, sifting, tempering, pugging, etc. The "blending" of clays is only briefly mentioned, though an enunciation of the principles upon which this could be systematically carried out would have been very welcome. The third chapter is devoted to boilers and their management, to power production and transmission and to the various classes of machinery specially required for clay-working, such as edge-runners, pan-mills, brick-making machines, etc. Some useful notes on sieves emphasise the necessity of knowing the diameter of the wires as well as the number of meshes in order to ascertain the size of the particles passed or retained. Chapter IV. deals with appliances for handling and transporting solid and liquid materials on a works. In Chapter V. the principles and methods of drying clay wares are described and much useful information on this important stage in their manufacture is embodied. Chapter VI. is devoted to the methods of applying engobes—materials used to cover clay goods and so hide the material of which the goods are made—and glazes. The succeeding chapters describe the setting or charging of kilns, the construction of different types of kiln and the methods of carrying out and controlling the firing process. Chapter X. on discharging, sorting and packing, and Chapter XII. on "Waste" contain a few notes which should be quite obvious to any competent works manager. The intervening chapter contains a list, with explanatory notes, of the defects found in finished wares. These notes should prove of great assistance to all who are concerned with the selection and purchase of clay goods, as, without such explanation it is very difficult to understand and appreciate the meaning of many of the technical terms mentioned. Chapter XIII., the longest in the book, is probably that which will appeal most to readers of the ANALYST, as it offers suggestions of tests and methods of control suitable to the ceramic industries. In places the information is strung together in a somewhat startling way, as, for example, on p. 274, "Iron should invariably be tested for in new batches of clay and glaze materials. When used in machinery it should have as much of its surface as practicable painted to prevent particles of rust and iron scale falling into the materials and so contaminating them." In dealing with the "fineness" of samples, it is surprising that no mention is made of Purdy's modification of Jackson's "surface factor" as the modified form is most frequently employed nowadays.

The aim of the author—to compress within a single volume, information on all the raw materials and processes of manufacture of clay articles, from a common

building brick to a highly decorated ornament—is certainly ambitious, and the subject is presented in an aspect not afforded by other books. The general impression left after perusal is that the book will prove of value to managers of clayworks who wish to gain an insight into the functions of the various departments, and will appeal more to the brickmaker than the potter in the ordinary acceptance of the term. One noticeable omission is the very scant reference to the method of “casting,” which of late years has been extended to classes of clay wares for which its application was never contemplated. It is a process of great interest and ranks as an important application of colloids in industry.

The arrangement of the subject matter adopted has led to a good deal of repetition and a number of “cross references,” so that it is not always easy to acquire quickly all the information wanted on a particular point; for instance, Seger’s classification of “grain sizes” appears on page 50 and again on page 270. Also in many ways, it would have been an advantage if the tests of various materials had immediately followed their description. The Appendix comprises a very useful bibliography, several tables and Standard Specifications in a convenient form. One very serviceable feature of the book is the number of examples that are given of calculations involving the use of formulae, but it is regrettable that so few references to original papers have been included.

In conclusion, this is “a manual for all engaged in the manufacture of articles from clay,” and the fact that it has reached its third edition indicates the extent to which it has fulfilled its purpose.

WALTER C. HANCOCK.

ITALIAN TECHNICAL WORDS AND PHRASES: AN ENGLISH-ITALIAN AND ITALIAN-ENGLISH DICTIONARY. By E. F. Paventa. London: E. Marlborough and Co. Price 6s. net.

So many important contributions to pure and applied chemistry are now published in Italy that a knowledge of Italian is each year becoming more essential to the English chemist, and it might be advisable if the language were recognised as an alternative to French or German in the examinations of the Institute of Chemistry.

Hitherto there has not been available any concise dictionary of the technical words met with in Italian chemical journals, but the present little book will go a long way towards supplying this want. Its aim has been to supplement the ordinary dictionaries with those technical words which the latter do not give. There is, for example, a long list of terms used in architecture, aviation, medicine, music, photography, and the textile industries, together with the business terms and phrases used in commerce.

The lists of words included under the headings “Chemical Apparatus,” “Chemical Expressions,” and “Chemicals,” have been well selected, and terms omitted can frequently be found under other appropriate headings. At the same time it would be an improvement if in the next edition group-sections were added on physical expressions, bacteriology, and pharmacology similar to that

now given on medical terms. Taking into consideration, however, the fact that the dictionary has not been compiled exclusively for the chemist, it is remarkable how much of value to him has been compressed into so small space.

The clear printing and the form in which the book is published, enabling it to be carried in the pocket, increase its value for ready reference. EDITOR.

Publications Received.

CAMBRIDGE REVISITED. By A. B. GRAY. Pp. 159. W. Heffer & Sons, Ltd. Cambridge. 1921. Price 12s. 6d. net

An illustrated account of the by-ways of Cambridge, its traditions and lore.

POISONS, THEIR EFFECTS AND DETECTION. By A. WYNTER BLYTH. 5th Ed. Chas. Griffin & Co., Ltd., London. 1921. Price 36s.

THE PHYSIOLOGY OF PROTEIN METABOLISM. By E. P. CATHCART, M.D., F.R.S. Longmans, Green, London. 1921. Price 12s. 6d. net.

CHEMICAL DISINFECTION AND STERILISATION. By S. RIDEAL, D.Sc., and E. K. RIDEAL, D.Sc., M.A. Pp. vii+313. 1921. Arnold. Price 21s. net.

MICRO-CHEMICAL TESTS FOR ALKALOIDS. By C. H. STEPHENSON. With numerous Photomicrographs. Pp. 110. Chas. Griffin & Co., Ltd., London. Price 21s. net.

ELEMENTARY CHEMICAL MICROSCOPY. By EMILE MOURIER CHAMOT, B.Sc., Ph.D. Pp. xv.+479. New York: J. Wiley. London: Chapman & Hall. 25s. net.

THE VITAMINE MANUAL. By W. EDDY. Pp. vi+121. Williams & Wilkins Co., Baltimore, U.S.A. 1921. Price \$2.50.

A readable summary of the subject from all points of view.

THE FIXATION OF ATMOSPHERIC NITROGEN. By J. KNOX, D.Sc. 2nd Ed. Chemical Monographs. Pp. vii+124. London: Gurney & Jackson. Price 4s. net.

A TEXT BOOK OF QUALITATIVE ANALYSES OF INORGANIC SUBSTANCES. By S. A. KAY, D.Sc. Pp. vii+180. London: Gurney & Jackson. Price 7s. 6d. net.

ORGANIC ANALYSIS. By E. DE BARRY BARNETT, B.Sc., F.I.C., and C. L. THORNE, M.A., A.I.C. Pp. xi+168. University of London Press. Price 7s. 6d. net.

MICROBIOLOGY. Ed. by CHAS. E. MARSHALL. Pp. xxviii+1043. London: Churchill. 1921. Price 21s. net.

A symposium by leading American biologists.

THE VALUATION OF FEEDING STUFFS BY MEANS OF CHEMICAL ANALYSIS. By A. SMETHAM, F.I.C., and F. ROBERTSON DODD, F.I.C. Royal Lancashire Agricultural Society. Price 2s. 6d.

Describes the methods of analysis and shows the composition of feeding stuffs of every description.