

THE ANALYST.

OBITUARY.

HENRY ENFIELD ROSCOE.

THE name of Sir Henry Roscoe will always stand out as that of one of the most able and successful pioneers of the advancement of science, and particularly of chemistry, during the long period of his activities.

It is not easy to-day to realise the conditions that obtained in the teaching and practice of chemistry, and in the status of those associated with the science, when Roscoe commenced his life's work as Professor of Chemistry at the Owens College, Manchester, in 1857. There were then but few institutions outside London where a training in chemical science could be obtained. The necessity of scientific instruction as a basis for industrial work was barely recognised, and the status of those engaged in either the teaching of chemistry or in chemical industry was considerably below the none too high level it has since attained. In the changes that have taken place during the intervening period of some sixty years, Roscoe played a prominent part. As a teacher he founded the leading school of chemistry in the country, which through his students did a great work in promoting the advancement of the science and of its industrial applications. By his writings and public lectures he spread an appreciation of the national importance of chemistry, and by his active association with scientific societies he aided, with conspicuous success, the co-operation of all workers in the science for their mutual benefit.

Apart from his more direct services to chemistry, Roscoe did much for the promotion of University and of technical education both in Lancashire and subsequently in London. The University of Manchester, which has arisen from the old foundation of Owens College, owes much to his labours and marked powers of organisation; and the period of his Vice-Chancellorship of the University of London (1896-1902) was characterised by valuable and progressive work during a difficult stage of transition from an examining body to a teaching University. As Member of Parliament for South Manchester from 1885 to 1895, his influence was chiefly concerned with the promotion of scientific and technical education. During the later years of his life he devoted much time to the organisation of the Lister Institute of Preventive Medicine; he was the first Treasurer and subsequently Chairman of its Governing Body, and held the latter office until his death.

In each of these spheres of activity the work accomplished and the sound basis laid for further development will remain as a lasting tribute to Roscoe's labours.

Here it must suffice to refer to them only as an indication of the wide scope of his sympathies, which may help somewhat in the appreciation of his more specific work as a chemist.

Henry Enfield Roscoe was born in London on January 7, 1833. When nine years of age he was sent to the High School of the Liverpool Institute, to which city his father had moved shortly before his death in 1836. It is exceptional that a school curriculum in those days should have included some instruction in science, and fortunate that it should have fallen to Roscoe's lot to have had Balmain, the discoverer of luminous paint and of boron nitride, as his instructor, for from him Roscoe appears to have received his first impulse towards the study of chemistry. In 1848 he entered University College, London, where he studied first under Graham and subsequently under Williamson, with whom he acted for a short time as private assistant. During this period Roscoe decided to adopt chemistry as his profession, and after taking the degree of B.A. in 1853 he went to Heidelberg to continue his studies under Bunsen, who was then in the prime of his labours as a teacher and as an investigator. Heidelberg was at that time a very active centre of scientific worth. Kopp, Kirchoff, and Kekulé, were on the staff of the University, and Roscoe's fellow-students included Von Baeyer, Beilstein, Atkinson, Lothar Meyer, Russell, Pebal, Pauli, Quincke, Mathiessen, and Landolt. This stimulating atmosphere of workers had a great influence in moulding Roscoe's future career and the character of his work, whilst it laid the basis of many lasting friendships. After a course of advanced quantitative analysis, followed by the study of the well-known accurate methods of gas analysis which had been worked out by Bunsen, Roscoe took his Ph.D. degree, and then commenced his classical photo-chemical investigations with Bunsen, which were continued during many subsequent long vacations.

On his return from Germany in 1855, Roscoe acted as official assistant to Williamson at University College for a short time, and subsequently set up as a consulting chemist in conjunction with his friend Dittmar. There is little record of the extent of his professional practice, which was cut short in 1857 by his appointment to the Chair of Chemistry in Manchester, in succession to the late Sir Edward Frankland. It is interesting to recall that the late Dr. Grace Calvert and the late Dr. Angus Smith were among his unsuccessful competitors for this post.

The Owens College, which had been founded by John Owens in 1848, was then in the throes of a struggling infancy—in fact, Roscoe speaks of it as “nearly in a state of collapse.” The premises in Quay Street, at that time anything but an attractive district of Manchester, consisted of a small house, of which the only title to distinction was that it had previously been the residence of Richard Cobden. The endowment was inadequate, and the status of the institution in the mind of the public may be gauged from the fact that Roscoe was refused the tenancy of a house by the landlord on the ground that the College would probably close its doors within a year. The total number of students was thirty-four, of whom fifteen were working in the laboratory which had been fitted up by Frankland; and the appreciation by the trustees of the value of instruction in science is indicated by the stipend of the Chair of Chemistry being fixed at one-half of that of the other professorships!

These unattractive prospects served but to stimulate Roscoe and his colleagues to establish the value of science as an efficient instrument of education, and of such education as a necessity for an industrial career. It was hard uphill work for many years, but a wide and liberal educational outlook, a full sympathy with and understanding of the prevailing industrial conditions, and an exceptional power of winning the interest of others, gradually gained the day. Year by year the number of students increased, and within fifteen years the Chemistry Department of Owens College had gained a European reputation, which continued to grow during the remaining fifteen years Roscoe remained as its director, and which he handed, on his retirement, as a splendid legacy, to the College and to his successor in the Chair, Professor H. B. Dixon. In this great work Roscoe received invaluable aid, which he always most fully acknowledged, from his colleague, Carl Schorlemmer, who first came to him as his private assistant in succession to Dittmar, and who was subsequently appointed to the first and, for a long time, the only Chair of Organic Chemistry in the country.

It is as a teacher, above all else, that Roscoe will always stand pre-eminent. He possessed that real love for his science which is the hall-mark of every great teacher, and he imbued his students with a like spirit. Many who attended his first year's course of lectures as a preliminary study to their further work were attracted from indecision or from the study of other subjects they had originally in view to make chemistry their profession, and it is no exaggeration to say that this influence led some of the best students of the College to the Chemistry Department. Once within its portals, Roscoe's sincere personal interest in their progress and his stimulating influence as their teacher retained them as his disciples both during and long after their college days. For Roscoe's care of his students never waned; his interest in their work and welfare was always retained, and his valued friendship remained a constant encouragement throughout their careers. It was their privilege to record their gratitude to him on his resignation of the Manchester Chair, on the occasion of the jubilee of his doctorate, and finally on the attainment of his eightieth birthday, when his bust was presented by them to the Chemical Society. The addresses presented to him on each of these occasions show how affectionately he was regarded by his students, and how highly they prized his counsel and example.

The methods of teaching adopted by Roscoe were to a large extent the outcome of his experience in Bunsen's laboratory. He was from the start a firm believer in the view that it is in the laboratory rather than in the lecture-room that the real teaching of chemistry must take place, and this principle was the basis of his system of instruction. It was his custom to give two courses of lectures each session, one to junior and one to senior students, each of which was replete with experimental illustrations. Roscoe was always an interesting if not a brilliant lecturer; he had the faculty of treating his subject-matter simply and directly, and a marked gift of encouraging his students to further inquiry and study. The laboratory curriculum consisted of a course in qualitative analysis, followed by quantitative analysis, with subsequent organic and technical work and research, which were developed with the gradual growth of the school. His view of laboratory teaching was that it must

inculcate method and accuracy, so that the student should gradually gain the power of exact observation and logical inference, and that a thorough practical acquaintance with qualitative and quantitative analysis must form the basis of the proper education of the chemist, whether for purely scientific or for technical purposes. There is no need to accentuate the soundness of his views. They hold with full force still, despite an interval of anti-test-tubing revolt.

No better indication can be given of the secret of Roscoe's great success as a teacher than to quote his own view of the functions of a professor, as stated in the record of the work done in the Chemistry Department of Owens College, which he published at the time of his retirement. In speaking of his plan of laboratory teaching, he says: "The personal and individual attention of the professor is the true secret of success; it is absolutely essential that he should know and take an interest in the work of every man in his laboratory, whether beginning or finishing his course. The professor who merely condescends to walk through his laboratory once a day, but who does not give his time to showing each man in turn how to manipulate, how to overcome some difficulty, or where he has made a mistake, but leaves all this to be done by the demonstrator, is unfit for his office, and will assuredly not build up a school."

How fully Sir Henry practised what he preached will be well remembered by his students. Each morning after his lecture he went into the laboratories, helping and advising and, above all, interesting each student in his work, and with fascinating personal recollections of great chemists and stories of new discoveries making the science real and living to all.

In his recognition of the importance of research, Roscoe was much in advance of his time, and throughout his life he missed no opportunity of accentuating its national and educational value. He encouraged it among his assistants and students both by example and by the provision of facilities for its prosecution, with the result that many more original investigations were published from the laboratories of Owens College during the thirty years of his professorship than from any other laboratory in the kingdom.

Roscoe's own contributions to science commenced with the researches he carried out with Bunsen on the chemical action of light. These investigations laid the basis of actinometry, and have played an important part in the more modern developments of quantitative photo-chemistry. An initial study of Wittwer's experiments on the action of light on chlorine water led to the construction of the hydrogen and chlorine actinometer, which they established as a satisfactory instrument for the measurement of photo-chemical action. During the progress of this work Roscoe was considerably perturbed by the discovery that Draper had previously devised a somewhat similar instrument—his "Tithonometer"—and wrote at once to Bunsen on the subject. In an encouraging reply, which may similarly merit the appreciation of the younger chemists of to-day, Bunsen said: "It appears to me that the value of an investigation is not to be measured by whether something is described in it for the first time, but rather by what means and methods a fact is proved beyond doubt or cavil, and in this respect I think that Draper has left plenty for us to do." Bunsen and Roscoe

pointed out the errors associated with Draper's instrument, and fully proved the greater accuracy of their own form of actinometer. They subsequently devised the first satisfactory method for the preparation of silver chloride papers of constant sensitiveness, the darkening of which was compared, for actinometrical measurements, with a scale of standard tints prepared from zinc oxide and lampblack. This form of photographic actinometer was modified at a later date by Roscoe by adopting darkened silver chloride papers, fixed by sodium thiosulphate, as the scale of comparison. By these means they studied the relation of the time and intensity of action of light to the photo-chemical effect, and the conditions of absorption of the actinic rays, and made measurements of the photo-chemical action of diffuse daylight, direct sunlight, and of the distribution of actinic rays in the solar spectrum. This work led to the discovery of the phenomenon of photo-chemical induction, a problem of very great interest, which they investigated with much care and skill. It has been the subject of much subsequent research which has proved that the delay in the combination of hydrogen and chlorine is due to the inhibiting effect of impurities, in the absence of which there is no period of induction. The inclusion of these photo-chemical researches of Bunsen and Roscoe in Ostwald's "Klassiker der exacten Wissenschaften" is a fitting measure of their importance and value.

Shortly after his appointment to the Manchester Chair Roscoe commenced his work on the composition of aqueous acids of constant boiling-point. The results obtained with the halogen acids either by distillation or by the passage of a current of air are well known. It may be of interest to add that aqueous solutions of nitric, sulphuric, formic, acetic, and perchloric acids were similarly investigated. From the last of these Roscoe was led to his study of perchloric acid, which had not been obtained pure until he prepared it by the decomposition of the pure potassium salt with sulphuric acid. He determined its composition and that of its potassium salt, and subsequently studied the isomorphous relations of the perchlorates of potassium, ammonium, and thallium.

In 1865 Roscoe commenced his classical investigations on vanadium. This work originated from a visit to the copper-mines at Mottram, near Alderley Edge, in Cheshire, where the copper occurs together with other metals, notably cobalt, in the form of carbonate, as an incrustation over the grains of Keuper sandstone. The process of extraction consisted in treating the ore with hydrochloric acid, and subsequent precipitation of the copper with metallic iron or zinc. On the occasion of Roscoe's visit he was shown a dark blue solution which was regarded as a concentrated solution of copper salt, in a peculiar condition, inasmuch as it was not precipitable by zinc. He concluded at once that the blue colour must be due to the presence of some metal other than copper, and soon confirmed his first suspicions that it was due to vanadium. He subsequently obtained a good supply of a lime precipitate from this source, from which he prepared a considerable quantity of vanadium oxide, which served as the starting point for his work.

Vanadium was first investigated by Berzelius in 1831, who, although he had only a few grams of material at his disposal, succeeded in preparing, with characteristic skill, a large number of vanadium compounds, from the study of which he concluded that the metal was closely allied to chromium and molybdenum, forming an acidic

trioxide and an acid chloride. By heating this chloride in an atmosphere of ammonia, Berzelius obtained brilliant metallic scales, which he regarded as the metal, and he based his determination of the atomic weight of the element upon the relation of the acid chloride and of the acidic oxide to the reduction product of the latter. Roscoe, however, showed that the substance regarded by Berzelius as vanadium was, according to its method of preparation, either a nitride or an oxide, and that the acid trichloride was really an oxychloride analogous to that of phosphorus. He prepared the pure metal by reducing the dichloride, VCl_2 , by means of hydrogen, and determined its atomic weight from the ratio $V_2O_5 : V_2O_3$, as ascertained by reduction in hydrogen, and also from the ratios $VOCl_3 : 3Ag$ and $VOCl_3 : 3AgCl$. The mean values of these results, calculated on the present atomic weights, were 51.38, 51.05, and 51.26, respectively. The most recent determinations* give the atomic weight as between 50.93 and 50.97, so that the figures obtained by Roscoe so many years previously indicate the accuracy of his work. From these results, as well as from his study of the composition of the vanadium compounds, of which he prepared a large number, Roscoe concluded that vanadium belongs to the nitrogen and arsenic family, and thus succeeded in placing it in its accepted position in the fifth group of the periodic classification.

These researches formed the subject of the Bakerian Lecture before the Royal Society in 1868, and received further recognition in the award, by the Society, of a Royal Medal in 1873.

Roscoe's other contributions to science stand in a somewhat subsidiary relation to the above important investigations. These include the determination of the vapour density of the chlorides of lead and of thallium; the discovery of the pentachlorides of tungsten and of uranium; and the proof that the so-called element "phillipium" was really a mixture of terbium and erbium. He also, in conjunction with Schuster, mapped the spectrum of terbium salts, and, in conjunction with Thorpe, studied the absorption spectrum of bromine and of iodine chloride.

It is not only with those who worked in his laboratories that Roscoe exerted his influence as a teacher. His writings extended this influence to a far wider sphere. Both in this country and abroad they have, for many years, formed a basis for the teaching of chemistry in schools and colleges. Roscoe was endowed with much literary ability, a gift inherited from his father, Henry Roscoe, an able barrister and the author of several standard works on law, and from his distinguished grandfather, William Roscoe, so well known by his "Life of Lorenzo de Medici" and of "Leo X." Roscoe's style is marked by lucidity and simplicity of expression, and in the selection of his subject-matter he avoided, with exemplary success, the tendency towards an unattractive compilation of data which is too often the characteristic of more modern textbooks and treatises on science.

At the time of the publication of the "Lessons in Elementary Chemistry," in 1866, there were scarcely any books of the kind in existence; a small textbook by George Wilson, and the larger and more expensive works by Fownes, Graham, and Miller, appear to have been the only books available for the use of students. That

* H. V. A. Briscoe and H. E. V. Little, *J. Chem. Soc.*, 1914, 105, 1310.

the "Lessons" met an acknowledged want, and did much to promote the teaching of chemistry, is shown by the remarkable demand that followed its original publication and that of the many successive editions. They were translated into German by Schorlemmer with an equally successful result, and into no fewer than nine other languages, including Polish, Hungarian, Modern Greek, Japanese, and the Indian vernacular, Urdu.

At a somewhat later date, Roscoe, in conjunction with Huxley and Balfour Stewart, undertook the editorship of a series of simple books on elementary science, the "Science Primers," and contributed the volume on Chemistry. This little work did excellent service as a first step in chemistry for schoolboys, and, like the "Lessons," was translated into many other languages.

These works were followed, in 1877, by the "Treatise on Chemistry," in the publication of which Roscoe enjoyed the valued co-operation of his colleague Schorlemmer. The "Treatise" is too well known to need comment. It has long been a standard textbook of Inorganic Chemistry, and its value has been repeatedly enhanced from edition to edition, by careful revision and additions, without destroying the essential characteristics which contributed so fully to its initial success. In the revision of the later editions Roscoe received the help of several of his former students and others; but even in the preparation of the last editions, which were published but a few years before his death, he supervised the whole of the work with the greatest care and judgment and with enviable mental vigour. The portion of the treatise devoted to Organic Chemistry was never completed. This was in part due to the death of Schorlemmer, but chiefly to the fact that the modern developments of this branch of the science became unsuitable for adaptation to the original plan of the book. The German edition of this portion of the work has, however, been carried to completion under the direction of Brühl.

Other literary work includes the "Lectures on Spectrum Analysis," published in 1869, a series of lectures which were originally given in the Hall of the Apothecaries' Company, and which did much to arouse interest in the pioneer work of Bunsen and Kirchhoff on this subject. This book has also proved its merit by the call for successive editions, the later of which were published in conjunction with Schuster.

Roscoe's long association with Manchester not unnaturally directed his interest to the life and work of his townsman, John Dalton, several of whose manuscript laboratory and lecture notebooks he unearthed from among the archives of the local Literary and Philosophical Society. The examination of these papers revealed a number of historical data which shed an entirely new light on the origin of the atomic theory, and showed how much more Dalton had relied upon philosophic reasoning from physical considerations than on his experimental data, in arriving at his fundamental hypothesis. The views arising from these discoveries were published by Roscoe, in co-operation with Harden, in a volume entitled "A New View of the Origin of Dalton's Atomic Theory." He also wrote a life of Dalton for the Century Series of Scientific Men.

Sir Henry added a welcome coping-stone to his literary work by the publication of his autobiography in 1906, under the title of his "Life and Experiences." The story of his career, his work, his friends, and his home, is told with characteristic

simplicity and charm. It is a book that will tell future generations something of the personality and labours of a great and good man.

Roscoe was awarded many honours both by his fellow-scientists and by his country. He was elected a Fellow of the Royal Society in 1863; in 1879 his name was added to the restricted roll of honorary members of the German Chemical Society; he was the recipient of many honorary degrees, and served as President of the Chemical Society, the Society of Chemical Industry, and of the British Association. He received his knighthood in 1884, and the signal honour, for a scientist, of a Privy Councillorship was conferred upon him in 1909.

Death came to him as he would have wished, a quick and peaceful passing, free from pain. He died at his residence, Woodcote Lodge, West Horsley, on December 18, 1915, within a few weeks of his eighty-third birthday.

CHARLES A. KEANE.

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

THE annual general meeting of the Society was held on Wednesday evening, February 2, in the Chemical Society's Rooms, Burlington House. The President, Mr. A. Chaston Chapman, F.I.C., occupied the chair.

The minutes of the previous annual general meeting were read and confirmed.

Mr. J. F. H. Gilbard and Mr. F. T. Harry were appointed scrutators of the ballot-papers for election of Officers and Council for 1916.

The Hon. Treasurer presented the accounts of the Society for 1915; and votes of thanks were passed to the Hon. Treasurer, Hon. Secretaries, and Auditors.

Mr. J. F. H. Gilbard and Mr. H. F. Stephenson were appointed auditors of the Society's accounts for 1916.

The President delivered his annual address (ANALYST, 1916, 31-45).

Dr. KEANE, in conveying the thanks of the meeting to the President for his admirable address, and for his exceptionally efficient services to the Society during a period of great difficulty and strain, referred especially to his remarks concerning the status and teaching of analytical chemistry. He agreed most fully with Mr. Chapman's view that the work of professional and professorial chemists should be more completely associated. This and other similar societies afforded a common meeting ground, of which he was glad to think increasing advantage was now being taken, and it was a good sign that a number of representative professorial men had recently joined the Society. There was still room for much further co-operation, and he felt sure that it would aid the advancement of analytical chemistry if teachers

knew more of the work and methods of their professional colleagues. If one bore in mind how limited was the division of professorships of chemistry, and that even in so important a branch as organic chemistry there were only some half-dozen independent chairs, it was perhaps not surprising that not a single professorship of analytical chemistry existed in this country. This implied a sad want of recognition of the value of this branch of the science. Not only was it of exceptional importance as a training in the methods of experimental inquiry, but it was above all fundamental for all further work in every branch of the science, whether applied to professional work, chemical industry, or research. Such further work introduced factors which were difficult to introduce into teaching curricula, especially the factor of responsibility. Although in the teaching of analytical chemistry a fair degree of accuracy was insisted upon, it must be remembered that the results were never the basis of sales or purchases, and that the responsibility that attached to the work of every employee, from the directors downwards, in professional or industrial work was typically absent. From this standpoint research work was of outstanding importance. The investigator had to stand by his results when he came before his peers in this or any other society; the accuracy and reliability of his work was on trial, and the element of responsibility thus introduced into his labours was, from a teaching standpoint, usually of considerably greater value than that of the discoveries made. In regard to post-graduate work other than research, and especially in the teaching of technological chemistry, there was a tendency to regard the scale of the operations as a helpful factor in this direction. But apart from the definite limitations that existed to the introduction of manufacturing conditions into teaching curricula, even fairly large scale operations, if carried through, were no more real or responsible in character than the smaller laboratory experiments on which they were based. The greatest value of technological instruction was obtained when it was given by experts to those who had already gained some technical experience. Such students had the requisite previous knowledge to appreciate the instruction, and there was a wide field open for such teaching in the form of part-time courses in analytical and other branches of applied chemistry. Abroad such post-graduate teaching in technology was, for the most part, effected in the works themselves. Here, with few exceptions, this was not the case. The necessity for such instruction might perhaps be only of an interim character; the future development of the chemical industries of the country might render it superfluous, but for the present it was a very real need, and likely to prove of outstanding value in the promotion of industrial progress. He hoped that the President would give his permission for his address to be printed in the ANALYST.

Mr. J. H. B. JENKINS seconded, and the motion was carried by acclamation.

The PRESIDENT, having received the report of the scrutators, announced the election of Officers and Council for 1916 in accordance with the Council's nominations, as follows:

President.—G. Embrey, F.I.C.

Past-Presidents serving on the Council (limited by the Society's Articles of Association to eight in number).—L. Archbutt, F.I.C.; E. J. Bevan, F.I.C.; A. Chaston Chapman, F.I.C.; Bernard Dyer, D.Sc., F.I.C.; Otto Hehner, F.I.C.; R. R. Tatlock,

F.I.C.; E. W. Voelcker, A.R.S.M., F.I.C.; J. Augustus Voelcker, M.A., B.Sc. Ph.D., F.I.C.

Vice-Presidents.—H. G. Colman, M.Sc., Ph.D., F.I.C.; J. H. B. Jenkins; R. T. Thomson, F.I.C.

Hon. Treasurer.—E. Hinks, B.Sc., F.I.C.

Hon. Secretaries.—P. A. Ellis Richards, F.I.C.; E. Richards Bolton.

Other Members of Council.—W. T. Burgess, F.I.C.; J. A. Dewhirst, F.I.C.; J. T. Dunn, D.Sc., F.I.C.; P. V. Dupré, A.C.G.I., F.I.C.; R. G. Grimwood, F.I.C.; H. G. Harrison, M.A., F.I.C.; E. M. Hawkins, F.I.C.; A. W. Knapp, B.Sc., F.I.C.; S. J. C. Macadam, F.I.C.; W. Macnab, F.I.C.; H. L. Smith, B.Sc., F.I.C.; W. Collingwood Williams, B.Sc., F.I.C.

An ordinary meeting followed the annual meeting, the newly-elected President, Mr. G. Embrey, F.I.C., occupying the chair.

The minutes of the previous ordinary meeting were read and confirmed.

Certificates of proposal for election to membership in favour of Messrs. N. T. Foley and T. J. Hitchcock were read for the second time; and a certificate in favour of Mr. Frank Theodore Alpe, "Bracondale," Wymondham, Norfolk, analyst and bacteriologist to the Forehoe Rural District Council, was read for the first time.

Messrs. T. F. Harvey, C. H. Manley, B.A., A.I.C., C. C. Roberts, M.A., A.I.C., and F. T. Shutt, M.A., D.Sc., F.I.C., were elected members of the Society.

The following papers were read: "Notes on Common Processes used in Water Analysis," by W. T. Burgess, F.I.C.; "Note on Human Milk," by G. D. Elsdon, B.Sc., F.I.C.; and "Poli Oil—a New Adulterant of Ghee," by J. H. Barnes, B.Sc., F.I.C., and Arjan Singh.



"POLI OIL," A NEW ADULTERANT OF GHEE—INDIAN CLARIFIED BUTTER-FAT.

BY J. H. BARNES, B.Sc., F.I.C., AND ARJAN SINGH, L.A.G.

(Read at the Meeting, February 2, 1916.)

IN the North-West of India, in that tract of cultivated country extending from Umballa in the South, to Peshawar in the North, a persistent thorny weed is found growing with and alongside the wheat crop. It is known locally by the vernacular names of *Poli*, *Polyan*, *Leh*, *Kasumbhi*, or *Karav*. It belongs to the natural order *Compositæ*, and is known to botanists as *Carthamus oxyacantha*, one of the safflowers. The plant itself resembles safflower (the *Carthamus tinctorius*) in appearance, though, unlike that plant, it does not often exceed $2\frac{1}{2}$ feet in height. Its period of growth extends from the beginning of the cold season to the early dry hot weather—December to May—exactly similar to that of wheat, though the actual breaking of the seed capsules naturally takes place a little later than the reaping of wheat in this part of the world (middle of April till the middle of May), and the germination

of the seed is about a month later than that of wheat. The plant is troublesome in the reaping and threshing of the cereal crop, and, on account of its growing period coinciding so closely with this, it is very difficult to eradicate. With the great extension of wheat lands in North-West India during the last twenty years through irrigation, this weed has been brought more and more to the notice of the agricultural classes, and the Government Department of Agriculture is even now devising means of checking and controlling its extension.

It is not, however, with the plant as a pest to the farmer that we are concerned in this note, but with the industrial uses to which it may be and is put.

The seed is edible, for in famine years its use as a food has been recorded by many observers. On expression, it yields a yellow oil which in the Peshawar district is used as an illuminant, and in other parts of the Punjab is added to Ghee—Indian clarified butter-fat—thus constituting an adulterant of this very important item of Indian food.

Bellew (Stewart's "Punjab Plants," p. 123) states that the oil has been used medicinally, but little is known of this. We have had inquiries from the Indian Museum, Calcutta, for this oil for use in colour stencilling on fabrics.

The principal outlet for Poli oil in the Punjab at present seems to be its use as a food, and its colour and taste render it a very suitable and cheap substance with which to adulterate Indian clarified butter-fat.

The chemical and physical constants of a genuine sample of fresh oil as determined by us are given below :

Specific gravity (at 15·5° C.)	...	...	...	0·9272
Iodine value	...	...	...	167·4
Saponification value	...	...	...	174·2
Acetyl value	...	...	...	60·5
Acid value	...	...	...	5·9
Reichert-Meissl value	...	...	...	0·61
Optical rotation in 200 mm. tube	...	...	...	Nil
Refractive index at 28° C. ...	...	...	...	1·4818
" " at 40° C. ...	...	...	...	1·4755

It will be seen that these constants do not bear out those given by Crossley and Le Sueur (*J. Soc. Chem. Ind.*, 1898, **17**, 991) for a sample of oil from the Punjab *Carthamus oxyacantha*. This is probably due to the sample examined by these authors not being fresh. It is well known that all the safflower oils are drying oils, and contain considerable quantities of unsaturated acids, hence their tendency to undergo polymerisation. But whether he has to deal with fresh or stale oil the analyst will have little difficulty in recognising this adulterant when found in conjunction with Ghee. Cf. Bolton and Revis (*ANALYST*, 1910, **35**, 343; 1911, **36**, 392.)

PUNJAB AGRICULTURAL COLLEGE.



NOTE ON HUMAN MILK.

By G. D. ELSDON, B.Sc., F.I.C.

(Read at the Meeting, February 2, 1916.)

Two samples of human milk (taken from the same source on two successive days) recently examined by the writer, had the following composition, the lactose being determined by difference :

				Per cent.	Per cent.
Fat	...	...	...	4.0	3.5
Lactose	...	...	...	7.5	7.4
Proteins	...	...	...	1.5	1.4
Ash	...	...	...	0.2	0.2

The mixed fat of samples taken on several successive days had the following characteristics :

Refractive index 40° C.	...	...	...	...	1.4568
Zeiss butyro refractometer 40° C.	...	...	...	...	46.3
Reichert-Meissl value (5 grms.)	...	...	...	...	2.0
Polenske value	...	...	...	...	2.2
Kirschner value	...	...	...	...	1.9

The mixed fat from four other samples of different origin had a refractive index at 40° C. of 1.4576, and gave a butyro refractometer reading at 40° C. of 47.5.

In the years 1910 and 1911, 146 samples of human milk were examined in the City of Birmingham Analytical Department in connection with an investigation on nutrition which was being carried out by the Medical Officer of Health ; the samples were obtained from twenty different mothers over a period of about ten months. Many of the analyses were carried out by the writer, and the following figures are now published by the courtesy of Mr. J. F. Liverseege, the Birmingham City Analyst ; those analyses not made by the writer were made by Mr. Norman Evers.

Sixty-seven samples were completely analysed with the following average results, the lactose being determined by difference.

	Total Solids.	Solids-not-Fat.	Fat.	Proteins.	Ash.	Lactose.
Average per cent.	11.7	8.59	3.11	1.19	0.21	7.18
Maximum „	14.6	9.1	5.9	1.8	0.3	7.6
Minimum „	9.6	8.0	1.1	0.7	0.2	6.6

Seventy-nine samples were partially analysed with the following average results

	Total Solids.	Solids-not-Fat.	Fat.
Average per cent.	11.78	8.50	3.28
Maximum „	14.3	9.4	5.7
Minimum „	9.4	7.9	0.7

MUNICIPAL CHEMICAL LABORATORY, SALFORD.



A NEW COLOUR REACTION FOR ALOES.

By C. E. STACY.

(Read at the Meeting, March 1, 1916.)

A PINK coloration sufficiently delicate to detect one part of Barbadoes aloes in 10,000 is produced by the addition of a freshly prepared solution of potassium ferricyanide to the cold aqueous solution of the aloes. If excess of either test solution or reagent is employed no colour is produced, and it is necessary that the strength of the reagents should be roughly proportional to the strength of the solution to be tested.

The colour is permanent, and is rendered apparent more rapidly by heating just to boiling, as in most cases the colour takes from five to fifteen minutes to appear. On treating Barbadoes aloes with petroleum ether, benzene, and chloroform, minute quantities of the reacting substance are removed, but none by ether or ethyl acetate, and, after the removal of the ordinary principles of aloes (aloin, emodin, etc.), the bulk of the substance causing the pink coloration is left behind.

In somewhat more concentrated solutions the colour is a deep crimson, and in 1 per cent. or upwards a blood-red.

Socotrine and Cape aloes do not give this reaction, but give an emerald-green colour, which is not nearly as delicate as the Barbadoes reactions, but is sufficient for the detection of 1 in 250 of Socotrine aloes, and is less delicate with Cape aloes. Commercial aloin also gives a green colour with this reagent.

No reaction is given with extracts of cascara sagrada or rhubarb, so that the colour is not given by frangulin, frangulic acid, or chrysophanic acid.

The chief value of the test consists in its ability to distinguish Barbadoes aloes from the other varieties and from commercial aloin in medicinal preparations.

I was unable to obtain specimens of Curaçoa or Natal aloes, but the three varieties tested are, I understand, the only ones used ordinarily in medicine, at least in this country.

The colour is destroyed by acids. Small quantities of alkalis intensify the reaction, at the same time modifying it by introducing a brown tint. Large amounts of alkalis destroy the colour.



ABSTRACTS OF PAPERS PUBLISHED IN OTHER JOURNALS.

FOOD AND DRUGS ANALYSIS.

Estimation of Benzoic Acid in Animal Foodstuffs. K. Baumann and J. Grossfeld. (*Zeitsch. Unters. Nahr. Genussm.*, 1915, **29**, 397-409, 465-472; through *J. Soc. Chem. Ind.*, 1916, **35**, 192.)—For the determination of benzoic acid in milk, butter, margarine, etc., it is converted into its potassium salt, potassium soaps are removed by precipitation with calcium chloride, and proteins by means of phosphotungstic acid; benzoic acid is extracted by percolation with carbon tetrachloride, and titrated with $\frac{N}{10}$ alkali. In the case of products, such as cheese, etc., containing considerable quantities of water-soluble fatty acids, the isolation of the benzoic acid is exceedingly difficult. For meat, sausages, and the like, 100 grms. are boiled with 100 c.c. of 5 per cent. sodium hydroxide solution, the aqueous solution is removed, the fat treated with 50 c.c. of benzene and extracted with water, and the united aqueous extracts are acidified with dilute sulphuric acid, an equal volume of sulphuric acid added to the solution so as to form a lower layer, and the liquid distilled with steam. The distillate (500 c.c.) is made faintly alkaline, warmed to dissolve the fatty acids, neutralised with sulphuric acid, concentrated to 50 c.c., treated with 2 c.c. of calcium chloride solution, the precipitate washed with 40 c.c. of hot water, the solution treated with 5 c.c. of dilute sulphuric acid, the benzoic acid extracted by percolating with carbon tetrachloride for six hours, and titrated. (Cf. Monier Williams, *Report of Local Government Board*, New Series, No. 13, 1909.)

Sampling and Analysis of Beeswax. M. S. Salamon. (*J. Soc. Chem. Ind.*, 1916, **35**, 8-10.)—In preparing samples for analysis from wharf samples of a consignment, it is best to take shavings from each piece of wax, preferably by means of a potato parer. When the pieces are of different appearance, it is advisable to halve the parcel and to prepare a sample from each portion. In some cases a consignment may be uniformly adulterated, but as a rule it will consist partly of pure wax and partly of adulterated wax, and the adulteration might escape detection in a melted sample of the entire wharf sample. Unless the actual origin of the wax be known, an estimation of the usual values may be insufficient to detect adulteration, and qualitative tests, especially for paraffin wax, should also be applied. For example, a sample of wax gave an acid value of 18 and an ester value of 71, which would have been normal for Chilian wax; but the sample was Moroccan wax, which has an ester value of about 75, and a special test showed that about 10 per cent. of paraffin wax was present. In the Weinwurm test no certain deductions can be drawn unless distinct flakes are observed. Certain hard waxes, such as Chilian and Egyptian waxes, will give a clear solution, even when 5 per cent. of paraffin wax is present, whilst others, such as Madagascar and Abyssinian waxes, give a cloudy solution, even when pure. The test should always be repeated with a further sample of the wax, to which 5 per cent. of paraffin wax has been added. If no flakes are now observed, and the ester value is normal, it may be concluded that no paraffin

wax is present. A clouding point test should always be made as a confirmation. The following table gives the characteristics of different varieties of beeswax, the results being obtained from the analysis of more than 500 wharf samples. The melting-points were determined in capillary tubes closed at one end :

Origin of Wax.	Number of Samples	Acid Value.	Ester Value.	Ratio.	Melting-Point.	Clouding-Point.
					° C.	° C.
Abyssinian :	42					
Average ...		19.8	74.5	3.8	63.5	60.0
Minimum ...		18	72.2	3.6	62.5	59.5
Maximum ...		21	77	4.1	64.0	60.0
Benguella :	29					
Average ...		19	73	3.8	63.0	60.0
Minimum ...		17.5	72.3	3.7	62.5	59.0
Maximum ...		19.5	78.5	4.1	65.0	60.0
Chilian :	11					
Average ...		18.5	72.3	3.9	64.5	60.0
Minimum ...		17.3	70.6	3.8	64.0	60.0
Maximum ...		18.5	74	4	65.0	61.0
Cuban ...	1	18	75	4.2	63.7	60.0
East African :	57					
Average ...		18.5	75	4	63.0	60.0
Minimum ...		17.3	70.6	3.7	63.0	60.0
Maximum ...		20	77	4.1	64.5	61.0
Egyptian ...	8	19.3	72-76	3.8-4.0	63.0-64.0	59.5-61.0
Madagascar :	40					
Average ...		18.5	75	4	64.0	60.5
Minimum ...		17.3	72.8	3.6	63.5	60.0
Maximum ...		20	78	4.5	65.0	61.0
Morocco :	185					
Average ...		19.0	76	4	63.5	60.0
Minimum ...		18	73.3	3.8	63.0	60.0
Maximum ...		20.5	78	4.2	64.5	60.5
Mozambique :	35					
Average ...		18.5	75	4	63.5	60.0
Minimum ...		18	73	3.9	63.0	—
Maximum ...		18.7	73.4	4	64.0	—
Portuguese :	15					
Average ...		18.4	72	3.9	64.0	60.0
Minimum ...		18	70.6	3.8	63.0	59.5
Maximum ...		18.7	73.4	4	64.0	61.0
San Domingo :	9					
Average ...		18.5	72	3.9	63.5	60.0
Minimum ...		18	70.6	3.8	63.0	—
Maximum ...		19	74	3.9	64.0	—
Sierra Leone :	29					
Average ...		19	74	4	64.0	60.5
Minimum ...		18.5	72.8	3.7	63.0	—
Maximum ...		20	76	4	65.0	—
Spanish ...	2	18-18.5	74.5-75.5	4	64.0	60.0
Smyrna ...	2	19	74	3.9	64.5	60.0

Abyssinian wax is of two types, one being dark-red and having an average acid value of 20 and an ester value of 76, and the other pale in colour with an acid value of 18 and an ester value of 73.

C. A. M.

Rapid and Exact Method of Estimating Alkaloids in Cinchona Bark. E. Lenci. (*Boll. Chim. Farm.*, 1915, **54**, 417-422; through *J. Chem. Soc.*, 1915, **108**, ii, 850-851.)—As a method for estimating the alkaloids in cinchona bark, Hager (*Zeitsch. anal. Chem.*, 1869, **8**, 477; 1882, **21**, 415) suggested the precipitation of the alkaloids as picrates and the weighing of the precipitate on a tared filter after drying at 40° C. This precipitation is accompanied by coagulation of the proteins, waxy matter, etc., high results being consequently obtained. The author finds that the following procedure gives good results. To 5 c.c. of a solution of the acid sulphate of the alkaloid are added 50 c.c. of a cold, saturated picric acid solution, the strength of which has been estimated by the "nitron" method (Busch and Blume, *ANALYST*, 1908, **33**, 135). After half an hour the liquid is filtered, and the residual picric acid in 5 c.c. of the filtrate estimated by precipitation with "nitron." Multiplication of the amount of picric acid thus formed by eleven, and subtraction of the product from the picric acid content of the 50 c.c. of precipitant, gives the quantity of the acid which has combined with the amount of alkaloid taken. The results obtained in this way with solutions of various concentrations of the acid sulphates of quinine, cinchonine, cinchonidine, and quinidine show that, in all cases, 2 mols. of picric acid combine with 1 mol. of the alkaloid. These results were controlled by, and found to agree with, estimations of the picric acid in the alkaloid precipitates, the latter being heated with dilute sulphuric acid and the liberated picric acid precipitated by means of "nitron." For the various alkaloids, the factors by which the amounts of picric acid in the precipitates must be multiplied in order to arrive at the corresponding quantities of alkaloid are: for quinine and quinidine, 0.7075; and for cinchonine and cinchonidine, 0.6419. For the complex mixture of alkaloids in cinchona bark, the mean factor, 0.6738, gives approximately exact results. The method given in the Italian *Farmacopea Ufficiale* for estimating the alkaloids in cinchona bark, in which the residue of the chloroform extract, after distillation of the solvent, is weighed, gives results which, on the average, are 1.2 per cent. in excess of the true values.

Amount of Stalk in Tea. J. J. B. Deuss. (*Chem. Weekblad*, 1916, **13**, 66-71).

—In the Swiss Food Codex the permissible maximum of stalks in tea is fixed at 22 per cent. The estimation is made by Besson's method, in which 5 grms. of tea are boiled for fifteen minutes with 500 c.c. of water, and then transferred to a dish, covered with fresh water, and the stalks picked out with forceps. The leaves and stalks are dried separately at 105° C. and weighed. Besson thus obtained the following results: Green tea, 0.4 to 5.3; China tea, 4.1 to 17.5; Ceylon tea, 5.8 to 43.4; Indian tea, 11.5 to 37.4; and Java tea, 4.4 to 9.29 per cent. Samples examined by the author included: Japanese Oolong, choicest, 7.3; ditto, choice, 9.3; ditto, fine, 8.5; Uji, 3.6; Darjeeling, 28.3; Assam, 8.85; and Tonkin, 8.55 and 17.9 per cent. Java teas had a much higher proportion of stalks than Japanese tea. The

conclusion is drawn that it is justifiable to fix a maximum proportion, though not so stringent as in Switzerland, since this would exclude good qualities of Indian, Ceylon, and Java teas.

C. A. M.

Hyoscyamus Cultivated in Minnesota. E. L. Newcomb and M. H. Haynes. (*Amer. J. Pharm.*, 1916, **88**, 1-3.)—A satisfactory germination of the seed of *H. niger* (biennial) may be obtained by treating the seeds with concentrated sulphuric acid for two and a half minutes, after which they are well washed with water. Such treatment considerably shortens the time required for germination. It was observed that out of some five hundred of the biennial type under culture two specimens of *H. niger* developed as annual plants. The following table gives the results of the analyses, the material in all cases being first dried at a temperature of from 60° to 80° C.

Description of Sample.	Moisture per Cent.	Total Ash per Cent.	Total Alkaloid per Cent. U.S.P. (ix.) Method.
<i>Hyoscyamus niger</i> biennial, lamina only, first year	87.4	14.5	0.0896
<i>Hyoscyamus niger</i> biennial, petioles only, first year			
<i>Hyoscyamus niger</i> annual, flowering tops	85.06	11.5	0.1561
<i>Hyoscyamus pallidus</i> , flowering tops	84.8	12.33	0.1301
		11.09	0.1243

H. F. E. H.

Adsorption of Aqueous Solutions of Pepsin by Alumina. M. A. Rakuzin and E. M. Braudo. (*J. Russ. Phys.-Chem. Soc.*, 1915, **47**, 1055-1056; through *J. Chem. Soc.*, 1915, **108**, i. 1018-1019.)—Whereas trypsin is optically inactive and is not adsorbed from its solutions by alumina, pepsin exhibits the specific rotation $[\alpha]_D = +68.0^\circ$, and is adsorbed by alumina. From 100 grms. of a 5 per cent. aqueous pepsin solution (sp. gr. 1.0222 at 15° C.), 10 grms. of alumina adsorbs, in twenty-four hours at the ordinary temperature, 12.4 per cent. of the pepsin present, the fraction thus removed having $[\alpha]_D = +68.0^\circ$. If the liquid is then freed from alumina by centrifuging and treated with a second portion of alumina, both the concentration and optical rotation of the solution remain unchanged. Removal of the liquid by pressure from the alumina containing the adsorbed pepsin and treatment of the residue with water yield a neutral liquid which is proteolytically inactive, and leaves no solid residue on evaporation. Adsorption of pepsin from its aqueous solution by means of alumina is, therefore, an irreversible process.

Estimation of Urea in Urine by the Urease Method. C. H. Fiske. (*J. Biol. Chem.*, 1915, **23**, 455-458; through *J. Soc. Chem. Ind.*, 1916, **35**, 140.)—A

volume of urine containing 3 to 6.5 mgrms. of urea nitrogen is delivered from an Ostwald pipette into a large test-tube and diluted with water to about 3 c.c. Two drops of kerosene and 2 c.c. of urease extract are added, and the tube is closed by a rubber stopper fitted with tubes to enable a current of air to be drawn through the liquid, and left for fifteen minutes. Through the air inlet tube are then introduced 5 c.c. of a solution made by dissolving 500 grms. of potassium carbonate in 500 c.c. of warm water, adding 10 c.c. of 30 per cent. potassium oxalate, filtering and cooling. A current of air (free from ammonia) is drawn through the liquid slowly for five minutes and afterwards rapidly for an hour, and the ammonia is absorbed in 25 c.c. of $\frac{N}{50}$ hydrochloric acid contained in a narrow-necked bottle of 120 c.c. capacity. The excess of acid is titrated with $\frac{N}{100}$ sodium hydroxide solution, in presence of 2 to 3 drops of a 0.05 per cent. alcoholic solution of methyl red, until a pink colour appears. The urease is prepared by extracting 25 grms. of powdered soya beans for one hour with 250 c.c. of distilled water, shaking at intervals, adding 25 c.c. of $\frac{N}{10}$ hydrochloric acid, filtering with suction after five minutes, and treating the filtrate with 5 c.c. of a solution of 70 grms. of crystallised disodium phosphate and 27 grms. of mono-potassium phosphate in 100 c.c. of water. This extract can usually be kept for four weeks at -1° to -2° C. with only slight loss of activity and no marked increase of ammonia-content. The method is accurate to within 0.05 per cent. of the amount of urea determined.

ORGANIC ANALYSIS.

Detection of Acetone by Frommer's Test. N. O. Engfeldt. (*Berl. klin. Woch.*, 1915, 52; 458-459; through *J. Chem. Soc.*, 1915, 108, ii. 849-850.)—Frommer's test depends upon the condensation of acetone with salicylaldehyde in presence of alkali hydroxide to form the red di-*o*-hydroxy-distyryl ketone. Ten c.c. of the urine or other liquid to be tested are treated with 1 gm. of solid potassium hydroxide, and, without waiting for the alkali to dissolve, 10 drops of a 10 per cent. solution of salicylaldehyde in alcohol are added, and the mixture is heated to 70° C. If acetone is present, a purple-red zone appears at the junction of the two liquids. The test will detect 0.05 mgrm. of acetone in 10 c.c. of water, but the author finds that it may be rendered more sensitive and capable of detecting 0.001 mgrm. of acetone in 10 c.c. when modified as follows: Ten c.c. of the distillate from the urine are mixed with 5 grms. of solid potassium hydroxide and 5 drops of concentrated salicylaldehyde solution. The test-tube containing the mixture is placed in a water-bath at 50° C., and the water is heated gradually to boiling. As the potassium hydroxide dissolves, a crystalline mass is formed which, in the presence of acetone, is coloured bright-red. Formaldehyde, acetaldehyde, formic acid, lactic acid, phenols, and alcohol do not give the red coloration, but acetoacetic acid and β -hydroxy-butyric acid yield red-coloured compounds with the test. On account of its sensitiveness, the test is not suitable for clinical purposes.

Distribution Co-efficients and Velocity of Extraction of Certain Organic Acids. J. Pinnow. (*Zeitsch. anal. Chem.*, 1915, 54, 321-345.)—The distribution co-efficients between water and ether for acetic acid at 15° C., succinic acid at 15° ,

20°, and 25.5° C., citric, tartaric, lactic, and oxalic acids at 15°, 25.5°, and 27.5° C. have been determined by the author, who has also investigated the velocity of extraction of these acids from their aqueous solution by means of ether in the Parthiel-Rose apparatus (*cf.* ANALYST, 1902, 27, 103). The extraction practically follows the formula of monomolecular reactions; it is, within certain limits, inversely proportional to the volume of liquid extracted and also to the distribution co-efficient at 27° C. The distribution co-efficients at 27° C. are: Citric acid, 153; succinic acid, 7.58; malic acid, 70.9; lactic acid, 11.28; oxalic acid, 13.9. If the distribution co-efficients of the acids at 27° C. be divided by 0.04, the time (in minutes) required for the approximately complete (99 per cent.) extraction of the acids from 30 c.c. of solution is obtained. The addition of sulphuric acid up to one-sixth grm. molecule per litre is recommended in the case of oxalic acid solutions, and a small addition of sulphuric acid is also advantageous in the case of the other acids. W. P. S.

Analysis of Textiles. Pontio. (*Comptes. rend.*, 1916, 162, 81-83.)—The microscopical identification of textile fibres by the process established by Vetillard may be greatly facilitated by a preliminary chemical purification of the samples. Portions ranging from 1 to 3 grms. (the warp and weft being treated separately) are boiled with 150 c.c. of a 2 per cent. solution of caustic soda for fifteen minutes; the coloured liquid is poured off and replaced by a further quantity of the same alkali, with which the fibre is again boiled for fifteen minutes. After thorough washing, the fibre is heated with 25 c.c. of sodium hypochlorite solution (sp. gr. 1.007) diluted with 75 c.c. of water. The liquid is brought to the boil for exactly two minutes and then poured off. The fibre is treated with a dilute solution of sodium bisulphite for five minutes, then thoroughly washed with water. For the microscopic examination, a slight modification of Vetillard's staining reagent is desirable; in the original recipe the iodine was too weak and the sulphuric acid too strong. The modified reagent consists of two solutions: (A) Potassium iodide, 3 grms.; water, 100 grms.; resublimed iodine in excess. (B) Sulphuric acid (sp. gr. 1.767), 24 grms.; mixed with water, 16 grms.; then, after cooling, glycerol (sp. gr. 1.169), 16 grms. These reagents should be made up fresh every month. The fibres, having been pressed dry between blotting-paper, are steeped in a drop of the solution (A) on the microscope-slide. The iodine is allowed to act for two minutes and pressed out again with blotting-paper. The fibre is then mounted in a drop of solution (B). In the examination of several fields, the coloration, the shape and structure of the fibres, and of the woody fibres, the epidermal cells, the parenchyma, the woody vessels, etc., are carefully noted and photomicrographs are taken of representative fields, using autochrome plates. The magnifying power of the apparatus being known, the dimensions of the various elements may be measured on the photographs. The preliminary treatment above described in no way changes the structure of the fibres, while clearing out all the overlying impurities. The coloration with the iodine stain remains perfectly characteristic, the lignified portions still reacting in the normal way, and the structural details are made more distinct. The separation of the fibres from one another is greatly facilitated and compound filaments only remain in the case of a few highly lignified materials, such as jute. J. F. B.

INORGANIC ANALYSIS.

Volumetric Estimation of Cadmium and Zinc. H. Enell. (*Zeitsch. anal. Chem.*, 1915, **54**, 537-546.)—A method which yields approximately correct results depends on the reaction which takes place when cadmium sulphide is shaken for some time with an excess of iodine; $\text{CdS} + \text{I}_2 = \text{CdI}_2 + \text{S}$. The excess of iodine is then titrated and the quantity of cadmium calculated from the amount of iodine consumed. The method is unreliable. A better method is based on the reaction between cadmium sulphide and silver nitrate: $\text{CdS} + 2\text{AgNO}_3 = \text{Ag}_2\text{S} + \text{Cd}(\text{NO}_3)_2$. The cadmium sulphide, obtained by precipitation in the usual way, is washed with a warm 2 per cent. ammonium sulphate solution (to each 250 c.c. of which are added 20 drops of 10 per cent. sulphuric acid) until the wash water no longer gives a reaction with silver nitrate. The filter and precipitate are then transferred to a stoppered cylinder, and shaken with a mixture of 50 c.c. of water and 20 c.c., or more, of $\frac{N}{10}$ silver nitrate solution. Five c.c. of 25 per cent. nitric acid are now added, the mixture is again shaken for one minute, filtered, and the excess of silver is titrated in an aliquot portion of the filtrate. A similar method is recommended for the estimation of zinc. The zinc sulphide is obtained in a condition in which it is readily filtered and washed by rendering the zinc salt solution slightly ammoniacal, adding 2 c.c. of acetic acid, treating the solution with hydrogen sulphide, then heating the mixture on a water-bath for fifteen minutes, and adding 1 gram. of ammonium sulphate. The precipitate is washed with a warm 2 per cent. ammonium nitrate solution which has previously been rendered slightly ammoniacal and then acidified with acetic acid. The results yielded by the method are trustworthy, from 99.5 to 100.1 per cent. of the zinc present being obtained.

W. P. S.

Volumetric Estimation of Cerium by Means of Potassium Permanganate. V. Lenher and C. C. Meloche. (*J. Amer. Chem. Soc.*, 1916, **38**, 66-70.)—When cerium is titrated with permanganate, zinc oxide or magnesium oxide are the best neutralising agents. Fairly good results may also be obtained by using borax or sodium bicarbonate, whilst sodium carbonate is distinctly less satisfactory. The following reagents were also tried, but none were found suitable for the purpose: Sodium hydroxide, barium hydroxide, sodium acetate, sodium silicate, trisodium phosphate, disodium phosphate, sodium tungstate, and sodium arsenate. Under proper conditions the method serves for the accurate estimation of total cerium or of trivalent cerium in presence of tetravalent cerium.

G. C. J.

Rapid Estimation of Iron in Presence of Organic Substances. F. Ferrari. (*Annali Chim. Applic.*, 1915, **4**, 341-343.)—Iron is quantitatively precipitated by "cupferron" (the ammonium salt of nitrosophenylhydroxylamine) in the presence of tartrates, citrates, etc. The solution of the iron salt containing an excess of hydrochloric acid is oxidised with chlorine water, and treated, drop by drop with continual stirring, with a 6 per cent. solution of cupferron, until there is an excess of at least one-fifth of the quantity required to precipitate the iron. After standing for fifteen to twenty minutes the precipitate is separated, washed twice with cold water

acidulated with hydrochloric acid, then successively with water alone, ammonia solution, and water, and ignited, and the residue of ferric oxide weighed. The method is not applicable in the presence of copper, silver, lead, mercury, tin, bismuth, titanium, or zirconium, all of which form insoluble compounds with cupferron.

C. A. M.

Estimation of Nickel with Dimethylglyoxime. K. Wagemann. (*Ferrum*, 1915, 12, 126-129; through *Zeitsch. angew. Chem.*, 1915, 28, 590.)—The following procedure is recommended in order to render this method more rapid. The metal is precipitated with an aqueous dimethylglyoxime solution, the precipitate is collected, dissolved in dilute sulphuric acid, and the solution boiled after the addition of hydrochloric acid. The latter treatment serves to destroy the dimethylglyoxime. The solution is now rendered ammoniacal, and the nickel is deposited electrolytically, and weighed.

W. P. S.

Nitrogen, Chlorine, and Sulphates in Rain and Snow. B. Artis. (*Chem. News*, 1916, 113, 3.)—The work is a continuation of that by Knox (*Chem. News*, 1914, 111, 61), and covers the period from October, 1914, to June, 1915. Fifty-nine samples were investigated, of which 35 were of rain and 15 of snow, or 15.35 inches of rain and 37.75 inches of snow, equivalent in all to 18.49 inches of rain. The author considers 12 inches of snow as equivalent to 1 of rain, and 101 tons $5\frac{1}{2}$ cwt. as the weight of 1 inch of rain upon an acre. The chlorine was the most constant constituent in amount, showing 7.1 parts per million in 30 out of the 59 samples examined.

The following values were obtained as parts per million :

		Sulphate.	Chlorine.	Nitrogen as Free Ammonia.	Nitrogen as Albuminoid Ammonia.	Nitrate.
Rain (35 samples)	Highest	38.0	0.80	0.89	0.79	21.3
	Lowest	1.7	0.005	0.11	0.13	3.5
	Mean	18.0	0.3	0.25	0.23	8.7
Snow (15 samples)	Highest	34.0	0.4	0.47	0.59	14.0
	Lowest	5.0	0.02	0.13	0.12	7.0
	Mean	17.0	0.10	0.22	0.22	83.0

(*Cf. ANALYST*, 1914, 39, 190.)

H. F. E. H.

Perchlorate and Gravimetric Cobalti-nitrite Methods for Determination of Potash. T. D. Jarrell. (*J. Assoc. Offic. Agric. Chemists*, 1915, 1, 29-32.)—Experiments are described which support the opinion that the gravimetric cobalti-nitrite method must be greatly improved before it can be successfully used. In the experiments with the perchlorate method, the precipitate was washed first with a 0.5 per cent. solution of perchloric acid in 95 per cent. alcohol, and finally with 10 c.c. of

absolute alcohol. All the results were low, and this is attributed to the fact that the precipitate was partially redissolved whilst being washed. It is stated that if it were possible to find a "wash" in which potassium perchlorate is insoluble, results might perhaps be obtained which would compare favourably with those obtained by the platinum method.

G. C. J.

Note by Abstractor.—Such a "wash" is a saturated solution of potassium perchlorate in 95 per cent. alcohol (Davis, *ANALYST*, 1913, **38**, 47; Cumming and Thin, *ANALYST*, 1915, **40**, 296).

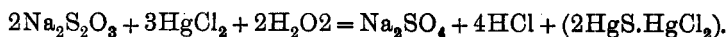
Qualitative Detection and Separation of Platinum, Arsenic, Gold, Selenium, Tellurium and Molybdenum. P. E. Browning. (*Chem. News*, 1915, **112**, 325.)—In the method of Noyes and Bray (*J. Amer. Chem. Soc.*, 1907, **29**, 137) compounds of gold, tellurium and selenium may, under certain conditions, be precipitated together with the arsenic, on adding magnesium chloride in ammoniacal solution immediately after the separation of the platinum. It is therefore advisable to modify the method as follows: The platinum is precipitated as platinichloride by evaporating the solution with a potassium salt. The filtrate is heated with oxalic acid or with hydrogen peroxide to precipitate the gold, and the filtrate from this evaporated nearly to dryness and treated with strong hydrochloric acid and sodium sulphite to remove the selenium. The filtrate is diluted and the tellurium precipitated by the addition of potassium iodide and sodium sulphite. On now evaporating the filtrate from the tellurium with bromine or nitric acid the arsenic and molybdenum are oxidised, and the arsenic may be precipitated by magnesian mixture. The filtrate from the arsenic is treated with zinc and potassium thiocyanate, which forms the red molybdenum thiocyanate.

C. A. M.

Titration of Thiosulphates in the Presence of Sulphides and the Estimation of Thiosulphates in the Presence of Sulphites, Bisulphites, and Sulphides. A. Sander. (*Chem. Zeit.*, 1915, **39**, 945-947.)—The different behaviour of alkali thiosulphates and sulphides towards mercuric chloride affords a means for their estimation when they are present in the same solution. If mercuric chloride is added to sodium sulphide solution, a black precipitate at first forms, which, on the addition of more mercuric chloride, changes to white mercuric sulphochloride:

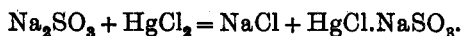


On the other hand, sodium thiosulphate reacts with mercuric chloride according to the equation:



For the estimation, an aliquot portion of the solution containing the two salts is titrated with $\frac{N}{10}$ iodine solution; another portion of the solution is then treated with an excess of mercuric chloride, ammonium chloride is added, and the mixture is titrated with $\frac{N}{10}$ sodium hydroxide solution, using methyl orange as indicator. The number of c.c. of the alkali solution used divided by 2 gives the quantity of $\frac{N}{10}$ iodine solution required for the thiosulphate, and the difference between the two titrations

corresponds with the iodine required for the sulphide. For the estimation of thiosulphate in the presence of sulphites a method described by Bosshard and Grob (*ANALYST*, 1913, 38, 297) may be employed. An alternative method described by the author for this purpose consists in titrating a portion of the solution containing the two salts with iodine solution; another portion of the solution is then treated with mercuric chloride and the acidity formed from the thiosulphate is titrated with alkali solution. The reaction between sulphites and mercuric chloride proceeds according to the equation:



Thiosulphate, sulphide, and sulphite, when present in the same solution, may be estimated as follows: A definite volume of the solution is added to an excess of $\frac{N}{10}$ iodine solution previously acidified with 10 c.c. of $\frac{N}{10}$ hydrochloric acid, and the excess of iodine is titrated with $\frac{N}{10}$ thiosulphate solution. Let the number of c.c. of iodine solution consumed be a . The same solution is then titrated with $\frac{N}{10}$ sodium hydroxide solution, using methyl orange as the indicator; after deducting the 10 c.c. of $\frac{N}{10}$ hydrochloric acid added previously, the remaining quantity of alkali solution used is equivalent to the amount of $\frac{N}{10}$ iodine solution (b) required for the sulphite. Another equal portion of the original solution is now treated with an excess of mercuric chloride, ammonium chloride is added, and the acidity of the mixture is titrated with $\frac{N}{10}$ alkali solution (c); the ammonium chloride is added to prevent precipitation of mercuric oxide by the alkali during the titration. Then, the amount of $\frac{N}{10}$ iodine solution used by the thiosulphate is $\frac{c}{2}$, by the sulphite, b , and by the sulphide, $a - (b + \frac{c}{2})$. A mixture consisting of $\text{Na}_2\text{S}_2\text{O}_3$, 0.2471 gm., Na_2SO_3 , 0.1249 gm., and Na_2S , 0.1207 gm., when analysed by the above method yielded $\text{Na}_2\text{S}_2\text{O}_3$, 0.2483 gm., Na_2SO_3 , 0.1261 gm., and Na_2S , 0.1201 gm. (See also *ANALYST*, 1914, 39, 279; 1915, 40, 254.)

W. P. S.

APPARATUS, ETC.

Sources of Error in Viscosity Measurement. E. C. Bingham, H. I. Schlesinger, and A. B. Coleman. (*J. Amer. Chem. Soc.*, 1916, 38, 27-41.) —The average pressure to be used in the calculation of a viscosity measurement is not strictly one-half the sum of the initial and final pressures as ordinarily assumed, and the use of this value may lead to considerable error. The method of calculating the correct value has been developed and tested experimentally. In the flow of a liquid through a capillary tube it is immaterial whether the capillary is in a horizontal or in a vertical position. When a liquid flows out from a capillary with a trumpet-shaped opening, there is a definite loss of kinetic energy, but whether this kinetic energy correction is the same as in the well-studied case of a capillary of uniform bore, is not proved. The capillaries should in consequence have ends as nearly right angles to the axis as possible, so that the kinetic energy correction may be calculated. It is also shown that the bulbs should be as short as possible. This is best accomplished by making each bulb approximate the shape of two cones placed base to base.

G. C. J.



REVIEW.

EXPERIMENTAL ORGANIC CHEMISTRY. By JAMES F. NORRIS, PH.D. Pp. vii + 215.
Price 5s. 2d. net. Publishers: McGraw-Hill Book Co. (Inc.), 239, West 39th
Street, New York, and 6, Bouverie Street, London, E.C. 1915.

Primarily intended as a laboratory guide in elementary experimental work for the student of organic chemistry, this little book goes far to justify the claims of its author. In many respects it shows originality in scope and treatment of the subjects dealt with, whilst at the same time it includes the greater number of the organic preparations with which the junior student is expected to be familiar. As the author has made no attempt to confine himself to the syllabus of any particular examination the ground covered is naturally wider than is usually the case in textbooks of a similar type.

The chapter on "Laboratory Methods" is quite a useful one, and the descriptions of apparatus employed and of the processes suggested for qualitative organic analysis are both clear and concise. In succeeding chapters the preparation and reactions of a great variety of organic substances are given, including both aliphatic and aromatic compounds. Most of the methods described are good, and contain all the essential detail of manipulation that the student would require to know. Due emphasis is laid on the important point, so often forgotten by the worker, that he should not be satisfied with merely obtaining a small specimen of each particular substance, but should ascertain the theoretical yield and how far the weight of his product falls short of this.

The concluding chapters contain the preparation of one or two dyes, together with somewhat brief accounts of pyridine compounds and a few proteins.

The book, as already mentioned, covers a rather wide range of subjects, and very probably the fact that the last few chapters will not be required in an elementary course justifies their brevity.

At any rate, the work as a whole is one that may very fairly be recommended for the purpose for which it is intended.

P. A. ELLIS RICHARDS.
