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THE ANALYST

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

ANNUAL GENERAL MEETING AND ORDINARY MEETING, HELD FEBRUARY 1, 1922.

THE Annual General Meeting of the Society was held at the Chemical Society's Rooms, Burlington House, W. 1. The president, Mr. Alfred Smetham, occupied the chair.

The minutes of the previous annual General Meeting were read and confirmed.

Messrs. E. M. Hawkins and W. Partridge were appointed scrutators of the ballot papers for the election of officers and Council for 1922.

The Hon. Treasurer presented the accounts of the Society for 1921, which were adopted, and votes of thanks were passed to the Hon. Treasurer and the Hon. Secretaries.

Messrs. Marreco, Houseman, and Brandon, chartered accountants, were appointed auditors of the Society's accounts for 1922.

The President delivered his Annual Address. Dr. J. A. Voelcker proposed that a hearty vote of thanks be accorded to the President for his address and for his services in the chair, and that his permission be asked to print the address in the ANALYST. This was seconded by Mr. F. H. Carr, and the motion was carried.

The scrutators having reported the result of their examination of the ballot papers, the President announced that the officers and Council for 1922 had been elected in accordance with the Council's nominations, as follows:—

President.—P. A. Ellis Richards, 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., A. Chaston Chapman, F.I.C., F.R.S., Bernard Dyer, D.Sc., F.I.C., Otto Hehner, F.I.C., Samuel Rideal, D.Sc., F.I.C., A. Smetham, F.I.C., E. W. Voelcker, A.R.S.M., F.I.C., and J. Augustus Voelcker, M.A., Ph.D., F.I.C.

Vice-Presidents.—F. W. F. Arnaud, F.I.C., C. A. Keane, D.Sc., F.I.C., G. W. Monier-Williams, O.B.E., M.C., M.A., Ph.D., F.I.C.

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

Hon. Secretary.—E. Richards Bolton, F.I.C.

Hon. Assistant Secretary.—R. G. Pelly, F.I.C.

Other Members of Council.—S. F. Burford, F.I.C., B. A. Burrell, F.I.C., R. L. Collett, M.A., F.I.C., C. H. Cribb, B.Sc., F.I.C., B. S. Evans, M.B.E., M.C., B.Sc., F.I.C., Norman Evers, B.Sc., F.I.C., H. Heap, M.Sc., F.I.C., J. H. B. Jenkins, F.I.C., A. More, A.R.C.Sc., F.I.C., Raymond Ross, B.Sc., F.I.C., W. R. Schoeller, Ph.D., A.I.C., and C. J. H. Stock, B.Sc., F.I.C.

An Ordinary Meeting followed the Annual Meeting, the newly-elected President, Mr. P. A. Ellis Richards, F.I.C., being in the chair.

Certificates were read for the first time in favour of:—As an Honorary Member: Sir R. Robertson, K.B.E., F.R.S. As Ordinary Members: Messrs. Reginald Thomas Colgate, D.Sc. (Lond.), F.I.C.; Harold James Foster; Frederick Norman Appleyard, A.I.C.; Hammersley David George Holt, B.A. (Cantab); Shozaemon Keimatsu; and James Miller, F.I.C.

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

The following were elected Members of the Society:—Messrs. Jack Cecil Drummond, D.Sc. (Lond.), F.I.C.; Alfred William Long; John Charles Mellersh; Charles Harold Wright, M.A. (Cantab), F.I.C.

The following paper was read:—"The Quantitative Separation of Nitro-body Mixtures from Nitro-glycerin," by William Dickson, F.I.C., and W.C. Easterbrook.

A demonstration of a universal indicator for the rapid and approximate determination of hydrogen ion concentration was made by Mr. Francis H. Carr.

Obituary.

CHARLES EDWARD CASSAL.

ALTHOUGH not a member of this Society at the time of his death, Col. Cassal for many years took a very prominent part in its proceedings. He was Vice-President during the years 1893, 1894, 1899 and 1900, Secretary during 1897 and 1898, and served for three periods on the Council.

He was the eldest son of Professor H. S. Cassal, LL.D., of University College, London, and was born in London in 1858.

Educated at University College School, where he had as contemporaries Professor Percy Frankland and Dr. Teed, he carried off many prizes. He was originally intended for the sea, but eventually began a less adventurous career by entering University College, where he studied Chemistry under Williamson and Graham, obtained various medals for Chemistry, and took honours in the Preliminary Science Examination of the University of London; but circumstances prevented him from proceeding to the degree.

In 1879 he was appointed Demonstrator of Hygiene and Public Health under Professor Corfield, and this, no doubt, turned his attention to that branch of Chemistry which ultimately became his life's work.

In 1884 he passed the Associateship examination of the Institute of Chemistry, at a time when he could easily have obtained admission without that ordeal.

His first appointment as Public Analyst was for Chepping Wycombe in 1884. He gained the Kensington appointment at the end of the same year, that for St. George's, Hanover Square (afterwards merged into the City of Westminster) in 1886, that for Battersea in 1888, and two years later the county appointments for two of the "parts" of Lincolnshire, Kesteven and Holland.

During his student days, and for some time after, he was assiduous in cultivating the art of public speaking, and his great natural gifts in this direction were fostered and developed by the prominent part he took in the proceedings of the University College Debating and the Belsize Societies and the North London Parliament, in all of which he attained high office. Before the demands of a large practice became too insistent he did much popular lecturing on scientific subjects. The experience he thus gained stood him in good stead all through his life, and enabled him to establish excellent relations with the authorities he served. He was remarkably successful in inducing them to realise the importance of the work of the Public Analyst, and to recognise that, as a professional man, he was worthy of adequate remuneration. He was always jealous of his professional reputation, and was probably unique in having issued a writ against, and exacted a public apology from, a Councillor for remarks made in committee reflecting on his work. Beyond this, however, by sheer force of character, and by his clear and vigorous speeches, he did much to bring about the better administration of the Sale of Food and Drugs Acts. He was largely influential in starting the campaign against the use of preservatives in foods, and gave important evidence before various Parliamentary and Departmental Committees on that and allied subjects.

His readiness in debate brought him early into prominence in the various scientific societies to which he belonged.

While he was keenly interested in the scientific problems connected with his work, his natural bent really lay in other directions. As soon as he became established in analytical practice he realised the ambiguous position occupied by the profession in those days, and took a leading part in the movements for raising its status. He was a, if not the, prime mover in one which culminated in what was afterwards described by one of the journals as "A Hot Night at the Chemical Society," during which, before a packed meeting, a fierce battle took place over the lax methods of admitting new members which then prevailed, and the slashing attack he made on the existing system and all who upheld it did much to decide the issue.

At the Institute of Chemistry, of which he became a Censor, and on the Council of which he served for no less than six periods, his great ability as a fighter found ample scope, and he did much to mould the policy of the Institute with regard to matters of professional conduct, as well as with regard to the elevation of the profession as a whole. His views on these matters, frequently in advance of the times, were expressed with a vigour and fearlessness which earned the respect of all. It is only a testimonial to the power of his influence to mention that he sometimes led the Council into paths which it was afterwards loth to follow, and disappointment with this had, no doubt, much to do with his taking a chief part in the formation of the "Institute of Chemical Technologists," of which he was the first President. Aware, as he was, of the difficulties that would beset the path of the new body, he led it, perhaps as a forlorn hope, with characteristic courage and energy.

His work took him much into the Law Courts, where he figured in many important cases, and, as would be expected, he was a most excellent expert witness. The air of conviction with which he gave his evidence, and his adroitness and readiness in reply to awkward questions, made him much more formidable than many who were equipped with greater knowledge of the point at issue. While he read but few papers before this Society, he was nevertheless almost as active with the pen as with his tongue. In his earlier days he was a constant contributor to the *British Medical Journal,* to which he acted as advisor on matters of chemical interest, and he was one of the first to issue lengthy annual reports on the work done for the authorities appointing him. In 1899 he founded the *British Food Journal,* of which he was editor for 15 years.

Of his other activities it is unnecessary to write at any length in this Journal. They have been admirably and fully set forth in the *British Food Journal* by his son, Mr. Noel Cassal. It will be sufficient to say that he was a keen volunteer from his youth, worked his way up to the rank of Lieutenant-Colonel, and was only precluded by the age limit from being accepted for active service during the war. Further evidence of his ability as an organiser lies in the fact that after having commanded for six years a battalion of Engineers, he undertook the difficult task of transforming it into a brigade of heavy artillery, one of the most highly specialised branches of the service.

In Freemasonry he attained the highest honours, and it was obvious to those who knew him that he did not enter into it as a hobby or amusement, but that its tenets formed a guiding principle of his life.

His kindness to the younger members of his profession will be long remembered by many who have benefited by his advice as well as by the influence he was able to exert on their behalf.

Great as were his gifts as a speaker, he was a man of action, and a strenuous worker too, and his sincerity, his forceful character, and his strong convictions, tempered by a delightful and characteristic sense of humour, marked him out as a leader of men, and enabled him to achieve a high, and in some ways unique, position in the profession he was fated to adopt. It is only to be regretted that it was not one in which his peculiar and outstanding abilities could find their fullest scope.

CECIL H. CRIBB.

Annual Address of the Retiring President.

(*Delivered at the Annual General Meeting, February* 1, 1922.)

WITH the present meeting another official year of the Society of Public Analysts and other Analytical Chemists and my Office as President of the Society terminate, and we now enter on what promises to be a resumption of the full activities of the Society. The War with all its troubles and trials and the post-war difficulties and disappointments have had their effect upon the initiative work of the Society at large, and the individual incentive of our more promising members in the prosecution of research; but notwithstanding these disabilities, the record of the last year's output of work by the Society is a good one and at least shows that within the ranks of the Society there are members who have done, and those who promise to do, work in connection with analytical chemistry which is not unworthy of the traditions of the Society, and which will compare favourably with the investigations of other kindred Societies and foreign nations.

That the interest in our Society has not waned is indicated by the fact that during the past year the membership of the Society has increased by seven members, and has now reached a total of 461.

The following are the official figures taken from the books of the Society:—Total number of members to December 31st, 1921 (including 10 Honorary Members), 461; New members, 19; deaths, 7; resignations, 4; removal for non-payment of subscription, 2.

Unfortunately death has removed some of those best known to us and some of the most indefatigable workers among our members, and we deplore their loss exceedingly.

The names of the deceased members are as follows:—William Odling, Edward John Bevan, Soren Hoy Blichfeldt, A. Wynter Blyth, Bertram Blount, and Sir Charles Cameron.

William Odling, M.A., M.B., F.R.S., died on February 17th, 1921, in his 92nd year. He studied chemistry under Hofmann at the Royal College of Chemistry, and medicine at Guy's Hospital, graduating as M.B. (London) in 1851. His career from that time up till 1891 was a brilliant one, and embraced many activities and investigations of the utmost importance in the advancement of Chemical Science.

In 1872 he succeeded Sir Benjamin Brodie as Waynflete Professor of Chemistry at Oxford University, which position he retained until his retirement in 1912.

Edward John Bevan, our old and valued friend, was Hon. Secretary of the Society from 1894 until 1904, and was President for the years 1905-06. He died suddenly at a nursing home in London on October 17th, in his 65th year. Although his work was very varied, and included a wide experience in Food and Drug Analysis as Public Analyst for the County of Middlesex, his name will probably be handed down to posterity by his classical researches, in conjunction with

Mr. C. F. Cross, into the chemistry of cellulose, and its various industrial applications.

Soren Hoy Blichfeldt was born in Denmark, and died after a short illness, at the early age of 44. He worked for several years on questions connected with the application of pure cultures in brewing and dairying in the Fermentation Laboratories of Jörgensen in Copenhagen, and subsequently joined the staff of the Maypole Margarine Works, where he stayed until his death.

Alexander Wynter Blyth, who died on April 1st, in his 77th year, was trained in chemistry and medicine at King's College, London, and qualified as M.R.C.S. (Eng.) in 1870. After practising medicine for several years, he was appointed Public Analyst for the County of Devon and other places, and subsequently went to London to take up the duties of Medical Officer of Health and Public Analyst for the borough of South Marylebone.

Associated with our Society from its inception, he took an active part in its formation, and was Vice-President three times. He frequently contributed papers to the Society, and was the author of two well-known books, "Foods" and "Poisons."

Bertram Blount died in April 9th, in his 55th year. He was educated at King's College, under Professor Bloxam, where he was Daniell Scholar in 1885. Early in his career he was associated with the late W. H. Stanger, and paid much attention to the chemistry and testing of cement, upon which subject he delivered two lectures before the Institute of Chemistry. About 1888 he was appointed Chemist to the Crown Agents for the Colonies.

Sir Charles Alexander Cameron was born in Dublin, where he was educated in medicine and chemistry, taking the latter subject with Dr. Aldridge, and died on February 27th, 1921, in his 91st year. He was appointed Medical Officer of Health in 1880, and was Public Analyst for that city and for many other counties and cities in Ireland.

He was a Past President of our Society, having presided over it in the years 1893–1894, and in 1885 was knighted for his services in the cause of public health.

One of the best raconteurs it has been my fortune to meet, he was the life and soul of a country meeting of the Society in Derbyshire during his Presidency.

During the year there has passed from our midst a very old, highly-esteemed and much beloved friend, John Hughes.

Although, just before his death, he had resigned the membership of the Society, he had been for many years a familiar figure at our meetings, and took much interest in the proceedings of the Society. He was trained at the Royal Agricultural College, Cirencester, under the late Dr. Augustus Voelcker, and was assistant to him in London until 1872. He subsequently was chemist to Lawes Chemical Works, and visited Ceylon on behalf of the Coffee Planters, and issued a very valuable report on his investigations.

On his return he commenced a consulting and analytical practice in London, which he carried on actively almost to the time of his death, which occurred on June 5th last, at the age of 77.

We also have to mourn the loss of Francis William Passmore, an obituary notice of whom will appear in a forthcoming number of the ANALYST.

During the Session the number of papers read at the meetings was 24, and 29 papers and 19 notes were published in the ANALYST. These figures compare favourably with those of the previous year, and an examination of the pages of the Journal shows that both in quality and quantity the high standard of previous years has been well maintained. The following is a list of the papers which have appeared in the pages of the ANALYST during the year 1921:—

"Reactions of Sugars and Polyatomic Alcohols in Boric Acid and Borate Solutions, with some analytical applications." By G. van B. Gilmour.
"The estimation of Theobromine in Cocoa and its products." By Raymond V. Wadsworth.
"A new Process for the estimation of small quantities of Chromium in Steels." By B. S. Evans.
"Notes on the Reactions of Fulminate of Mercury with Sodium Thiosulphate." By F. H. Dupré and P. V. Dupré.
"The Time Factor in Saponification." By Percival J. Fryer.
"Iodimetric Determination of the Diastatic Power of Malts." By Julian L. Baker and Henry F. Everard Hulton.
"Composition of the Harrogate Mineral Waters." By William Lowson.
"The Acidity of Ink and the Influence of Bottle Glass upon Ink." By C. Ainsworth Mitchell.
"Liquid Extract of Red Squill (*Scilla maritima*) as a Rat Poison." By F. W. Smith.
"Apparatus for the Routine Determination of Melting Points of Fats and Fatty Acids." By S. H. Blichfeldt and T. Thornley.
"The Detection of Adulteration in Butter by Means of the Melting Point of the Insoluble Volatile Acids." By George van B. Gilmour.
"The estimation of Strychnine in Scale Preparations containing Quinine and other Cinchona Alkaloids." By T. F. Harvey and S. Back.
"A Colour Reaction for Aconite." By S. Mallanneh.
"A Method for the Determination of the Acidity of Coloured Solutions." By J. L. Lizius.
"Detection and Estimation of Illipé Butter used as Substitute for Cacao Butter." By Francis G. H. Tate and John W. Pooley.
"A Note on the 'Oil' of Oats." By Ernest Paul.
"Notes on the so-called Action of Water on Lead." By John C. Thresh.
"The Composition of Egg Powder." By F. F. Beach, F. E. Needs and Edward Russell.
"Notes on the Measurement of Hydrogen Ion Concentration." By G. W. Monier-Williams.
"A further contribution to the study of South American Oilseeds." By G. T. Bray and H. T. Islip.
"Estimation of Potassium in presence of Sodium, Magnesium, Sulphates and Phosphates." By H. Atkinson.
"The Joint Use of two Indicators in the Titration of Acids and Bases." By J. L. Lizius.
"Spectrometric examination of certain fixed Oils as a means of Identification." By Hermann C. T. Gardner.

"The Separation of Aluminium from Beryllium," Parts I. and II. By Hubert T. S. Britton.
"The Colorimetric Method of determining Hydrogen Ion Concentration; some applications in the Analytical Laboratory." By Norman Evers.
"Gemsbok Beans" (*Bauhinia esculenta*, Burch). By G. T. Bray.
"Sugar Calculations." By J. F. Liverseege.
"Morphine, Codeine and Narcotine in Indian Opium." By Jitendra Nath Rakshit.

In addition to the papers given in the foregoing list, a very welcome and instructive paper on "Vitamins" was read by Drs. Drummond and Watson, which was a source of much interest to our members, and will find a wider appreciation when it appears, as it will shortly do, in the ANALYST.

In addition to the large quantity of work done, as indicated in the long list of papers read before the Society, and contributions made to the Journal, it is interesting to note that, under the able Editorship of Mr. C. Ainsworth Mitchell, THE ANALYST is resuming very nearly its pre-war volume. The number of pages for 1921 is 530, as against 468 in 1920, and 576 in 1914.

There have been 648 Abstracts published, covering every branch of Analytical Chemistry.

Members of the Society and other chemists have continued to avail themselves of the columns of the ANALYST for the publication of short, but interesting, notes, not of sufficient length to be read at our meetings.

A new feature introduced during the year has been the publication of notes from the Reports of Public Analysts, which have been of great service to Public Analysts generally, by enabling them to compare their own practice with that of other Public Analysts in other parts of the country. Seven such reports were published during the year.

In addition to all the activities already enumerated, there has been a great increase in the number of books which have been reviewed in the pages of the ANALYST, viz., 72 as against 32 the previous year. The reviews have been in every instance carefully considered, and have been not merely instructive, but have enabled the reader to decide whether a book on a subject he is specially interested in is of sufficient merit to add to his bookshelves.

During the year, as indeed throughout the whole period of its existence, the co-operation of the Society of Public Analysts with the Institute of Chemistry has been of the most cordial description, and, although the functions of these bodies are by no means identical, their interests are co-related. While our own Society concerns itself with the advancement of Analytical Chemistry, there are many questions of policy which have a more direct bearing on the public and practising analysts, in contradistinction to the main body of chemists comprised in the Institute of Chemistry; and, while not usurping the functions of the Institute, it is right and proper that such matters should come under the survey of your Council.

Although the results of the deliberations at the Council Meetings are not as a rule made public at our meetings, or in the pages of the ANALYST, the interests of our members have been sedulously guarded throughout the period under survey. It has been suggested that a closer working agreement between our Society and the

Institute should be considered, but, as the interests of the two bodies are not identical in many respects, it seems to me that the policy pursued in the past is the most useful, and that the cordial relations hitherto existing will be best maintained by limiting the co-operation to those points which we have in common.

In this respect, I may, perhaps, remark that there never was a time at which such co-operation was more needed than now. Public Analysts and other Analytical Chemists in active practice are very much in the public eye, more so, perhaps, than chemists employed in industrial pursuits or engaged in chemical work of other descriptions; and it, therefore, behoves us to guard very jealously the honour of our profession, and to avoid, as far as may be, any conflicts of opinion or results.

I am happy to think that the members of our Society have been exceptionally correct in this respect, but it occurs to me that, with a little more mutual confidence, some of the differences which are almost inevitable at times might be avoided by a freer discussion of methods employed, or of the deductions to be drawn from given results.

Since I addressed you a year ago a conference of Fellows and Associates of the Institute of Chemistry has been held to discuss the question of the desirability of the members adopting a uniform practice with regard to the style, the character of type used, and the particulars given in the entries of their names in directories, diaries and similar publications. At the meeting the matter was very fully discussed, and the consensus of opinion was clearly:—(1) "That in the opinion of the Conference it is desirable that Fellows and Associates should adopt a uniform practice with respect to the style, the character of type used, and the particulars given in the entries of their names in published directories, and that departure from this practice should be considered as unprofessional conduct within the meaning of the Charter;" and (2) "That the insertion of names of Fellows or Associates in publications such as diaries, pocket books, guide books, and timetables constitutes an advertisement, and is therefore held to be discreditable."

At a subsequent meeting, acting on the advice of Counsel, it was proposed to "defer immediate action in the matter, since it would be reasonable that members should be allowed time to comply with the resolution passed by the Conference."

Doubtless our members who, like myself and most of the Liverpool practtitioners, at the instigation of importunate Directory canvassers have been induced to have their names entered in the Directory in black type, will comply with the resolutions of the Conference, and reduce their entries to the ordinary type adopted by medical and other professional practitioners.

Probably in no other profession outside that of Analytical Chemistry have so many diversified and complicated problems to be solved as fall to the lot of the professional analyst, and in the solving of these problems it is imperative that the subject should be investigated from every point of view, and that, so far as may be, an unbiassed report returned. The public, who read the reports of law-cases in the papers, or come into closer touch with practitioners in law suits or commercial transactions, are apt to judge chemists generally by the conduct of those with whom they come into contact, and it therefore behoves us to be wary in the way we act, not merely on our own account, but on account of the profession at large. I am happy to think that the members of our Society have almost invariably set themselves high ideals, and have done their work in a most commendable manner.

During the year a matter of considerable importance to Public Analysts has been raised. In a memorandum of the Ministry of Health the Ministry was informed that Public Analysts took exception to the encouragement of "rough sorting methods" in dealing with informal or test samples taken in connection with the administration of the Sale of Foods and Drugs Acts, and especially to the suggestion that the "sorting" should be entrusted to "some other person" other than the Public Analyst. As "some other person" might be a scavenger or an office boy in the Scavenger's Department, it is evident that by the employment of such incompetent person much injury might be inflicted on the public. The "rough sorting" methods might detect the grosser kinds of adulteration, but the more subtle and scientific forms would go undetected, and, in my opinion, it is imperative that in the interests of traders and the public generally, such crude methods should be discouraged.

A point of interest to Public Analysts and others has been discussed by your Council and by the Institute of Chemistry. Public Analysts have complained that they do not receive copies of memoranda and regulations issued by the Ministry of Health. The practice has been for the Ministry to send these communications to the Clerks of the local authorities, with the result that, in many cases, these notices are not forwarded to the Public Analysts and Medical Officers. As the result of these discussions, the Ministry has been asked to send copies of all memoranda relating to Public Analysts to the Institute of Chemistry for notification in its Journal, and to our Society for publication in the ANALYST. If this is done in the future, it will add materially to the usefulness of the Journal.

During the year correspondence has taken place between the Institute and the Society and the Ministry of Food and the Board of Trade with regard to the proposal to introduce a new Food Bill, and the Councils of the Institute and of our Society have notified the Ministry of Health that they are anxious to afford the Government every assistance in their power when such a measure is in contemplation. In the meantime a joint committee of the Institute and our Society are taking steps to collect from Public Analysts and others information which may have a useful bearing on such legislation.

The turn which Irish politics have taken, and the pressure of legislative work in other directions, render it improbable that any Bill will be introduced in the near future, but it is important that all facts bearing on the subject should be kept up to date so as to be in readiness when required.

In this respect I wish to remind my hearers that among the information required it is desirable to put on record any glaring examples of mis-description of food, and particulars of any difficulties experienced owing to lack of standards and definitions of food products.

If the Irish Free State materialises, as there is now every prospect that it will, the position of Public Analysts in Southern Ireland may be gravely affected, but it is to be hoped that the administrative body set up to carry out the Sale of Food and Drugs Act, or such other Act as may replace it, will have a proper sense of its responsibilities, and be alive to the fact that a Public Analyst is a highly trained man, and, as such, should receive proper remuneration.

Another point which has claimed your Council's attention is a report of the Committee appointed by the Home Secretary to advise on the Draft Regulations under the Dangerous Drugs Act, 1920. The chief object of the Act is to restrict the sale and use of morphine and other drugs, and, with this end in view, Regulations have been drawn up indicating the persons who may, or may not, be in possession of the specified drugs. Under Regulation 11 a Public Analyst, *inter alios*, is authorised, as far as it is necessary for the practice of his profession, to be in possession of a supply of the drug.

The Councils of the Institute of Chemistry and of the Society of Public Analysts have been informed that the Secretary of State will be prepared to consider any applications for licences under the Act from Fellows and Associates of the Institute, other than Public Analysts, who show to his satisfaction that the drugs are needed by them for carrying out investigations in the course of their professional practice.

Another point on which your Council has been actively engaged during the past year has been the Standardisation of Scientific Glassware. In addition to delegates from the Institute of Chemistry and a number of learned Societies, the Society of Public Analysts sent representatives to a conference on the subject convened by the Director of the National Physical Laboratory on October 29th

The conference proceeded to discuss the desirability of providing two grades of glassware, one of the highest possible quality suitable for the most accurate work, and a second quality sufficiently reliable for use in ordinary commercial operations and suitable for use by students in Universities, Colleges, and Schools.

Such a course strikes me as being eminently practicable. It is useless to insist on a graduation of a burette or other piece of apparatus, to a degree of accuracy which far exceeds the normal limits of error, inevitable in almost all the separations in chemical analysis.

In a busy laboratory, where breakages are not unknown, the cost of the higher grade glassware would be no inconsiderable tax upon the working expenses, without any sufficient advantages.

At the termination of the Conference a permanent Committee was appointed, and it is to be hoped that, as a result of their deliberations, much good will result.

Finally I have to thank Mr. P. A. Ellis Richards, whom I am pleased to greet as our new President, and Mr. E. R. Bolton, our other Hon. Secretary, for their courtesy and many kindnesses they have shown me during my term of office.

Also my grateful thanks are due to Mr. C. Ainsworth Mitchell for the help he has given me in preparing this address, and to the members generally for the indulgence they have shown during the year just ended.

The Quantitative Separation of Nitro-body Mixtures from Nitroglycerin.

BY WILLIAM DICKSON, F.I.C., AND W. C. EASTERBROOK.

(*Read at the Meeting, February* 1, 1922.)

IN the process of explosives' analysis it is frequently necessary to separate nitro-body mixtures from nitroglycerin, as these substances are taken out together in the ether extract.

As stated by Snelling and Storm in their booklet on the *Analysis of Black Powder and Dynamite*, published by the U.S. Bureau of Standards, p. 62, there is no satisfactory method generally available for the purpose indicated. The analysis of such mixtures is usually made by estimating the nitroglycerin by means of the nitrometer and finding the amount of nitro-body mixture by difference. An approximate estimation of the nitro-body can also be made by destruction of the nitroglycerin by treatment with a hydrochloric acid solution of ferrous chloride by heating on the water bath, and recovery of the nitro-body by extraction with ether.

During the progress of work involving the titration of nitroglycerin by means of ferrous sulphate, according to the well-known method for the titration of nitric acid (Bowman and Scott, *J. Ind. Eng. Chem.*, 1915, **7**, 766; *Chem. News*, 1916, **114,** 2957; Scott's *Text-Book of Analysis*), it was considered that if this method were applied to a mixture of nitroglycerin and nitro-body, the nitro-body could be recovered from the reaction mixture by extraction with ether. It was thought that probably the results would be too high, owing to a further nitration of the nitro-body during the destruction of the nitroglycerin. Such was, indeed, found to be the case, particularly with mononitrotoluene. A commercial mixture of dinitrotoluene, trinitrotoluene and dinitrobenzene did not appear to be so sensitive to the nitrating action. The first experiments with such a mixture gave excellent results, but it was considered that, as the nitro-body was more or less impure, the results might be due to a compensation of errors—further nitration on the one hand, and loss of impurity by the action of strong sulphuric acid on the other.

In subsequent experiments, therefore, the nitro-body mixture was first purified by dissolving a quantity in concentrated sulphuric acid, and pouring the solution into water. The dilute solution was then extracted with ether, the ethereal solution dried over calcium chloride and distilled, and the residue dried to constant weight *in vacuo*.

In the experiments with mononitrotoluene it was evident that nitration to dinitrotoluene was taking place.

Information was received privately from the United States that methyl alcohol was added to reaction mixtures in which nitroglycerin was being destroyed, for the purpose of preventing further nitration of the nitro-body. Varying quantities of methyl alcohol were therefore added, in order that this substance might be acted on by the nitric acid liberated from the nitroglycerin in preference to the nitro-body. Very satisfactory results were obtained in this way. The following table shows the results obtained up to this stage of the investigation:—

TABLE 1.

Estimation of Nitro-body in presence of Nitroglycerin in Synthetic Mixtures of the two by treatment with ferrous sulphate and recovery of the Nitro-body by extraction with ether. Nitroglycerine present ·8—1·4 grams.

	Nitro-body Taken Grm.	Nitro-body Found Grm.
Commercial nitro-body mixture. (before purification)	0·332	0·336
,, ,,	0·478	0·472
Mononitrotoluene (distilled).	0·31 (calculated to D.N.T. 0·412 grm.)	0·412
,, ,, ,,	0·253 (calculated to D.N.T. 0·340 grm.)	0·338
Mononitrotoluene (distilled) reaction conducted in presence of 20 c.c. methyl alcohol.	0·1233	0·145 Partially solid, showing presence of D.N.T.
,, ,, ,,	0·2024	0·193 liquid.
Mononitrotoluene (distilled) reaction conducted in presence of 40 c.c. methyl alcohol.	0·199	0·205
,, ,, ,,	0·161	0·167
Commercial nitro-body mixture after purification. Reaction conducted in presence of 40 c.c. methyl alcohol.	0·238	0·238
	0·486	0·482
	0·314	0·307
	0·162	0·161

The results given in the above table represent various ratios of nitroglycerin to nitro-body, and it is evident that the results are independent of this ratio. This is not the case when the determination is carried out by means of the nitrometer. It will be seen that, while it is necessary to have 40 c.c. of methyl alcohol present during the reaction in the case of mononitrotoluene, it is not so clear that this is necessary in the case of commercial nitro-body mixture, which is probably less easily nitrated. As the manipulation with 40 c.c. of methyl alcohol is more tedious than with 20 c.c., owing to the heat generated on the addition of sulphuric acid (it being necessary to keep the temperature of the reaction mixture below 20° C.

to avoid possible further nitration), it was decided to carry out a series of experiments using 20 c.c. of methyl alcohol. Table 2 shows the results obtained:—

TABLE 2.

Estimation of commercial Nitro-body Mixture in presence of Nitroglycerin by means of Ferrous Sulphate. Synthetic Mixtures.

	Commercial Nitro-body Mixture Taken Grm.	Nitro-body Found Grm.
Reaction conducted in presence of 20 c.c. methyl alcohol.	0·408	0·406
	0·097	0·101
	0·133	0·137

These results having proved satisfactory, and the first result in Table 1 also being satisfactory, it was thought that, perhaps, with the commercial nitro-body mixture, methyl alcohol might be unnecessary. Table 3 shows the results obtained:—

TABLE 3.

Estimation of commercial Nitro-body Mixture in presence of Nitroglycerin by means of Ferrous Sulphate.

	Commercial Nitro-body Mixture Taken Grm.	Nitro-body Found Grm.	
Reaction conducted in absence of methyl alcohol.	0·094	0·1650	Partly solid.
	0·065	0·1138	
,, ,, ,,	0·063	0·150	Completely solid.
,, ,, ,,	0·066	0·148	

High results and solidification showed that further nitration was taking place, and that therefore methyl alcohol was necessary.

The question of the drying of the residue of nitro-body after the evaporation of the ether was rather difficult. Occasionally, high results were obtained which could not be attributed to further nitration of the nitro-body. At other times, low results were obtained after prolonged drying, and this was attributed to volatilisation of the nitro-body *in vacuo*. In the first place it was considered that thorough drying of the ethereal solution over calcium chloride was most necessary, because, otherwise, when the ether evaporated off, it left an emulsion of nitro-body and water, which took a very long time to dry *in vacuo*, and the substance could never be said to attain constant weight. Drying at ordinary pressure over sulphuric acid was satisfactory, but very slow; some residues took as long as 90 hours to become constant in weight.

In order to determine the best conditions for drying nitro-body residues, weighed quantities of the purified nitro-body were dissolved in ether, and the ether was removed in different ways:—

(1) Spontaneous evaporation of the ether, after thorough drying of the ethereal solution over calcium chloride, and drying the residue, either over sulphuric acid

at ordinary pressures for a prolonged period or *in vacuo* for 24 hours. This method showed a loss of less than 0·5 per cent.

(2) The ether was evaporated off quickly over a water bath, and the residue dried on the bath, either with or without the addition of a little alcohol. Losses by this method amounted to 1 to 2 per cent. Spontaneous evaporation of the ether and drying *in vacuo* over sulphuric acid was therefore adopted. The following table shows the results obtained:—

TABLE 4.

Separation of commercial Nitro-body from admixture with Nitroglycerin by the Ferrous Sulphate method.

Series	Nitro-body Taken Grm.	Nitro-body Found Grm.	Remarks
1.	0·0948	0·0932	Ether evaporated off in presence of $CaCl_2$. Residue dried at atmospheric pressure.
	0·1408	0·1400	
	0·1090	0·1066	
	0·1668	0·1726	
2.	0·1706	0·1600	Ether solution not dried sufficiently over $CaCl_2$. Residue dried *in vacuo.*
	0·1614	0·1502	
3.	0·1276	0·1272	Ethereal solution dried over $CaCl_2$ for 24 hours. Evaporated spontaneously and dried *in vacuo* for 24 hours.
	0·1354	0·1354	
	0·1424	0·1476	
	0·1927	0·1899	
	0·1312	0·1313	
	0·2363	0·2437	
	0·1988	0·2021	
	0·1751	0·1705	
	0·1944	0·1957	
	0·2530	0·2507	
	0·2722	0·2664	
	0·2592	0·2623	

It will be seen that in series 3, where the conditions of drying were satisfactory, the results are all within 3 per cent. of the truth. This degree of accuracy is perfectly satisfactory from the point of view of the examination of explosives for manufacturing control, where the nitro-body does not usually amount to more than one or two per cent.

Experience gained in the recovery of less volatile substances than nitro-body mixtures from admixture with nitroglycerin, by the ferrous chloride method mentioned at the beginning of the paper, showed that good results could be obtained with such substances. This fact suggested the possibility of conducting the ferrous chloride separation in the cold, to prevent loss of nitro-body, and in the presence of methyl alcohol, in order to prevent further nitration of the nitro-body, as previously explained. The results obtained were quite as good as those obtained by the ferrous sulphate method, as is shown in the following table:—

TABLE 5.

Separation of Nitroglycerin from Commercial Nitro-body Mixture by modified Ferrous Chloride Method.

Nitro-body Taken Grm.	Nitro-body Found Grm.
0·5286	0·5367
0·1756	0·1786
0·2589	0·2606
0·3170	0·3260
0·3458	0·3508
0·2692	0·2750
0·3452	0·3524

The manipulation with the ferrous chloride method is more satisfactory, owing to the fact that the concentration of the acid does not need to be so great, and, consequently, no great dilution of the reaction mixture is required before ether extraction. On the other hand, the ferrous sulphate method has an advantage, in that the end point indicating the complete destruction of the nitroglycerin is definite, whilst the completion of the reaction with ferrous chloride can only be ensured by adhering to the conditions found to be satisfactory by working with synthetic mixtures. Both the ferrous sulphate and the ferrous chloride methods have been applied to the analysis of actual explosives with satisfactory results. Of the two methods dealt with, the ferrous chloride one has been found most satisfactory from the manipulative point of view, and has, therefore, been adopted by the authors. The method is carried out as follows:—

The ethereal solution of nitroglycerin and nitro-body, obtained on extracting an explosive with pure dry ether, is allowed to evaporate spontaneously. The residue is dissolved in 40 c.c. of methyl alcohol, and 25 c.c. of saturated ferrous chloride solution added for every grm. of nitroglycerin present in the quantity of explosive taken. An addition of 25 c.c. of concentrated hydrochloric acid is also made.

The solution is set aside at room temperature for at least 24 hours, and then extracted with three quantities of ether, 50 c.c. at a time.

The ether extracts are united, washed repeatedly with 50 c.c. of water, until free from iron salts, and dried by introducing a quantity of granular calcium chloride into the separating funnel. The ether solution is filtered into a large crystallising basin, the calcium chloride and the funnel are thoroughly washed with pure dry ether, and the washings filtered into the same basin. The filter is also washed with dry ether, and the whole filtrate and washings allowed to evaporate spontaneously. The residue is washed from the basin into a weighed fat-extraction flask by means of a little pure dry ether, the ether is allowed to evaporate spontaneously, and the flask and residue finally dried to constant weight *in vacuo* over sulphuric acid. The fat-extraction flask is much more convenient for drying and weighing than the large basin.

When the explosive contains substances, like wood-meal, which yield extracts to ether, a suitable correction must be deducted from the nitro-body as estimated before calculating the percentage on the explosive, because the extract from the wood-meal will not be touched by ferrous chloride solution, and will appear in the final ether extract together with the nitro-body.

The authors desire to express their thanks to the research committee of Messrs. Nobels Explosive Co., Ltd., for permission to publish these results, and to Mr. Rintoul for his interest during the progress of the work.

DISCUSSION.

Mr. DUPRÉ said the method brought forward by the authors should prove of value, older methods having always been unsatisfactory and the results unreliable owing to the further nitration of the mono- and dinitro-bodies. From the figures given, it certainly seemed that this method gave remarkable results, far more accurate than it was possible to get by older methods, and the manipulation seemed so simple that he did not consider any criticism to be required. Referring to the drying of the nitro-bodies, he stated that one frequently came across substances which, on drying, reached a stage where the remaining moisture was so enclosed by the exterior dried portions that very prolonged exposure to heat or drying agents was required to drive it off. In such cases he had found it useful to mix it, previous to drying, with some inert material such as French chalk, so as greatly to increase the surface exposed. However, he did not consider that anyone could complain of only 24 hours' drying.

Notes.

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.

BORIC ACID IN CAKES.

The following particulars of the occurrence of boric acid in cakes may be found of interest as supplementing the notes previously published (Liverseege, ANALYST, 1922, 19):—

A sample of sponge cake submitted to me showed 0·33 per cent. of boric acid. The various materials which had been used in the cake were later submitted, and some liquid yolk of egg used was found to contain 1·7 per cent. of boric acid.

J. T. DUNN.

FELLSIDE, LOW FELL,
GATESHEAD.

THE TERM "FINE CHEMICALS."

The recent cases brought before the official referee under the Safeguarding of Industries Act have thrown into evidence the misunderstanding which exists in the non-chemical mind as to what is meant by the term "fine chemicals." Previous to the war this term was very loosely employed, and is sometimes still so used.

A note by the present writer appearing in THE ANALYST of February, 1919 (p. 47) set forth the classification of fine chemicals which the writer and T. D. Morson put forward at the annual meeting of the Society of Chemical Industry in 1916, viz. (1) laboratory chemicals, (2) pharmaceutical chemicals, (3) photographic chemicals, (4) rare earths, (5) synthetic perfumes.

This classification, which was adopted by the Association of British Chemical Manufacturers, has never been challenged, and, so far as is known, has met with general acceptance. One must conclude that it is in this sense that the term "fine chemicals" is used in the schedule to the Safeguarding of Industries Act.

To produce an actual definition of fine chemicals is by no means easy, and many attempts have been made. The present writer has already at some length set forth his views in his previous publications on the subject, particularly in an article entitled "What is a 'Fine Chemical'?" appearing in the Journal of the Society of Chemical Industry, November 30th, 1921. In order to define fine chemicals it is necessary first to define a chemical. Having done this, one can proceed to state the attributes which constitute "fineness." The term "chemical" arose as a contraction of chemical substance, article or thing, just as other adjectives have come to be used as substantives (e.g. epidemic); whereas chemists, speaking of a chemical substance generally, have in mind the pure substance, the commercial term "chemical" is applied both to pure and impure substances. But purity, in regard to chemicals, is a matter of degree, so the distinction is unimportant. Attempts at a definition of a chemical made since the recent hearings before the official referee were begun cannot be described as happy. The first rule to which a definition must conform is that it shall not contain the name of the thing defined. No definition of a chemical can be accepted which contains the root "chem-."

This at once rules out the definition put forward by Mr. Parry in the santonin hearing, namely, that "a chemical is a body which has either been brought into existence by chemical action or is itself used as a chemical agent for the purposes of chemical reaction." To a chemist, it is difficult to see how the question as to whether a substance is produced naturally or brought into existence by human agency has any bearing on the matter.

The present writer has put forward the following definition of a chemical: "A chemical is a substance capable of being produced in a pure state, and, when so produced, it becomes an entity and has definite and invariable properties dependent upon its molecular structure, so that any specimen of a given pure chemical will have the same molecular structure and the same properties dependent thereon as every other specimen." Mr. F. H. Carr expresses somewhat the same idea in different language, as follows:—"A chemical is a pure element or combination of elements possessing uniform composition and identity, and not separable into two or more substances without changing its identity." From these one can derive the following: "A chemical is a substance which, when pure, possesses a uniform composition and an identity and is not separable into two or more substances without losing its identity."

The fact that some chemicals are generally used in the form of a solution should not be held to invalidate this definition. It would be a quibble to say that to define a chemical in this way rules out hydrochloric acid or formaldehyde or hydrogen peroxide.

What, now, is a fine chemical? The general distinctions between heavy chemicals and fine chemicals are clear and well understood, but no one of them alone is true for all cases. The idea underlying the word "fine" is "refined," and refined to a requisite degree. A fine chemical, then, is a chemical, produced by skilled labour under the supervision of a skilled chemist, which is of specified purity for a specific purpose.

C. A. Hill.

The British Drug Houses, Ltd.,
London, N. 1.

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.

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH.

Food Investigation Board.

REPORT ON HEAT INSULATORS.*

A report has been issued by the Engineering Committee of the Department giving the results of experiments by E. Griffiths, D.Sc. Special apparatus has been devised for the measurement of thermal conductivity in absolute measure. This is described with diagrams, and a typical example of the method of making the test is described at length. The results, which are given both in C.G.S. units and in the usual British measures, are tabulated in full, and cover the range of temperature met with in cold storage work.

The data obtained indicate that cork, slag wool, charcoal and wood fibres, when of good quality and dry, have practically the same thermal conductivity, viz., 0·00011 grm. cal. per sec. per cm. per 1°C. [=0·32 B.T.U.'s per sq. ft. per hour for 1″ and for 1° Fahr. diff.]. Different brands of cork, etc., of good quality do not show any very considerable differences in their efficiency as insulators, and the extravagant claims sometimes made for such insulating materials are devoid of foundation.

The thermal conductivity of materials such as cork is not an invariable physical constant like the thermal conductivity of pure metals. Hence it is advisable to test samples of various consignments. The tests indicate that a considerable decrease in the insulating efficiency of certain materials may take place in use. In the case of coarse granular materials the phenomenon of heat transmission is complicated by the circulation of convection currents.

Rubber expanded by gas into a highly cellular substance, with a density varying from 0·059 to 0·12, gave the most promising results as a heat insulator.

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* Special Report No. 5. H.M. Stationery Office, Kingsway, London, W.C. 2. Price 3s. net.

The conductivity of this material was found to be about 0·000085, which is lower than that of cork or any other substance examined, being only one and a half times that of still air. A sample of spongy rubber, as used for upholstery work, was volume for volume, considerably heavier than the cellular expanded rubber. It weighed 14 lbs. per cb. ft., and its conductivity was greater than that of cork (0·00013 as compared with 0·00010 to 0·00012 for various samples of cork).

An appendix to the Report describes the method and apparatus used for determining the specific heats of the materials examined.

THE CLEANING AND RESTORATION OF MUSEUM EXHIBITS.*

This Bulletin contains a report upon investigations conducted at the British Museum, under the direction of Dr. A. Scott.

PRINTS.—Brown or coloured spots, which are almost invarably due to the growth of mould fungi, may be best removed by treatment with very dilute (0·5 to 1 per cent.) bleaching agents. The prints should be immersed for 10 to 20 minutes in dilute hydrochloric acid (1 fl. oz. per quart, and then, without washing, in a solution of bleaching powder (0·25 to 0·5 oz. per quart) for the same length of time, and again transferred to the acid bath, this treatment being alternately repeated until no further improvement is noted. The prints are then thoroughly washed for some hours in water, to which finally a *small* quantity of sodium sulphite may be added to remove every trace of free chlorine.

The so-called "solution of chlorinated soda" may be used instead of bleaching powder, but, if too alkaline, may dissolve the size and render the paper soft and tender.

Thymol and similar antiseptic agents have given promising results as mould preventatives, especially when aided by heat, but formalin can hardly be regarded as a "safe" reagent, owing to the readiness with which it will yield formic acid, the presence of which might prove dangerous to many colours.

The white portions in many drawings and coloured pictures are intensified by means of white lead or lead carbonate (ceruse), and will therefore, in time, become discoloured, and finally quite black, through the action of hydrogen sulphide in the air. The original white tone may be restored by oxidising the lead sulphide to sulphate by means of hydrogen peroxide. This may be safely applied in the form of vapour by saturating a plaster of Paris block with the hydrogen peroxide solution, and exposing the blackened print, face downwards, at a distance of about an eighth of an inch for a few hours. This treatment will also remove many of the mouldy brown spots (foxiness) which disfigure prints, but the treatment will require a much longer time than the whitening of lead sulphide.

Brown stains in drawing or prints due to oils or varnishes do not yield to any of the ordinary bleaching agents or the more usual paint-removing solvents. They can be removed, however, in many cases by means of pyridine (which must be colourless and anhydrous). This solvent should be applied by means of a brush of silky glass fibre, and the liquid removed after a short time with pure white blotting paper. The paper of the print is not affected.

ENAMELS.—The occurrence of cracks in enamels is due to the enamel having a different coefficient of expansion from that of the metal with which it is fused, and appears to be inevitable unless the metal is thin enough or its form such that it can adapt itself to expansions and contractions caused by changes in temperature. An effective method of preserving cracked enamels is to place them in

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* Bull. No. 5. Dept. Scientific and Industrial Research, H.M. Stationery Office, Imperial House, Kingsway, W.C. Price 2s. net.

a flat dish under the receiver of an air pump, and, after maintaining a good vacuum for half an hour, to run a 10 per cent. benzene solution of dried Canada balsam over the surface of the enamel, through a separating funnel passing through the rubber stopper of the receiver. On then admitting air the balsam solution is forced into each tiny crack and underneath those portions of the enamel which have separated from the metallic base. The thin film of Canada balsam on the surface can be removed, if desired, by treatment with benzene, but it is advisable to leave it as a protection to the enamel.

SILVER.—When objects of pure silver or of an alloy with copper are exposed to the air and to the action of a solution of common salt, silver chloride is formed, and also sodium hydroxide, which soon becomes sodium carbonate. If any copper is present in the alloy it reduces the silver chloride to metallic silver, and the copper chloride simultaneously formed continues the corrosion of the silver.

A warm dilute (5 to 25 per cent.) solution of formic acid is a safe reagent to remove the copper crust of oxides, carbonates and oxychlorides, without attacking either the silver or the alloy. Any lead present will also be dissolved as lead formate.

Other suitable reagents are: (1) A solution of ammonium sulphite and ammonia containing some cuprous sulphite; (2) A solution of ammonia and ammonium formate; (3) "Zinc dust" moistened with very dilute sulphuric acid. The last is particularly useful for removing silver chloride and the stains produced by the action of light in presence of organic matter.

LEAD.—Under certain conditions lead may be rapidly converted into a basic carbonate, and it is well known that objects of lead should not be stored in oak cabinets, although mahogany and various other woods are quite safe.

To prevent corrosion, when once started, it is necessary to remove from the lead all organic matter. For this purpose two reagents have proved of great value. (1) A solution of sodium hydroxide containing some methylated spirit; (2) A solution of basic lead acetate. After warming the object with either of these solutions it should be thoroughly washed, then heated with a dilute solution of lead acetate (the normal salt), and again thoroughly washed.

Zinc dust with dilute acetic acid is also useful for separating hard incrustations and reducing them to a porous mass of metallic lead, which must be removed by careful brushing.

RUSTING OF IRON.—The ordinary constituent of soil most injurious to iron is common salt. In the presence of water, carbon dioxide, and often organic substances of acidic character, iron is rapidly attacked by sodium chloride, with the formation, first, of ferrous chloride, which, with air and moisture, yields basic chlorides of iron, and these, in turn, give ferrous chloride once more, together with ferric hydroxide.

For the prevention of rusting, therefore, it is essential that all chlorine should be removed from the iron. Basic chlorides must be decomposed by treatment with sodium hydroxide or carbonate solution, and the iron then thoroughly washed and boiled with distilled water until no more soluble matter is extracted.

Final traces of chlorine may also be eliminated by means of an electric current, the iron core being used as the cathode, so that chlorine ions are driven to the anode, which is of zinc. A dilute solution of sodium hydroxide is used as the bath in which the rust-covered iron object is immersed.

COPPER AND COPPER ALLOYS.—The reagents found of value for removing the superficial deposits from objects of copper, bronze, and brass, include dilute ammonia solution, which, however, attacks the copper when air has free access. Ammonium chloride, either alone or with the addition of stannous chloride and a little hydrochloric acid, appears to be safer and trustworthy. An alkaline solution of Rochelle salt has also given good results, and, in other cases, formic or acetic acid, with or without the addition of zinc dust, has proved effective.

PREHISTORIC PAINTINGS ON ROCKS.—The lichens on paintings from Northern Rhodesia could not be removed by mechanical means, but they could be softened and apparently gelatinised by treatment with a dilute solution of ammonia. They were painted with this solution, and, after a few minutes, the lichens were removed by gentle brushing, and the face of the painted rock washed with distilled water, and finally with absolute alcohol.

ABSTRACTS OF PAPERS PUBLISHED IN OTHER JOURNALS.

Food and Drugs Analysis.

Detection of Egg Substance in Cakes. O. Noetzel. (*Zeitsch. Untersuch. Nahr. Genussm.*, 1921, **42**, 299–302.)—The alcohol-soluble phosphoric acid in flour cannot be estimated by a single extraction of the flour with absolute alcohol for 15 hours, but if the extracted residue is mixed with water to a moderately thick paste, and this spread in a thin layer on a porcelain dish, dried at 100° C., finely ground and subjected to further extraction with absolute alcohol for 12 hours, the sum of the two amounts extracted represents approximately the true value. Application of this method to cakes prepared from flour containing 0·038 per cent., and eggs each containing 0·164 grm., of alcohol-soluble phosphoric acid, and made with the help of either yeast or a baking powder consisting of tartaric acid and sodium hydrogen carbonate, gave results in good agreement with the calculated values. When, however, as many as three eggs were taken per pound of flour, the sum of the two extracts (0·117—0·124 per cent.) was slightly lower than the calculated value (0·133 per cent.); this discrepancy is due less to the effect of the high baking temperature than to that of the increased protein content, which renders alcohol-soluble phosphoric acid less liable to attack. T. H. P.

Composition of Chinese Edible Birds Nests and Nature of their Proteins, C. C. Wang. (*J. Biol. Chem.*, 1921, **49**, 429–439.)—This material is difficult to obtain in a pure state owing to the presence of minute feathers interspersed throughout the mass. Analysis of four samples gave the following average results:—Moisture, 11·60; total ash, 2·51; water-soluble ash, 0·74; phosphorus, 0·035; sulphur, 1·10; and total nitrogen, 8·78, 9·15 and 10·29 per cent. with the original bird's nests, the same ground and the feathers partly removed, and after hydrolysis with 20 per cent. hydrochloric acid for thirteen hours respectively. The results obtained indicated that the material consists of dried saliva secreted by the birds, and belongs to the class of glycoproteins. Estimation of the distribution of nitrogen by van Slyke's method (*J. Biol. Chem.*, 1911, **10**, 15) gave results which agreed in most respects with those of pure proteins, but higher values were obtained for the humin nitrogen and for cystin nitrogen owing probably to the presence of the carbohydrate radicle and of fine feathers. Artificial digestion experiments proved that the nest is digested by pepsin-hydrochloric acid and by trypsin, but in each case less rapidly than hard-boiled egg white. The addition of 16 per cent. of the nest material to basal diets containing maize kernels or rolled oats which were given to young rats led to no improvement in growth, and it is suggested that the bird's nest protein is of "inferior quality." T. J. W.

Isolation and Nature of the Amino Sugar of Chinese Edible Bird's Nests. C. C. Wang. (*J. Biol. Chem.*, 1921, **49,** 441–452.)—Methods previously described for isolation of carbohydrates from glucoproteins met with little success when applied to edible bird's nest, and the following procedure was adopted: Three hundred grms. of the material were heated with two litres of 3 per cent. hydrochloric acid for five hours, and the product evaporated to dryness *in vacuo* over sulphuric acid and solid sodium hydroxide. The black residue was repeatedly extracted with 95 per cent. alcohol, and the extracts evaporated to a syrup under a pressure of 30 mm. of mercury. Solution of the syrup in 500 c.c. of methyl alcohol produced brownish crystals which were filtered off, dissolved in boiling water, and precipitated by the addition of absolute alcohol and ether. Repeated crystallisation yielded about 10 grms. of pure white crystals of uniform microscopic appearance. By slight modification of the method of purification crystals of other forms were obtained which differed, with fresh solutions, in optical rotation, and in the temperatures at which they darkened in colour. The three varieties were all readily soluble in water and 80 per cent. alcohol, insoluble in ether, chloroform, and acetone, had a sweet taste, strongly reduced Fehling solution and, on boiling with strong sodium hydroxide solution, evolved ammonia. They did not show any protein reactions, but formed with phenylhydrazine an osazone melting at 214° C. On standing for twenty hours the solutions showed the same optical rotation of $(\alpha)^{20}_{D} = +70{\cdot}5$ to $+70{\cdot}9^\circ$. Examination of the results obtained indicates that the carbohydrate is an aminohexose, the identity of which is not yet determined. T. J. W.

Test for Sucrose in the Presence of Dextrose. L. A. Congdon and C. R. Stewart. (*J. Ind. Eng. Chem.*, 1921, **13,** 1143–1144.)—The test depends on the solubility of dextrose in hot ethyl acetate and on the insolubility of sucrose in this solvent. If a mixture of the two dry sugars is extracted for three hours with ethyl acetate in a Soxhlet apparatus, the dextrose passes into solution and separates as crystals when the solvent is cooled. W. P. S.

Cider Preservatives. R. D. Scott and E. G. Will. (*J. Ind. Eng. Chem.*, 1921, **13,** 1141–1143.)—The addition of 0·2 per cent. of salicylic acid or of 0·1 per cent. of thymol to cider inhibits both alcoholic and acetic fermentations; these substances are, therefore, suitable for the preservation of samples for analysis. For preserving cider commercially, sodium benzoate and salicylic acid are of some value; alcoholic fermentation is practically checked by the addition of 0·05 per cent. of sodium benzoate, but acetic fermentation proceeds at the usual rate.

About 0·1 per cent. of salicylic acid would have to be used for the purpose, an amount probably too high to be desirable from a physiological standpoint.

W. P. S.

Hazel Nut Oil and Estimation of Arachidic Acid. J. Pritzker and R. Jungkunz. (*Zeitsch. Untersuch. Nahr. Genussm.*, 1921, **42**, 232–241).—For the estimation of arachidic acid the following method is recommended: Twenty grms. of the oil are treated in a Jena beaker of about 200 c.c. capacity, covered with a clock-glass, with 40 c.c. of 20 per cent. alcoholic potassium hydroxide solution, on a water bath for ten minutes, with frequent stirring. The clear soap solution is diluted with 50 c.c. of hot water and immediately decomposed by 20 c.c. of 25 per cent. hydrochloric acid, the fatty acids being separated after 15 minutes by means of a separating funnel and dissolved in 180 c.c. of pure boiling acetone. The clear, boiling solution is mixed with 20 c.c. of aqueous *N* potassium hydroxide solution and allowed to cool, the first crystals appearing at 35° C. The liquid is left for 30 minutes at 15° C., and the crystalline mass of potash soap pumped off, washed four or five times with small portions of acetone, and dissolved in water, and the fatty acids liberated by the addition of dilute hydrochloric acid, and dissolved in 50 c.c. of 90 per cent. alcohol below its boiling point. This solution is slowly cooled and left at 15° C. for three hours, any precipitate—which in presence of arachidic acid consists mostly of fine crystalline leaflets—being filtered off and washed with three portions of 10 c.c. of 90 per cent. alcohol. The residue may be transferred to a weighed flask by means of boiling absolute alcohol and weighed after it has been freed from alcohol by distillation and dried at 100° C. The melting point and molecular weight of the mixture of fatty acids thus obtained are determined. Crude arachidic acid usually shows a melting point 72–75° C., and if the value is below 70° C., or if the separated precipitate was not composed of fine crystalline leaflets, the fatty acids are again crystallised, as described above, from 50 c.c. of 90 per cent. alcohol and again weighed. This weight is corrected for the portion dissolved in the alcohol, the correction for 100 c.c. of alcohol at 15° C. amounting to 0·033, 0·050 and 0·070 grm. for values of below 0·1 grm., 0·1–0·5 grm., and over 0·5 grm. respectively of the weight found. Multiplication by 20 of the quantity of crude arachidic acid thus obtained gives approximately the amount of arachis oil in the oil examined. The proportion of arachis nut oil in hazel nut oil or olive oil may be determined with moderate accuracy by this method, which fails, however, in the case of cottonseed oil.

Addition of cottonseed oil, kapok oil, or sesame oil to hazel nut oil may be detected by means of the ordinary colour reactions, but these do not permit of the detection of olive oil in hazel nut oil. The colour reactions for hazel nut oil given by Schädler ("Technologie der Fette und Öle") and by Knorr (*Seifensieder-Zeitung*, 1912, **39**, 523) are invalid.

T. H. P.

Guere Palm Nuts from Colombia. (*Bull. Imp. Inst.*, 1921, **19**, 293–295.)—The nuts appeared to be derived from a species of *Astrocaryum* near *A. Tucuma*, Mart., and consisted of 60 per cent. shell and 40 per cent. kernel, whilst the kernels contained 6·2 per cent. of moisture and 37·6 of fat. The fat was pale cream coloured and fairly hard; it gave the following figures:—M.pt., 35·5° C.; sp. gr., 100/15° C., 0·864; solidifying pt. of fatty acids, 29·7° C.; acid value, 1·7; saponification value, 249·6; and iodine value, 9·4. The residual meal had a low percentage of protein (7·4 per cent. in meal with 7·0 per cent. of fat), and was thus inferior to palm kernel or coconut cake. R. G. P.

Colour Reaction of *Gynocardia* Oil and its Spectrum. I. Lifschutz. (*Chem. Zeit.*, 1921, **45,** 1264–1265.)—On adding concentrated sulphuric acid (4–5 drops) to a solution of *Gynocardia* oil (1 drop) in chloroform (0·5 c.c.) and glacial acetic acid (1·5 c.c.) an intense grass-green coloration is produced, which shows a red-violet colour in transmitted lamplight. The liquid shows a complicated absorption-spectrum:—(1) A narrow weak stripe in the red close to the ultra-red; (2) A similar, but stronger and more perceptible, stripe in the red close to the orange; (3) A strong sharply-defined dark band in the yellow, which rapidly becomes stronger and broader, so that the whole of the yellow and orange become extinguished; (4) A moderately broad stripe in the green fairly near the yellow; (5) A broad dark band with blurred margins in the blue close to the margin of the violet. In a short time the colours and absorption bands darken to such an extent that those described in 2 to 4 run together into a homogeneous dark band, and only become visible again after suitable dilution with a mixture of chloroform and acetic acid (1:1). The addition of a drop of a solution of ferric chloride in acetic acid does not change the appearance of the spectrum, but intensifies it; even when diluted the solution shows the colours and absorption bands after an hour.

The reaction does not occur at all or only slightly with fresh *Gynocardia* oil, or with oil which has been recently refined, but fresh oil reacts vigorously after oxidation, which is conveniently effected by adding a crystal of benzoyl peroxide to a solution of the oil (1 drop) in glacial acetic acid (1·5 c.c.). The liquid is gently warmed to dissolve the benzoyl peroxide and is then just boiled and cooled rapidly, after which a few drops of chloroform and 4 to 5 drops of sulphuric acid are added.

This new reaction with acetic and sulphuric acids is due to the fatty acids and not to the unsaponifiable matter; it must not be confused with the oxycholesterol-reaction (due to unsaponifiable matter) with the same reagents, for the colours and absorption bands are quite distinct, and, further, the addition of ferric chloride in the oxycholesterol test changes the blue-violet colour to a pure green, while the strong absorption band in the yellow of the spectrum disappears and a dark sharp stripe in the red (between *C* and *d*) appears. The reaction can be obtained with the fatty acids recovered from soaps after the removal of unsaponifiable matter in the usual manner. R. G. P.

Curcas Oil. (*Bull. Imp. Inst.*, 1921, **19,** 288–291.)—The seeds of *Jatropha curcas* (Linn.), the physic or purging nut, yield a liquid oil with purgative and emetic properties. Seed from the Gold Coast and South Africa respectively contained moisture 11·1 and 7·9 per cent., and oil 33 and 31·9 per cent. Oil extracted from Gold Coast seed gave the following results:—Sp. gr.

15°/15° C., 0·9191; solidifying pt. of fatty acids, 28·7° C.; acid value, 4·5; saponification value, 191·6; iodine value, 98·7; acetyl value, 25·4; soluble volatile acids, 0·37 c.c. 0·1 N-KOH per 5 grms. of oil; and insoluble volatile acids, 0·22 c.c. 0·1 N-KOH per 5 grms. of oil. The efflux time (Redwood) of three samples of curcas oil varied from 284–298 seconds foı 50 c.c. at 70° F., compared with 3888 seconds for commercial castor oil.

Thin films of curcas oil on glass exposed at 100° C. for 22 hours darkened, but did not dry completely; in 26 hours the films were quite dry; whereas castor oil was unaffected. Curcas oil films exposed to light and air for seven days showed slight signs of drying, whilst castor oil was unaffected. It is obvious therefore that curcas oil could not be used instead of castor oil as a lubricant (*e.g.* in aeroplane engines). (*Cf.* Archbutt, *J. Soc. Chem. Ind.*, 1898, 1010). R. G. P.

Micro-analytical Methods in the Examination of Foods. F. Wohack. (*Zeitsch. Untersuch. Nahr. Genussm.*, 1921, **42**, 290–298.)—*Vanillin*:—For the micro-estimation of vanillin in vanillin sugar, 0·2 to 0·25 grm. of the finely powdered sugar is boiled with a little phenol and 2 c.c. of hydriodic acid (sp. gr. 1·7) in a small flask through which air can be passed and which is connected successively with a reflux condenser, a small gas-washing bottle containing a suspension of red phosphorus in water, a short combustion tube charged with platinised asbestos and surrounded with asbestos paper and wire gauze, and absorption bulbs containing potassium iodide solution. The methyl iodide formed by boiling the vanillin sugar with hydriodic acid is carried by the air-current through the phosphorus suspension, where it is freed from any hydriodic acid and iodine, and then through the heated combustion tube, in which it is decomposed with quantitative separation of the iodine. The latter is absorbed in the potassium iodide solution and estimated by titration with thiosulphate solution. This method is applicable to all other estimations of alkoxyl groups, such as that of glycerol in wine or other liquid, but it cannot be used with mixtures of vanillin with flour, since the bran constituents of the latter contain a certain proportion of alkoxyl groups.

Formic Acid:—For the estimation of formic acid in foods, a micro-modification of Fincke's method (ANALYST, 1911, **36**, 103, 496) is recommended. The formic acid is distilled in a current of steam from an acidified solution of the material and absorbed in an aqueous suspension of calcium carbonate; the excess of the latter is removed by filtration, and the resulting formate solution heated with mercuric chloride solution. The mercurous chloride thus formed is filtered off and weighed, multiplication of the weight by 0·098 giving the amount of formic acid. By making use of a modification of Pregl's apparatus for micro-Kjeldahl estimations (*Die quantitative organische Mikroanalyse,* 1917), and by reducing all the quantities used, with the exception of the calcium carbonate (2 grms.), to one-tenth of those given by Fincke, the time required for the distillation is diminished from about half a day to 15–30 minutes, without loss of accuracy. The presence of higher fatty acids in large proportions has little effect on the results furnished by this process. T. H. P.

Examination of Chemical Foods. A. J. Jones. (*Pharm. J.*, 1922, **108,** 61–62.)—It is considered that the acidity of Syrup. Ferri. Phosph. Co. of the B.P.C. is undesirably high. For the estimation of the free, "associated," and total acid in chemical food, 50 c.c. of the syrup are diluted to 250 c.c., decolorised with purified charcoal, and 25 c.c. of the filtrate titrated with 0·5 *N*-sodium hydroxide, dimethylaminoazobenzene being used as indicator; when the free acid has been thus determined, phenolphthalein is added, and the second hydrogen ion of the phosphoric acid estimated by continuing the titration. For the third hydrogen ion 50 c.c. of the decolorised filtrate are neutralised to phenolphthalein and a slight excess of alkali added, and the solution is diluted to 100 c.c. and filtered. To 50 c.c. of this filtrate (=5 c.c. of syrup) are added a few drops of hydrochloric acid, and the end point adjusted to phenolphthalein; the azo indicator is then added and the mixture titrated to a browish-yellow. The sum of these three titrations gives the total phosphoric acid (1 c.c. *N* = 0·03269 grm. H_3PO_4). The difference between the second and third hydrogen ions titrated above is the H_3PO_4 associated with $Ca_3P_2O_8$ and $Fe_3P_2O_8$ (1 c.c. *N* = 0·0987 grm. H_3PO_4). For the estimation of calcium and iron, 25 c.c. of syrup are diluted, heated with nitric acid, a slight excess of ammonia added, the liquid neutralised with hydrochloric acid, and excess of acetic acid added and then ammonium oxalate. The filtrate from the calcium oxalate is treated with citric acid, and the iron precipitated by means of hydrogen sulphide. The following are the results of the analysis of five trade samples:—

H_3PO_4 Per Cent. w/v	B.P.C. Theoretical Standard	A	B	C	D	E
1. Free H_3PO_4	3·07	4·86	3·36	3·27	1·67	1·98
2. Associated with $Ca_3P_2O_8$ and $Fe_3P_2O_8$ ..	2·78	3·43	2·62	2·71	1·20	1·06
3. Sum of 1 and 2	5·85	8·29	5·98	5·98	2·87	3·04
4. Combined with Na_3PO_4 and K_3PO_4. Difference ..	0·15	—	0·10	—	0·39	0·01
5. Total H_3PO_4	6·00	8·26	6·08	5·93	3·26	3·05
$Ca_3P_2O_8$ per cent. w/v.	1·405	2·11	1·56	1·59	0·61	0·61
$Fe_3P_2O_8$ per cent. w/v.	0·917	1·01	0·89	1·00	0·61	0·51

H. E. C.

Note on Calcium Phosphate. A. J. Jones. (*Pharm. J.*, 1922, **108,** 62–63.)—Calcium Phosphate of the B.P. is a mixture of $Ca_3P_2O_8$ and $CaHPO_4$, together with about 20 per cent. of combined water. For the estimation of these two salts, 0·5 grm. is dissolved in 15 c.c. of 0·5 *N*-hydrochloric acid, diluted and slowly titrated with 0·5 *N*-sodium hydroxide, dimethylaminoazobenzene being used as indicator. The difference between the acid and alkali used is the acid absorbed to form $CaH_4P_2O_8$; phenolphthalein is added and the titration is continued until a pink colour is obtained. Regarding $Ca_2H_2P_2O_8$ as an associate $Ca_3P_2O_8.CaH_4P_2O_8$, the "acid absorbed" is a measure of the pre-existing and assumed $Ca_2P_2O_8$; hence the difference between the two figures (acid absorbed and intermediate figure) $\times 3/2$ = the total hydrogen of the dibasic salt (1 c.c. $N = 0{\cdot}136$ grm. $Ca_2H_2P_2O_8$). The acid absorbed, minus the above difference, is a measure of the $Ca_3P_2O_8$ existing as such (1 c.c. $N = 0{\cdot}0775$ grm. $Ca_3P_2O_8$). An example will make this clear:—C.c. *N* per grm. Acid absorbed = 6·2 c.c. Intermediate titration 9·5 c.c.

$(9{\cdot}5 - 6{\cdot}2) \times 3/2 = 4{\cdot}95$ for total H of $Ca_2H_2P_2O_8 = 67{\cdot}3$ per cent.
$(6{\cdot}2 - 4{\cdot}95) \quad = 1{\cdot}25$ for H taken up by $Ca_3P_2O_8 = 9{\cdot}7$ per cent.

H. E. C.

Bacteriological, Physiological, etc.

Colorimetric Estimation of Hydrogen Ion Concentration in Small Quantities of Blood. J. Lindhard. (*Compt. Rend. Lab. Carlsberg,* 1921, **14,** No. 13.)—Collodion sacs prepared by dipping glass rods of 4 mm. diameter into an alcohol-ether solution are dried by exposure to air for about four minutes and then immersed in water, in which they are subsequently stored. Their capacity is approximately 0·25 c.c., and for use a stopper of glass tubing is inserted in the mouth and held in position by a sleeve of thin walled rubber tubing, this tubing also acting as a stopper for the glass tube, 25 mm. in length and 7 mm. wide, in which the sac is immersed. For the estimation a small quantity of hirudin is placed in the sac, three drops of blood are added from a prick in a finger, the sac and stopper are filled with 0·1 *N* sodium chloride solution, wiped clean and placed in the glass tube, which has previously been filled with the sodium chloride solution. After standing for thirty minutes the sac and stopper are removed, and the tube is quickly filled with 0·1 *N* sodium chloride solution, and one or two drops of 0·01 per cent. solution of phenol-sulphonephthalein are added, when the whole is mixed by inverting several times and covered with a drop of petroleum oil to prevent loss of carbon dioxide. The resulting colour is compared with those of a standard series of Sorensen phosphate mixtures containing the same volume of indicator solution added, the difference between neighbouring tubes amounting to $0{\cdot}05P_H$ value. The results obtained agree well with those given by the electrometric method, and errors, which are in most cases due to loss of carbon dioxide, may be avoided by careful manipulation.

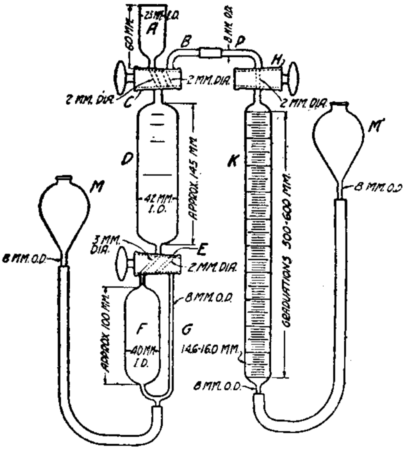
T. J. W.

Use of Sodium Sulphate as the Globulin Precipitant in the Determination of Proteins in Blood. P. E. Howe. (*J. Biol. Chem.,* 1921, **49,** 93–107.)—On treating dilute blood serum or plasma with sodium sulphate solution, so as to give at 37° C. increasing final concentrations of the salt, and then estimating the nitrogen in the filtrates from the precipitates, definite critical zones of precipitation were observed at concentrations of 13·5 to 14·5, 17·4 and 21 to 22 per cent. The weight of euglobulin precipitated by 13·5 per cent. sodium sulphate solution corresponded with that obtained by saturation of the serum with sodium chloride or with carbon dioxide, whilst the 22 per cent. solution gave results approximately agreeing with those obtained by saturation with magnesium sulphate or with ammonium sulphate, which are generally considered to precipitate completely all globulins. Throughout the experiments a definite concentration of the salt under constant conditions of temperature was found to precipitate a constant weight of protein. Examination of the blood of various mammals showed that in some fractional precipitations with sodium sulphate no critical zone of precipitation occurred at a concentration of 17·4 per cent. The results indicate that, in addition to euglobulin two other globulins exist in blood serum,—pseudoglobulin I and pseudoglobulin II—complete precipitation being obtained with concentrations of sodium sulphate of 17·4 per cent and 21 to 22 per cent. respectively. T. J. W.

Micro Method for the Estimation of Proteins in Blood. P. E. Howe. (*J. Biol. Chem.*, 1921, **49**, 109–113.)—Blood plasma containing 0·5 per cent. of potassium oxalate or serum is used in the following method, each sample being centrifuged until clear before analysis. *Total nitrogen*: Two c.c. of sulphuric acid and a drop of copper sulphate solution are added to 0·5 c.c. of plasma or serum, and the Kjeldahl estimation carried out in the usual way. *Fibrinogen*: Fourteen c.c. of 0·8 per cent. sodium chloride, 1 c.c. of 2·5 per cent. calcium chloride solution and a small crystal of thymol are added to 0·5 c.c. of plasma, the mixture is allowed to stand until fibrin is formed and is then filtered, and two 5 c.c. portions of the filtrate are used for the estimation of nitrogen. *Euglobulin*: Fifteen c.c. of 14 per cent. sodium sulphate solution at 37° C. are added to 0·5 c.c. of serum or plasma, the mixture is shaken and allowed to stand at least three hours when the solution is filtered and nitrogen estimated in the filtrate. The results show euglobulin nitrogen when using serum, and euglobulin plus fibrinogen in the case of plasma. *Euglobulin plus Pseudoglobulin I*: This method is the same as for euglobulin, except that 18 per cent. sodium sulphate solution is used. *Total globulin*: This method is also a repetition of the euglobulin procedure, but 22·2 per cent. sodium sulphate solution is employed. *Non-protein nitrogen*: Fifteen c.c. of 5 per cent. trichloracetic acid are added to 0·5 c.c. of plasma or serum at the ordinary temperature, the remaining procedure being as for the estimation of euglobulin. The results are expressed in terms of grms. of nitrogen per 100 c.c. of blood. A table of comparable results obtained by the above method and by the method of Cullen and van Slyke (ANALYST, 1920, **45**, 226) with blood obtained from the cow, pig, goat, and horse shows excellent agreement by the two methods. T. J. W.

Detection of Bismuth in Urine. P. Aubry. (*J. Pharm. Chim.*, 1922, **25**, 15–18.)—The urine of patients under treatment with bismuth compounds frequently develops a black coloration changing to a deposit, which is due to bismuth sulphide. When no coloration is produced, as little as one part of Bi_2O_3 in 600,000 of urine may be detected by means of a test based on the red-orange precipitate or colour formed by bismuth compounds in presence of quinine and potassium iodide. The test solution is prepared by dissolving quinine sulphate (1 grm.) in about 10 c.c. of water containing 3 to 4 drops of sulphuric acid, adding potassium iodide (2 grms.) in about 10 c.c. of water, and diluting the mixture to 100 c.c. In applying the test 50–100 c.c. of the sample are evaporated and incinerated, the ash dissolved in a few c.c. of water slightly acidified with nitric acid, and the solution tested with the quinine-potassium iodide reagent. The reaction can be used for the colorimetric estimation of bismuth in solutions of pure bismuth compounds, but the method is not applicable to urine, owing to variations in colour. R. G. P.

Water Analysis.



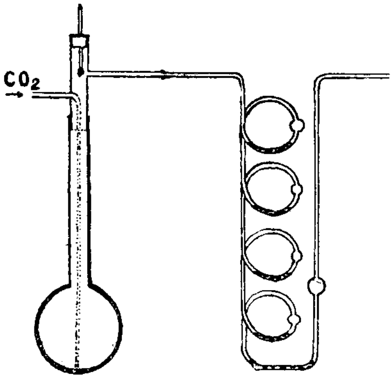
Method for the Estimation of Free and Combined Carbon Dioxide (in Waters). J. A. Shaw. (*J. Ind. Eng. Chem.*, 1921, **13**, 1151–1152.)—In using the apparatus shown in the diagram the vessels *F* and *D*, and the burette *K*, are first filled with mercury. A measured volume of the sample is introduced into *D* through the funnel *A* (sulphuric acid is added if the total carbon dioxide is to be estimated) and any gas liberated is passed over into the burette *K*, but none of the liquid is allowed to pass out of *D*. The stopcock *H* is then closed, the reservoir *M* is lowered, and mercury is drawn from *D* through the tube *G*, a vacuum being formed in *D*. When most of the mercury has been drawn from *B*, the tap *E* is turned so as to deliver the rest of the mercury and the sample into *F*. The tap *E* is then closed, confining the sample in *F*, and *M* is raised and tap *E* is turned to connect *D* with *G*; any gas liberated by the lowered pressure can now be passed over into the burette. The sample is returned to *D* and the operations repeated several times. The total volume of gas collected in the burette is then read, temperature and pressure corrections being applied in the usual way. W. P. S.

Hydrogen Ion Concentration of Some Natural Waters. J. T. Saunders. (*Proc. Cambridge Phil. Soc.*, 1921, **20**, 350–351; *Chem. Abstr.*, 1921, **15**, 3353.)—The hydrogen ion concentration of various waters from streams, lakes, wells, etc in districts with chalky soil or subsoil is fairly constant. The ground water and wells ranged from P_H 7·1 to 7·2, and in the streams rose gradually to 8·25 to 8·5. In sluggish streams the figure drops owing to acid products of decomposition. In the case of large deep ponds and lakes it is fairly constant at 8·25–8·5, whereas in the case of small shallow ponds the P_H value may drop, or, when there is much vegetable matter, may rise. R. F. I.

Organic Analysis.

Estimation of β-Hydroxy-butyric Acid. R. S. Hubbard. (*J. Biol. Chem.*, 1921, **49**, 351–355.)—Extensive trials of various methods for the estimation of β-hydroxy-butyric acid have led to the adoption of the following. One hundred c.c. of the solution are heated to boiling in a Kjeldahl flask fitted to a water condenser, and 15 c.c. of sulphuric acid diluted with an equal volume of water are run in, followed by 20 c.c. of 0·1 to 0·2 per cent. potassium dichromate solution. Fifty c.c. of distillate are collected in ten minutes, after which 50 c.c. of the potassium dichromate solution are added, and the distillation continued for a further ten minutes. After adding a second 50 c.c. portion of the dichromate solution and continuing the distillation for an additional ten minutes the whole distillate is collected in a second Kjeldahl flask and redistilled from sodium peroxide, the acetone present in the second distillate being estimated by the author's iodimetric method (*J. Biol. Chem.*, 1920, **43**, 43–). Thirteen estimations with quantities of β-hydroxybutyric acid between 0·1 and 25 mgrms. have shown that the results obtained are from 84 to 88 per cent. of the theoretical amount. T. J. W.

Apparatus for the Estimation of Methoxyl Groups. W. M. Cumming. (*J. Soc. Chem. Ind.*, 1922, **41**, 20T.)—When Robertson's apparatus for the estimation of halogens is used with Hewitt and Jones's method for the determination of methoxyl groups (cf. ANALYST, 1919, **44**, 175) the results are low on account of incomplete absorption of the methyl iodide by the pyridine. The apparatus figured overcomes this difficulty; the flask is of 250 c.c. capacity, the neck is 10 in. long and all joints are of ground glass. Only 10 to 15 c.c. of pyridine are necessary for the absorption, which is completed within an hour. The substance and the hydriodic acid are heated in a glycerin bath at 130° C., and the temperature on the thermometer should not be allowed to exceed 35°—40° C., at which temperature no hydriodic acid distils over. Twenty c.c. of redistilled hydriodic acid and 0·3 grm. of substance are convenient quantities for the estimation. H. E. C.



Estimation of Trimethyleneglycol in Crude Glycerin. L. V. Cocks and A. H. Salway. (*J. Soc. Chem. Ind.*, 1922, **41**, 17–20T.)—The author's previous method (*J. Soc. Chem. Ind.*, 1918, 123T.) has been slightly modified to allow for the contraction which takes place on mixing glycerin, trimethyleneglycol, and water. One hundred grms. of the crude glycerin are distilled under reduced pressure (15–30 mm.) in a 600 c.c. distillation flask fitted with a capillary inlet tube and an air condenser, until about 30 per cent. has collected in the receiver. An oil bath at 230°–240° C., or a smoky flame may be used for the heating. Loss of water during the early stages of distillation is an advantage, but if priming has occurred, the distillate must be redistilled. The specific gravity and the acetin value of the distillate are determined, the trimethyleneglycol can then be read off from large scale curves constructed for the purpose, or may be calculated from the specific gravity as follows: The difference between the specific gravity of the mixture under examination and that of glycerin at the dilution represented by the acetin figure of the mixture is divided by a given factor:—Acetin 50 per cent., factor 0·00134 per 1 per cent. glycol; 55 per cent., 0·00138; 60 per cent., 0·00143; 65 per cent., 0·00148; 70 per cent., 0·00152; 75 per cent., 0·00157; 80 per cent., 0·00162; 85 per cent., 0·00168; 90 per cent., 0·00174; 95 per cent., 0·00179. Tables are given for the specific gravity of glycerin which nearly agree with those of Nicol. The limit of accuracy is about 0·2 per cent. of trimethyleneglycol. H. E. C.

Characterisation of Fatty Acids by the Formation of Complexes with Uranyl and Sodium. J. Barlot and (Mlle.) M. T. Brenet. (*Comptes rend.*, 1922, **174,** 114–116.)—Streng (1883) devised a microchemical method of detecting the sodium ion by means of the formation of a double uranyl sodium acetate, which is only slightly soluble and crystallises in regular tetrahedra. Under suitable conditions this reaction, which requires the presence of hydrogen ions, serves for the detection of sodium, uranium or acetic acid. The author finds that a similar reaction is given by such homologues of acetic acid as contain an even number of carbon atoms in a chain. Thus formic, propionic, iso-butyric, *n*-valeric and *n*-oenanthylic acids do not yield crystalline complexes, which are, however, given by *n*-butyric, ordinary valeric (β-methylbutyric), and *n*-caproic acids. None of the three chloroacetic acids responds to the reaction, but sodium phenylacetate and uranyl nitrate yield immediately acicular crystals of the composition, $C_6H_5{\cdot}CH_2{\cdot}CO_2Na$, $(C_6H_5{\cdot}CH_2{\cdot}CO_2)_2UO_2$. T. H. P.

Relation between the Molecular Properties of Certain Hydrocarbons and their Capacity for Fixing Iodine. P. Woog. (*Comptes rend.*, 1921, **173,** 1471–1473; cf. ANALYST, 1921, **46,** 464–465.)—If the amounts of iodine corresponding with the number of double linkings in the molecules of mineral oils are subtracted from the actual amounts of iodine fixed by these oils, numbers are obtained which show regular increase with the molecular weight of the oils. This progressive power for fixing iodine appears to be due to changes wrought in the oils during the fractional distillation employed in their manufacture, these changes being analogous to those determining the dissociation reactions of the "cracking" process. Latent molecular instability of the oils is, indeed, rendered apparent by the formation of acid products when the oils, in benzene solution, undergo oxidation in the air under the influence of light. This photochemical action proceeds the more rapidly, the greater the number of double linkings in the molecule of the original oil. T. H. P.

Analysis in Tanning Chemistry. G. Grasser. (*Collegium,* 1921, 224–227; *Chem. Abstr.*, 1921, **15,** 3411.)—A method is given for controlling de-liming by the use of acid and varying amounts of salt, the solution being titrated after two to three hours' treatment, and the skin pressed and weighed to determine which solution has the least swelling action. Bromine water in moderate excess precipitates pyrogallol tannins, and in large excess dissolves catechu tannins. In the lime water test the precipitate should be brought to the surface, since oxygen

is required to effect the change of colour from green to red or violet in the case of galls, catechu or mimosa. On evaporating to dryness a dilute extract of sulphited quebracho, without the addition of acid, the characteristic reaction given by mimosa or quebracho with sulphuric acid is obtained. Since the three bath chrome liquors contain both chromic salts and chromic acids, the total chromium is estimated by means of sodium peroxide, the chromic acid is estimated volumetrically with, for example, iron alum and dichromate, and the chrome alum is found by difference. In analysing the second bath in the two bath process the following estimations are made: (*a*) Total sulphur dioxide by means of iodine; (*b*) total acid by titration; and both are calculated as H_2SO_3. If (*a*) is less than (*b*), free sulphuric acid is present, whilst if (*a*) exceeds (*b*), unchanged thiosulphate is present.
R. F. I.

Apparatus for Technical Gas Analysis. H. M. Lowe. (*J. Soc. Chem. Ind.*, **1922, 41,** 11–12T.)—An ordinary 100 c.c. gas burette is connected at the lower end with a levelling bottle containing dilute sulphuric acid, and at the top by means of rubber pressure tubing permanently with a single gas pipette bulb which serves for all absorptions and for explosion, two platinum wires being fused through the wall for this purpose. A three-way stopcock is fused on to the top of the pipette, one arm of which communicates with the burette, whilst the third serves for introducing or expelling the gases and reagents. The lower end of the pipette is connected with a levelling bulb which contains mercury, and a stopcock is provided in the tube leading from the bottom of the pipette. By suitable manipulation the gas under examination is run into the pipette and transferred to the burette. About 10 c.c. of the reagent are then drawn into the pipette where it floats upon the mercury and the gas is then run in from the burette, the pipette being gently agitated until absorption is complete and the residual gas again transferred to the burette where it is measured. The reagent is then expelled from the apparatus through the three-way stopcock, and a second one substituted if required. The apparatus is simply manipulated, yields much more accurate results than the Orsat instrument, and possesses the further advantage of using a small amount only of fresh reagent for each absorption, thus minimising the loss of gas owing to solubility. The apparatus may also be applied to the estimation of ammonia in waste ammonia liquors by introducing 20 c.c. of the liquor and then sodium hypochlorite solution, and measuring the volume of nitrogen evolved.
T. J. W.

Formation of Oxides of Nitrogen in the Slow Combustion and Explosion Methods in Gas Analyses. G. W. Jones and W. L. Parker. (*J. Ind. Eng. Chem.*, 1921, **13,** 1154–1157.)—In the slow combustion method, the quantity of nitrogen oxides produced is not more than 0·003 c.c. if the time of burning is not more than three minutes and the platinum wire is not heated beyond a bright yellow. Nitrogen oxides are not formed in the explosion method when air is used as the oxygen supply, but appreciable quantities are produced when mixtures of air and oxygen are employed; the error introduced by this means may amount to

2 per cent. The formation of nitrogen oxides in the explosion method is due to the flame temperature developed by the gas mixture when exploded rather than to the sparking across the electrodes; the addition of oxygen raises the flame temperature and reaches a critical point above which nitrogen oxides are produced in appreciable quantities. W. P. S.

Estimation of Total Sulphur in Coal Gas. A. Klemmer. (*Chem. Zeit.*, 1922, **46,** 79.)—The gas is made to pass a Drehschmidt flask containing 10 c.c. of perhydrol and 80 c.c. of strong caustic soda, which react together, with the formation of an abundant crystalline precipitate of hydrated sodium peroxide, $Na_2O_2 \cdot 8H_2O$. This compound quantitatively converts hydrogen sulphide, carbon oxysulphide, carbon disulphide, and mercaptans into sulphuric acid; thiophene is not affected, but is present in negligible amounts. The gas may be passed at the rate of 100 litres per hour with the use of a single flask. The contents are rinsed into a 500 c.c. beaker, acidified with hydrochloric acid, boiled to decompose hydrogen peroxide, and the sulphate precipitated with barium chloride. W. R. S.

Inorganic Analysis.

Separation of Silver and Mercury. I. M. Kolthoff. (*Pharm. Weekblad*, 1921, **58,** 1680–1683.)—The ordinary method of detecting silver in the presence of mercury fails when only a small amount of silver is present; for, on treating mercurous chloride with ammonia, ammonium chloride and the compound NH_2Hg_2Cl are formed, and the latter rapidly decomposes into NH_2HgCl and metallic mercury. When silver chloride is also present it reacts with the mercury to form ammonium chloride NH_2HgCl and metallic silver. Hence it is preferable to wash the precipitate of the mixed chlorides with hot water, to remove lead chloride, to treat it with a 2 per cent. solution of potassium cyanide, and to filter the mixture. A black residue (due to the decomposition of the mercurous cyanide into mercuric cyanide and mercury) indicates the presence of mercury, whilst silver is detected by adding hydrochloric acid to the filtrate. After separation of the precipitate of silver chloride the filtrate is tested for mercury by means of sodium sulphide. In this way it is possible to detect 0·1 per cent. of silver in the presence of mercury or lead, or 0·15 per cent. of mercury in the presence of silver.

Separation and Estimation of Copper, Lead, Antimony and Tin: Analysis of White Metal. A. Kling and A. Lassieur. (*Comptes rend.*, 1921, **173,** 1081–1082.)—The method previously described for the separation of tin and antimony by means of hydrofluoric acid, and for the subsequent estimation of the tin by means of cupferron (ANALYST, 1920, **45,** 275) is now adapted to the analysis of white metal. The alloy (0·5 grm.) is attacked by 10 c.c. of concentrated hydrochloric acid in presence of potassium chlorate, and the resulting solution diluted to about 100 c.c. and neutralised with sodium carbonate in presence of methyl orange. The precipitate formed is dissolved by adding 4–5 grms. of tartaric acid, and heating the solution gently. The cold liquid is transferred to an Erlenmeyer flask coated inside with paraffin wax, mixed with 10 c.c. of concentrated hydrofluoric acid, left for 30 minutes, and then treated with 10 grms. of crystallised sodium acetate and 1 c.c. of glacial acetic acid and made up to about 300 c.c. with water; any lead present is precipitated as the white fluoride. The solution is treated gradually with 20 c.c. of 10 per cent. sodium sulphide solution, mixed and allowed to stand till it clears; the copper, lead and antimony are precipitated as sulphides, whilst the tin remains in solution as complex fluoride. The precipitate is filtered off, washed with hydrogen sulphide solution, and then treated with 80 c.c. of sodium sulphide solution (sp. gr. 1·14) in several portions, this dissolving the antimony; the solution thus obtained is mixed with 60 c.c. of water and 4 grms. of potassium cyanide and electrolysed for 20 minutes with a current of 3–4 ampères, and the deposit of antimony weighed. The copper and lead sulphides are dissolved in 30 c.c. of nitric acid (36° Bè.), and the solution made up to 100-120 c.c. with water and electrolysed for 20 minutes with a current of 4 to 5 ampères; the lead peroxide deposited on the anode and the copper deposited on the cathode are weighed. The hydrofluoric acid solution separated from the lead, copper and antimony is treated with 10–15 grms. of boric acid, all subsequent operations being carried out in ordinary glass apparatus. The tin sulphide, precipitated by the boric acid, is redissolved by boiling the solution with hydrogen peroxide, which is added when most of the hydrogen sulphide has been driven off by·heating. The clear liquid is cooled and made up to 400 c.c., an aliquot part treated with 10 c.c. of concentrated hydrochloric acid and 10 grms. of ammonium oxalate and electrolysed for 20 minutes with a current of 4–5 ampères, and the deposit of tin weighed; the tin may also be estimated by means of cupferron. T. H. P.

Estimation of minute traces of Arsenic in Silicate Rocks. O. Hackl. (*Chem. Zeit.*, 1921, **45**, 1169.)—The finely powdered sample (10 grms.) is heated to 250° C. in a stream of dry carbon dioxide and bromine (produced by passing carbon dioxide through a wash bottle containing bromine), the arsenic and antimony bromides are collected in 10 c.c. of sulphuric acid (10 per cent.) in a Volhard's absorption apparatus, evaporated with a little sulphuric acid and the residue dissolved in water and tested by Gutzeit's method. The method possesses the advantages that comparatively large amounts of sample may be used, and that the arsenic is obtained free from other substances except antimony. R. G. P.

Volumetric Estimation of Zinc. E. Monasch. (*Pharm. Weekblad*, 1921, **58**, 1652–1656.)—In the potassium mercuric thiocyanate method of estimating zinc a known excess of a standard solution of the reagent is added in the presence of nitric acid, the zinc mercuric thiocyanate separated, and the excess of potassium mercuric thiocyanate in the filtrate titrated with mercuric nitrate solution, ferric ammonium sulphate being used as indicator. The method is not applicable in the presence of certain other metals which also give a precipitate with potassium mercuric thiocyanate. Thus cobalt gives a blue precipitate, cadmium a yellow, and copper a green precipitate. Stannous salts cause a separation of metallic mercury. Ferrous, manganese, nickel and chromic salts, by themselves, give no precipitate.

Zinc can only be titrated directly in the presence of ferric and aluminium salts, and any ferrous salts present should be oxidised to ferric salts by means of hydrogen peroxide (not potassium permanganate).

Estimation of Magnesium in Commercial Nickel. K. Chalupny and K. Breisch. (*Chem. Zeit.*, 1922, **46,** 91.)—Minute quantities of magnesium may be precipitated quantitatively as phosphate in presence of large amounts of nickel after conversion of the latter into nickel potassium cyanide. The metal (10–20 grms.) is dissolved in nitric acid in a flask, the solution transferred to a dish and evaporated twice to dryness with hydrochloric acid, the residue dissolved in dilute acid, and the silica filtered off. The filtrate is digested hot with 10 grms. of ammonium chloride, ammonia, and bromine water to precipitate iron, aluminium, manganese, and lead, which are filtered off. The last filtrate is nearly neutralised with hydrochloric acid and treated with a freshly-made filtered solution of pure potassium cyanide (50 grms. per 10 grms. nickel), followed by 20 c.c. of a 10 per cent. solution of disodium phosphate, and one-third of the total bulk of strong ammonia added gradually whilst stirring. After standing overnight, the liquid is filtered, the precipitate washed with dilute ammonia till free from nickel, and dissolved in warm dilute hydrochloric acid; the magnesium is re-precipitated in a small beaker with a little sodium phosphate and one-third the bulk of strong ammonia solution. After several hours' standing, the precipitate is filtered off on a Gooch crucible, washed with ammonia solution, dried, and ignited to pyrophosphate. W. R. S.

Electrolytic Estimation of Antimony. H. Angenot. (*Bull. Soc. Chim. Belg.*, 1921, **30,** 268–270.)—Electrolytic deposition of antimony from solutions containing 80 c.c. of saturated sodium sulphide and 30 c.c. of 30 per cent. potassium cyanide solution always gives high but fairly concordant results. The correction factor 0·9762 is recommended for quantities exceeding 0·1 grm., the metal being deposited on a dull platinum gauze cathode at 65°–70° C. with a current of 1 amp.; this is in close agreement with Hallmann's factor 0·9785. When a platinum dish slightly corroded by *aqua regia* was used, the results were about 1·7 per cent. higher than with a gauze cathode. W. R. S.

Estimation of Thorium in Monazite Sand by an Emanation Method. H. H. Helmick. (*J. Amer. Chem. Soc.*, 1921, **43,** 2003–2014.)—Cartledge's method (ANALYST, 1919, **44,** 115) is subject to errors due to adsorption of thorium X by matter suspended in solution, by filters, and by the walls of vessels used. These errors are avoided by using only one vessel and bringing about complete solution of the sand without filtration. The method described consists in fusing the sand with metaphosphoric acid and potassium hydrogen fluoride, and dissolving the melt in hot orthophosphoric acid. The solution is transferred to a specially constructed closed vessel, from which the emanation is drawn by suction into the electroscope. The original paper (with 8 illustrations) must be consulted for the description of the apparatus used and details of procedure. W. R. S.

Apparatus.

Graded Seal for Joining Pyrex to Lead Glass. W. C. Taylor and A. Bailey. (*J. Ind. Eng. Chem.*, 1921, **13,** 1158.)—The seal consists of five lead-free borosilicate glasses intermediate between Pyrex glass and lead glass; in making a joint with the graded seal, the low expansion (Pyrex) end is heated with the next consecutive glass, and the join between the two is blown in the usual way. During cooling, the lower expansion glass is re-heated, so that on final cooling it will pass through a greater range in temperature and thus approach more nearly the size of its nearest neighbour. The operation is repeated until the lead glass is finally sealed into place. W. P. S.

Reviews.

A TEXT BOOK OF ANALYSIS OF INORGANIC SUBSTANCES. By S. A. KAY, D.Sc. Pp. viii+80. London: Gurney & Jackson. 1921. Price 7s. 6d. net.

Yet another book on Quantitative Analysis, but one which can be thoroughly recommended for classwork with beginners. Not too big (eighty pages only), nor overloaded with unnecessary detail, it deals adequately with the commoner metallic and non-metallic radicals, and clearly sets out the usual methods of inorganic analysis. The book opens with a few pages of general instruction, followed by an explanation of the grouping of radicals for analytical purposes, with some useful preliminary exercises. The remaining sixty pages are devoted to systematic analysis of the ordinary type, with the addition of special paragraphs on alloys, minerals, glasses, etc. The main text is fully interspersed with notes, so that the student should have no difficulty in understanding thoroughly the reason for each step, and in avoiding many pitfalls that beset the beginner's path; in this way much time is likely to be saved, and the student will not be so dependent on the teacher as is frequently the case. More attention is directed to the preliminary examination of substances than many would consider desirable, and no less than six types of dry test are described. On the other hand only three organic acids receive notice; subsequent editions would probably be improved by the inclusion of one or two more.

The book contains a short index, and some blank pages for additional notes; furthermore it is well printed in clear type—a point of importance in a manual for laboratory work. A. F. KITCHING.

SOME MICRO-CHEMICAL TESTS FOR ALKALOIDS. CHARLES H. STEPHENSON. Pp. 110, with 27 plates. London: Charles Griffin & Co. 1921. Price 21s. net.

There are but few books which deal with the identification of alkaloids, and the most important of them is written in German, namely, "*Beitrage zur mikrochemischen Analyse Einiger Alkaloide und Drogen,*" Alide Grutterink, 1910. The present volume will prove helpful to all interested in the subject, the more so in that it contains the result of much original work. In it will be found a description of the crystalline precipitates which alkaloids give with such reagents as gold, platinum, palladium, mercury and zinc chlorides, phosphotungstic, phosphomolybdic and picric acids, etc. The micro-chemical appearance of the crystals is described, as well as the best conditions for their formation, and the value of the book is greatly enhanced by a series of beautiful micro-photographs, some 162 in all.

It is very difficult in the case of many alkaloids to identify them when only small amounts are available. Apart from physiological tests, it is customary to rely upon colour reactions and upon the crystalline and amorphous precipitates resulting from the addition of various reagents, but, especially where the material tested is likely to be contaminated with impurities, such chemical tests can, as a rule, only provide contributory evidence of identity, and, unfortunately, extracted alkaloids, as obtained in the course of analysis, are generally impure.

In the hands of those with much experience of alkaloids the information given in this book will prove of great value. There is, however, a danger lest the uninitiated may place too great reliance upon the superficial appearance of the crystals obtained. The appearance and characteristics of groups of crystals vary greatly according to the degree of purity, concentration and temperature of the liquid in which they form, so that, apart from actual goniometric measurements, crystalline form is apt to prove deceptive. The reviewer places greater reliance upon determinations of melting point of such crystalline deposits, and it is surprising how minute an amount may suffice for this purpose in careful

The book contains a record of a very large amount of experimental work which has not been published elsewhere. The precipitates of some 51 different alkaloids are described, and in most cases the reactions with 35 different reagents have been tried. It is consequently a notable contribution to the subject of which it treats.

A distinction is made between amorphous and crystalline precipitates. The question whether an amorphous or crystalline precipitate is obtained cannot always be regarded as conclusive evidence. For instance, in the famous Crippen murder case it was stated that hyoscine salts gave an amorphous precipitate with bromine water, and in the evidence much reliance was placed upon this test, but it has subsequently been shown that, even at dilutions of 1 in 1000, the precipitate obtained on the addition of bromine water to hyoscine salts rapidly changes from the amorphous to the crystalline state.

In addition to the description of crystalline precipitates, a full account is given of the melting points and chemical examination of the various alkaloids employed in the investigations.

The book is excellently printed and the plates are well produced.

FRANCIS H. CARR.

MICROBIOLOGY. Edited by CHARLES E. MARSHALL. 3rd Edition. Pp. xxviii+ 1043. London: J. & A. Churchill. 1921. Price 21s. net.

This book, described on the title page as a "Text Book of Micro-organisms General and Applied," is written by no less than 25 contributors, mostly Professors of American Universities and Colleges, but representing also France and Germany, each with special knowledge of his subject, under the general editorship of Professor Marshall.

Since the publication of the first edition in 1911 (reprinted with corrections in 1912) this book has been considerably enlarged and improved, and now contains 992 pages excluding the index. It is divided into three distinct parts:—1. Morphological and Cultural ; 2. Physiological ; and 3. Applied. General principles and the key to part 3 are thus dealt with in the first two parts, and part 3, the most interesting and generally useful, is unencumbered with preliminary detail.

Part I.—The cytology of the living cell generally, and of moulds, yeasts, bacteria and protozoa in particular, is admirably dealt with by Guilliermond and Todd with excellent illustrations. In this part, also, the distinctive features of the principal types of moulds and yeasts are described, and the recent classification of bacteria adopted by the Society of American Bacteriologists is given.

Part II. opens with a discussion of the bearing of phenomena in the realm of physical chemistry upon microbial activity, and a brief account is given of ionisation and dissociation, leading up to the true definition of acidity, neutrality and alkalinity, and its determination by means of the hydrogen electrode; surface tension; adsorption; osmosis; and colloidal phenomena. It is to be regretted that a table showing the colour changes of indicators and another showing solutions of known H ion concentration, together with their application to the adjustment of culture media, are not included.

The rest of Part II. deals with chemical studies of the contents of microbial cells; nutrition and metabolism—enzymes and their action, products of metabolism, etc.; physical influences—osmosis, desiccation, temperature, light, electricity, etc.; chemical influences; and mutual influences—symbiosis, etc. Artificial culture media are dealt with in a single short paragraph in Part I., and not under the heading "nutrition." The author has intentionally eliminated laboratory features as far as possible, but, in excluding a discussion upon culture media with special reference to those which have been introduced in recent years (with examples of suitable media for the isolation and study of special types of microorganisms), this elimination has been carried too far.

Part III., which occupies the major portion of this volume, is made up of 10 "Divisions," as follows:—Microbiology (1) of the Air, (2) of Water and Sewage, (3) of the Soil, (4) of Milk and Milk Products, (5) of Foods, (6) of Alcoholic Fermentation and Derived Products, (7) of Special Industries, (8) of Diseases of Man and Domestic Animals, (9) of Diseases of Insects, and (10) of Diseases of Plants.

The scope is, of course, enormous, covering as it does almost the whole field of bacteriological science, and it would be unreasonable to expect to find a full treatment of all the subjects dealt with. The contributors have, however, given a very able presentation of the general principles and more important features of their subjects, and a considerable amount of recent work is included.

The section on Water and Sewage is rather disappointing. Nothing has been added since 1912, no reference is made, as regards water, to the recent work of Clark, Lubs, and Levene on the differentiation of the colon-aerogenes group, sterilisation by hypochlorite and chlorine is barely mentioned, and the books recommended for a fuller presentation of the subject do not include the standard works of Houston and Thresh, nor the latest book, "Food and Water," of Savage. The activated sludge process of sewage purification is not mentioned at all.

The section dealing with the Microbiology of Soil was well revised in 1917, and then included a useful discussion of the function of the genus Actinomyces and Protozoa; now further new matter on the colloidal nature of the soil, soil reaction and H ion concentration, and the function of the Moulds in ammonification has been added. A description of the morphology and cultural characteristics of only a few of the soil micro-organisms is given, whereas the usefulness of this book would have been considerably enhanced had a concise but up-to-date description of the distinctive features of such organisms as *B. butyricus*, *B. megatherium* and varieties, *B. mesentericus*, *B. mycoides*, *B. proteus* and varieties, *B. putrificus*, *B. Welchii*, *B. sporogenes*, and other micro-organisms less well known, been included either in this section or elsewhere.

The section on Milk and Milk Products might have been brought more up to date by the incorporation of some of the work of Orla Jensen on the Lactic Acid Bacteria (published in English 1919) and by co-ordinating his work with the work of others, e.g. the identity of *Str. cremoris* (Jensen) the predominant type of the so-called "pure cultures" for butter-making and *Str. lacticus* (Kruse) should have been pointed out, and the fermentation tests given by which this streptococcus may be distinguished from *Str. lactis* (Jensen) and other streptococci. The function of his *Tetracoccus liquefaciens* in producing flavour in certain classes of cheese might have been alluded to, and a description given of suitable media for the isolation and study of micro-organisms of importance in dairy processes, such as whey agar and calcium lactate broth, fat-agar emulsion, etc.

The section on the Microbiology of Foods is full of interest. Under the heading "Controlling Factors in Successful Canning," instructive graphs showing the influence of temperature, number of spores, and speed of rotation upon sterilising time are given by Bigelow. This section includes also Compressed Yeast, Bread, Vegetables preserved by fermentaion, Silage fermentation, etc. A good account of recent work upon the distribution in nature and occurrence in canned vegetables and other foods of *B. botulinus* has been given. In this section the subject of Microbial Food Poisoning is dealt with. As in most German literature, no distinction is made between *B. paratyphosus B*, *B. aertryche*, and *B. suipestifer*, and one finds reference only to *B. paratyphosus*, whereas the last two are distinguishable from the first by absorption of agglutinin tests and have quite a distinct etiological connection, the symptoms of paratyphoid fever and of microbial food poisoning being altogether different. No reference is made to the work of Savage, and his recent work "Food Poisoning and Food Infections" (1920) is not included amongst the references at the end of the chapter. American authors have an unfortunate tendency to overlook English literature.

The section dealing with the Microbiology of Alcohol and Derived Products (Div. VI.) is ably contributed by Bioletti ,and includes Wine, Beer, Cider and Perry, Hydromel or Mead, Distilled Alcohol and Acetic Fermentation.

The Microbiology of Special Industries (Div. VIII.) is quite new, and includes Acetone and Acetic Acid, Lactic Acid, Citric Acid, White Lead, Leather, Indigo and Retting. A little more space might have been devoted to this interesting section, and a fuller description given of the micro-organisms concerned.

"Division VIII." on the Microbiology of Diseases of Man and Domestic Animals covers 246 pages, and includes chapters on Channels of Infection, Immunity and Susceptibility, Manufacture of Vaccines, Manufacture of Anti-sera, etc, Control of Infectious Diseases (giving American Public Health Regulations), and Microbial Diseases of Man and Domestic Animals. The last chapter of this section gives a description of some 90 diseases and of their causative organisms (when known) with cultural characters; these descriptions are necessarily brief, but exceptionally good. The fermentation tests for *B. pullorum* should have been given and contrasted with those for *B. sanguinarium* (not given), and the use of bile salt agar for its isolation might have been indicated. Gordon and Hine's legumin-trypagar for the cultivation of the meningococcus and gonococcus should certainly have been given, and Matthew's trypsinised blood agar for *B. influenzae.* A table showing the cultural reactions of the Typhoid-Paratyphoid-Dysentery group would be a useful addition to this section.

In the last two sections (9) Microbial Diseases of Insects and (10) Microbial Diseases of Plants some 20 and 30 diseases respectively are described with their causative organisms. These two chapters are exceedingly interesting, and provide in a concise form information with which one is least familiar, and at a loss to find elsewhere. Under Nosema Disease of Bees, brief reference should have been made to the Isle of Wight Bee Disease, so long associated with *Nosema apis* and the work of John Rennie, who showed that Tarsonema *Woodi* was the causative parasite.

Notwithstanding the criticisms which this review contains, Professor Marshall's book is certainly one of great value, and will be found very serviceable not merely to students, as his modest claims in the preface almost imply, but to many advanced workers also; for, if something is lacking in detail, it is abundantly made up for in scope. The book is singularly free from printers' errors, the type is excellent and the paper good. In spite of its 1043 pages it is a convenient and handy volume.

D. R. WOOD.

FIXATION OF ATMOSPHERIC NITROGEN. By JOSEPH KNOX, D.Sc. 2nd Edition. London: Gurney & Jackson. 1921. Price 4s. net.

This book is little more than a reprint of the 1st edition, published in 1914, the general arrangement, as well as the main bulk of the text, being unchanged, and the actual volume being increased only from 103 to 113 pages.

The manner in which the subject matter is dealt with is attractive, and the book constitutes a connected and readable account of the diverse processes by which the fixation of nitrogen from the air is effected, and also of the fundamental principles underlying these processes. Theory, indeed, occupies a predominant position throughout the book, which is consequently of especial value to the more advanced chemical student.

In view of the great developments made in the fixation of nitrogen since 1914, expansion of the treatment of certain portions of the subject would seem desirable. Moreover, the bibliography, although moderately complete, contains comparatively few references to the large amount of work published during the past few years.

The author is one of the few writers of chemical text-books who possess the ability to express themselves in fluent and correct English, and he has exercised care to avoid typographical errors.

It is unfortunate that it has been found necessary to double the original price of the book, but, even in this respect, the latter compares favourably with many scientific publications of the present day.

T. H. POPE.

SYNTHETIC TANNINS. By G. GRASSER Translated by F. G. A. ENNA. Pp. viii. + 143. London: Crosby Lockwood. 1922. Price 12s. net.

To the chemist this book is a valuable and useful collection of work on synthetic tannins, but is of very little use to the purely practical leather man from a works' standpoint.

After a comprehensive chapter on the synthesis of vegetable tannins, including the recent work of Fischer and Frendenberg, the synthesis of tanning matters, as distinct from vegetable tannins, is dealt with from the following standpoints:—(1) Aromatic Sulphonic Acids; (2) Condensation of Phenols; (3) Condensation of Napthalene derivatives; (4) Condensation of Anthracene; and and (5) Di-and-tri-phenylmethane groups.

A very interesting table is given, showing the relative behaviour of a large number of organic substances towards gelatin hide powder and pelt respectively. The tanning effects of mixtures and natural products, e.g. phenolsulphonic acid and formaldehyde, are briefly outlined.

The usual chapter on tanning analysis follows, but is amplified by the addition of useful results on the analysis of synthetic tannins (of great importance to the leather trade chemist).

Details are given of the manufacture of a number of the more important synthetic tannins. With regard to their industrial production, it is pointed out that "but few synthetic tannins are to-day of practical and commercial interest." The analysis of leathers containing Neradol C is briefly dealt with.

E. D. MERRY.

THE POPULAR CHEMICAL DICTIONARY. By C. T. KINGZETT, F.I.C. Pp. viii+536, with various figures in the text. London: Ballière, Tyndall and Cox. 1922. Price 31s. net.

The first edition of this work was reviewed in the ANALYST (1920, p. 158), when certain inaccuracies were pointed out; most of these have been rectified in the present enlarged edition.

Although the inclusion of the word "Popular" in the title tends to disarm acute criticism, it must be confessed that there is still much room for improvement. On the whole, inorganic materials appear to be accurately described, but unfortunately the same cannot be said of organic materials, particularly so-called raw materials. As an example, the article on rubber is a good instance, for, apart from various inaccuracies, it appears to contain little that is necessary in a popular treatise and much that is unnecessary. Although the botanical names of certain rubber-yielding plants are quoted (some incorrectly), there is no clear statement that the vast majority of the world's supply is derived from cultivated Para rubber trees (*Hevea brasiliensis*), introduced into Ceylon, Malay, etc., while part of the paragraph on the vulcanisation of rubber is quite obsolete. The information on vegetable oils is often inaccurate. For example, one frequently finds the statement that an oil is "soluble in alcohol," whereas unfortunately this is only accurate for castor oil. Cotton seed oil is mentioned as being used as a lubricant, for which purpose it is certainly not well suited; candle-nut oil (*Aleuritis moluccana* for *Aleurites*, a mistake surviving from the first edition) is not stated to be a drying oil. Palm oil is said to be obtained by crushing the fermented fruits; native oil-makers certainly do frequently allow fruit to ferment, but the practice is not always employed and is unnecessary, and, indeed, highly undesirable. Again, the specific gravity of West African palm oil is given as 0·92—0·93, and this is followed by a statement from a recent publication quoting 0·8586 and 0·8636 for West African and South American oils respectively. Apparently the influence of temperature on specific gravity determinations has been forgotten; in fact, only rarely is any temperature quoted with specific gravity figures.

There are a great many similar inaccuracies in the descriptions of raw products, but the above instances are sufficient to shake one's faith in all references to such materials, and it is to be hoped that these will be carefully revised in the next edition.

RUSSELL G. PELLY.

KELLY'S DIRECTORY OF THE CHEMICAL INDUSTRIES. 15th Edition. Pp. xxxi +856. London: Kelly's Directories, Ltd. 1921. Price 30s.

This useful work of reference was first published in 1869 under the title of *The Directory of Chemists and Druggists*, and contained 488 pages. In 1919 it was renamed the *Directory of Chemical Industries*, and contained 842 pages. In the present edition a large number of additions and alterations has been made, and the size has increased to 856 pages, and the book now covers every industry and trade directly or indirectly connected with the production and sale of chemical products in Great Britain and Ireland. Some years ago Mr. E. G. Clayton pointed out in his *Memoir of Dr. A. H. Hassall* (p. 40) that in the year 1850 there were no names of analytical chemists in the *Post Office Directory*. In 1854 there were eleven, in 1855 twenty, in 1857 twenty-four, and by 1877 the number had risen to fifty-four.

The present publishers have informed the writer that the number of entries under the heading "Analysts" in the *Post Office Directory* was 25 in 1878, 24 in 1888, and 23 in 1922, so that, so far as this was an index, the number of practising analytical chemists in London had kept fairly constant during the last 45 years. In this Chemical Directory, however, there are 198 entries under the heading of Analytical Chemists. The work shows evidence of the same careful compilation as the other directories issued by this firm, and the cut edges of the book are coloured differently to facilitate reference. If we might suggest an improvement, however, it would be a great advantage if the names of the various section headings were printed at the top of each page. EDITOR.

Publications Received.

OFFICIAL YEAR BOOK OF THE SCIENTIFIC AND LEARNED SOCIETIES OF GREAT BRITAIN AND IRELAND. 38th Annual Issue. London: Charles Griffin & Co., Ltd. 1921. Price 15s.

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