

# THE ANALYST

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

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ANNUAL GENERAL MEETING AND ORDINARY MEETING, HELD  
FEBRUARY 3, 1926.

THE Annual General Meeting of the Society was held at the Chemical Society's Rooms, Burlington House, on Wednesday, February 3rd. The President, Mr. Rudd Thompson, F.I.C., was in the chair.

The Hon. Treasurer presented the accounts of the Society for 1925, 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 1926.

The President delivered his Annual Address. Dr. Dyer proposed that a hearty vote of thanks be accorded to the President for his address, and that his permission be asked to print the address in THE ANALYST. This was seconded by Dr. Lampitt, and the motion was carried.

The following were elected as Officers and Council for the year 1926:—

*President.*—E. Richards Bolton.

*Past-Presidents, serving on the Council.*—Leonard Archbutt, A. Chaston Chapman, Bernard Dyer, P. A. Ellis Richards, Alfred Smetham, G. Rudd Thompson, E. W. Voelcker, and J. Augustus Voelcker.

*Vice-Presidents.*—R. L. Collett, C. H. Cribb and E. M. Hawkins.

*Hon. Treasurer.*—Edward Hinks.

*Hon. Secretary.*—F. W. F. Arnaud.

*Other Members of Council.*—L. K. Boseley, H. E. Cox, John Evans, C. A. Hill, L. H. Lampitt, H. T. Lea, T. Macara, S. E. Melling, E. H. Merritt, W. H. Simmons, J. Sorley, and John White.

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An Ordinary Meeting followed the Annual Meeting, the newly-elected President, Mr. E. R. Bolton, F.I.C., being in the chair.

Certificates were read for the first time in favour of:—Messrs. Sydney Back, B.Sc., A.I.C., Howard Henry Bagnall, B.Sc., F.I.C., William Percival Crocker,

Bernard William Alfred Crutchlow, B.Sc., A.I.C., Alec Munro Ferguson, M.A., B.Sc., A.I.C., Ralph Henry Klein, A.I.C., Oswald James Walter Napier, M.A., A.I.C., George Stubbs, C.B.E., F.I.C., Joseph Hughes Williams, B.Sc., F.I.C., and Kenneth Alan Williams, B.Sc., A.I.C.

Certificates were read for the second time in favour of:—Messrs. Guy Chignell, B.Sc., A.I.C., Hugh Gower Watts, B.Sc., A.R.C.S., A.I.C., and Dr. K. Saito.

The following were elected Members of the Society:—Messrs. John Douglas Barrett, B.Sc., A.I.C., Arthur Lerrigo, B.Sc., F.I.C., Oscar Adolf Mendelsohn, B.Sc., Harold Edward Monk, B.Sc., A.I.C., Eric Voelcker, A.R.C.S., A.I.C.

The following papers were read:—"The Determination of Copper in Food-stuffs," by L. H. Lampitt, D.Sc., F.I.C., E. B. Hughes, M.Sc., F.I.C., C. H. F. Fuller, and P. Bilham; "The Occurrence of Arsenic in Apples," by H. E. Cox, Ph.D., F.I.C.; "The Direct Titration of Thallous Salts with Potassium Iodate," by A. J. Berry, M.A.; "The Hot Springs at Nasavusavu," by C. H. Wright, M.A., F.I.C.; and "The Determination of Ascaridole in Chenopodium Oil," by H. Paget, B.A.

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## Death.

We regret to record the death of Sir John Burchmore Harrison, C.M.G., on February 8, in Demerara,

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## Annual Address of the Retiring President.

Two years ago you elected me to the position of President of the Society, an honour highly appreciated by me, and twelve months ago you confirmed your choice by re-electing me to the same office. Now that this second term has come to a close, the time has come for me to hand over things to my successor and to give you a brief account of our activities during the past year. On December the 31st, 1925, our members numbered 515, which I believe is the high-water mark up to the present time, and it is pleasing to note that on the fiftieth year of our existence as a Society we have a membership exceeding 500. We had 9 resignations, and have to regret the loss of the following by death:—Sir Edward Thorpe (Hon. Member), William Joseph Dibdin, Robert Atkinson Oddy, and Robert Walter Oddy. Although the deaths have been few, there are among the number members of great eminence and note. Sir Edward Thorpe, who died at the age of eighty, left behind a record of fine work in many fields. It can be said of him that his contributions to knowledge helped progress in abundant measure; to chemists his celebrated Dictionary of Applied Chemistry filled an immeasurable gap in the literature of the Science, and we as a Society are the poorer by his death.

William Joseph Dibdin, a great-grandchild of the sailor poet, was also one of those pioneers whose honesty of purpose and determined effort have left a legacy of achievement to younger generations. He died at the ripe age of 75.

There is, I think, something pathetic in the death of R. A. Oddy and R. W. Oddy; they were father and son, and the death of the son preceded that of his father; thus, in the one year, two sound chemists so closely related were called from their work.

Our new members during 1925 number 34, one of whom is an honorary member, Professor G. G. Henderson, M.A., D.Sc., F.R.S., F.I.C., President of the Institute of Chemistry, and this influx of new members is a most healthy sign.

During the past year 27 papers were read before the Society, whilst 34, some of which were read in 1924, were published in *THE ANALYST* for 1925. They included 11 on the analysis of foods and drugs, 7 dealing with organic chemistry, 8 with inorganic chemistry, 3 on gas analysis, 4 on physical methods and apparatus, and 1 on forensic chemistry. These comprise a catholic range of interests; they were the means of promoting excellent discussions, and I think it can be truly said that our Society is continuing to fulfil one of its main functions—that of advancing the knowledge of chemistry by the development of new analytical methods. A complete list of these papers will be printed in *THE ANALYST*, so that I do not propose to take up your time with reading this at this moment, but I would like to observe that, among the papers that have attracted much attention, mention should be made of the work of Dr. B. S. Evans on "Nickel, Cobalt and Tin"; Dr. Glasstone's communication on "The Electrolytic Determination of Hydrogen Ion Concentration," and Messrs. Powell and Schoeller's Investigation on Tantalum, Niobium and their Mineral Associates, which last promises to revolutionise the methods of determining these elements. Although it was not published until this year, I must also make special reference to the extremely fine and interesting paper on the "Measurement of Smoke Pollution in City Air," by Dr. J. S. Owens. We see each day in our newspapers reference to the quantity of dust, etc., in the atmosphere, and I am quite sure that until we had the honour of hearing Dr. Owens, very few, if any, of us had the least conception of how scientific and systematic measurements of such were made, the value of which cannot be over-rated in regard to what we all hope for eventually, *i.e.* the diminution and/or prevention of local fogs, and above all, the elimination of those conditions which so largely contribute to the prevention of sunlight from reaching our towns, which is undoubtedly the cause of much undevelopment of human life as it should be.

As a Society we may congratulate ourselves that work of such high value continues to be brought before our members, and it is to be hoped that the fine spirit which prompts original work may long continue to be a distinctive feature in our activities. Our best thanks and appreciation are due to those who contributed these various papers. The papers published in our Journal last year comprise the following:—

"On Certain New Methods for the Determination of Small Quantities of Arsenic, and its Occurrence in Urine and in Fish." By H. E. Cox, M.Sc., Ph.D. (Lond.), F.I.C.

"An Apparatus for the Catalytic Dehydrogenation of Alcohols." By S. G. Willimott, Ph.D., B.Sc.

- "The Influence of Hydrogen Ion Concentration on the Colorimetric Determination of Pyrogallol and Catechol Derivatives." By S. Glasstone, M.Sc., Ph.D., F.I.C.
- "The Determination of Coconut Oil and Butter Fat in Margarine." By G. D. Elsdon, B.Sc., F.I.C., and Percy Smith.
- "The Fat of Goat's Butter." By H. Droop Richmond, F.I.C.
- "The Analytical Value of the Melting Point of the Insoluble Volatile Acids from Fats." By G. Van B. Gilmour, B.Sc. (Lond.), A.R.C.Sc.I., A.I.C.
- "The Use of Mitchell's Ferrous Tartrate Reagent in Qualitative Analysis." By Alan H. Ware.
- "Cinchonine as a Tannin Precipitant with special reference to the Analysis of Cutch and Gambia." By David Hooper, LL.D., F.I.C.
- "On the Absorption of Carbon Monoxide." By H. R. Ambler, B.Sc., A.I.C., and T. Carlton Sutton, M.Sc., F.Inst.P.
- "The Examination of Charred Documents." By C. Ainsworth Mitchell, M.A., F.I.C.
- "The Investigation of Ventilation Conditions." By Robert C. Frederick.
- "The Carbon Error in the Quantitative Deposition of Nickel and Iron from Complex Oxalate Electrolytes." By P. K. Frölich.
- "Lemon Cheese." By G. D. Elsdon, B.Sc., F.I.C.
- "A Simple and Self-contained Spectroscope Lighting Unit." By Robert C. Frederick and E. R. Webster.
- "The Determination of Oxides of Nitrogen (except Nitrous Oxide) in Small Concentration in the Products of Combustion of Coal Gas in Air." By A. G. Francis, B.Sc., F.I.C., and A. T. Parsons, B.Sc., A.I.C.
- "A New Method for Determining Butter Fat." By G. Van B. Gilmour, B.Sc., A.R.C.Sc.I., A.I.C.
- "The Determination of Small Amounts of Iron by Colorimetric Methods." By W. B. Walker, B.Sc., A.I.C.
- "The Quantitative Determination of Cotton, Linen and Wood Fibres in Paper Pulp." By W. Dickson, F.I.C.
- "The Influence of Palm Kernel Meal on the Composition of Bacon Fat." By J. S. Willcox and H. T. Cranfield.
- "A Modified Electrometric Method for the Determination of Hydrogen Ion Concentration." By S. Glasstone, M.Sc., Ph.D.
- "A New Method for the Separation and Determination of Tin in Alloys." By B. S. Evans, M.C., M.B.E., Ph.D., B.Sc., F.I.C.
- "The Adulteration of Conserves, with Special Reference to Pectin, and Agar-agar." By John King, F.I.C.
- "The Detection of Plant Phenols by the Use of Nitrites or Nitric Acid." By Alan H. Ware.
- "A New Colorimetric Method for the Determination of Cobalt in the Presence of Nickel." By B. S. Evans, M.C., M.B.E., Ph.D., B.Sc., F.I.C.
- "The Occurrence of Glass Particles in Foodstuffs." By Arnold R. Tankard, F.I.C., and C. J. H. Stock, B.Sc., F.I.C.
- "Points Arising from the Analytical Standardisation of British Chemical Standards." By C. H. Ridsdale, F.I.C., and N. D. Ridsdale.
- "A Contribution to the Analysis of Milk, Condensed and Desiccated Milk." By Harry Hurst, B.Sc., F.I.C.
- "Glass Filter Apparatus." By Paul H. Prausnitz, Dr.-Ing.
- "The Absorption of Copper during the Digestion of Vegetables artificially coloured with Copper Salts." By I. C. Drummond, D.Sc., F.I.C.

- “Investigations into the Analytical Chemistry of Tantalum, Niobium, and their Mineral Associates.” By Alan R. Powell, and W. R. Schoeller, Ph.D.
- “The Reduction of Chloric Acid and Chlorates by Ferrous Sulphate.” By Cecil O. Harvey, B.Sc., A.R.C.S., A.I.C.
- “The Determination of Sulphates in Guncotton.” By H. B. Duniccliffe, M.A., Sc.D., F.I.C.
- “The Volumetric Determination of Soluble Sulphates by means of Barium Chloride and Potassium Stearate.” By H. Atkinson, B.A., A.I.C.
- “An Electrometric Study of the Separation of the Iodide, Bromide and Chloride of Silver.” By H. T. S. Britton, D.Sc., F.I.C., D.I.C.

It may be of interest to remind you that two of the papers were the outcome of researches under our ANALYTICAL INVESTIGATION SCHEME, namely, “Cinchonine as a Tannin Precipitant,” by Dr. Hooper, and “The Determination of Cotton, Linen and Wood Fibres in Paper,” by Mr. W. Dickson.

The progress of this scheme is most encouraging, and I think fully justifies its inception, for no fewer than seven different investigations are now being carried out, and the Committee has quite recently made three more small grants. Although no direct appeal is being made on behalf of the scheme, it is to be hoped that further financial support may be forthcoming from time to time.

In addition to the papers, forty-five notes on analytical and kindred subjects have been published, and there have been 458 abstracts of papers published in other journals. The popularity of THE ANALYST among publishers as a medium for reviews of books continues to extend, and during the year 66 books have been dealt with by reviewers with specialised knowledge.

The Standing Committee on the Uniformity of Analytical Methods has continued its activities during the past year, numerous meetings of the Essential Oils and Milk Products Sub-Committees having been held, and the progress made has been eminently satisfactory.

Reports and Regulations of Government Departments are regularly printed in full or in summary, and we are also glad to be receiving more reports from Government Chemical Examiners in the various Dominions and Colonies, as well as from Public Analysts at home and abroad. Under the heading of *Legal Notes* much valuable information is being given on points which arise in the Law Courts, and no doubt members will appreciate the extension of this section in our Journal, where only those cases which present unusual features of scientific or legal interest are summarised.

In outlining the work done by your Council during the past year, I feel that special mention should be made of the healthy state of the North of England Section which was launched last year. This offspring of the parent Society has now an excellent band of officers, having as Chairman, Mr. W. H. Roberts; Secretary, Mr. H. T. Lea; Committee, Messrs. J. Wood (Vice-Chairman), W. Marshall, J. R. Stubbs, H. Hurst, Raymond Ross, L. G. Paul, and G. D. Elsdon, and there is here a young growth which portends well for the future of this Section, whose progress we shall watch with a keen parental interest, whilst also hoping that those members who can do so will neglect no opportunity of coming here to our meetings and so keeping in personal touch with us.

Your Council has continued to watch with great vigilance the proceedings of Public and Local Authorities, and has considered from time to time in what way it might best serve the profession and the public either by offers of assistance or by the making of protests. We have worked hand in hand with the Institute of Chemistry in connection with many matters of general interest to chemists, and are sufficiently optimistic to continue to hope that all members of both bodies will ultimately band together in cases of this kind for the welfare of the profession as a whole.

In connection with material affairs, one may note that examples of inadequate remuneration on the part of Public Bodies are still being encountered from time to time. One which might have mention was the case of a Metropolitan Borough which offered in connection with the appointment of a Public Analyst, a fee of 10s. 6d. per sample, and, in view of the fact that the average fee per sample for appointments where the number of samples exceeded 100 was 14s. 8d., a joint letter was written by the Institute of Chemistry and the Society, whilst Public Analysts were at the same time made acquainted with the circumstances. In spite of this, it is to be regretted that a number of candidates offered their services. Three applicants were selected, including one who made his application conditional on a revision of the terms. This candidate withdrew his application on being assured by the Borough Council that no revision of the fees could be entertained. One candidate was selected, and any comment which I might be tempted to make would be so obvious that I shall be content to remark that, without loyal support from each individual, any efforts to secure an adequate degree of recognition of value for qualified service are rendered futile.

In addressing an audience containing so many chemists whose time is largely spent in the examination of foods no apology is needed for the brief reference which I propose to make to the present state of the law of this country relating to the sale of foods.

There is an ever-increasing tendency towards the sale of articles of food in the prepared form rather than in the natural state, and constant vigilance is needed to ensure that the process of preparation has not impaired the wholesomeness and nutritive value of such products, more particularly as the diet of the great mass of our industrial population is somewhat restricted in variety.

The Sale of Foods and Drugs Acts were framed at a period when less artificial conditions prevailed, and it has been necessary from time to time to pass Regulations dealing with certain specific articles. With few exceptions, however, no precise legal definition exists as to what constitutes adulteration in particular cases, decisions in Court being based on legal precedent rather than on explicit definitions.

The question as to whether small quantities of preservatives and artificial colouring matters in foods are harmful or otherwise has for many years occupied the attention of the Medical and our own Profession. Although certain of these are generally acknowledged to be objectionable, it has not, until recently, been considered feasible to prohibit their use, as many manufacturers have contended

that without preservatives it would be impossible to market their goods. The whole matter was very thoroughly considered by a Committee appointed for the purpose, and, as a result of their deliberations, we have the Public Health (Preservatives, &c., in Foods) Regulations, 1925. The terms are admirably precise and unequivocal, and one may venture to predict that in the near future efficient cold storage and transport will replace the indiscriminate use of preservatives. The Regulations referred to may be said to have definitely cleared up the phase of adulteration with which they deal, but much yet remains to be done with regard to the more precise definitions of many important articles of diet in terms of their composition, and I understand that the framing of a new Food and Drugs Act is now under consideration.

After remaining in abeyance for ten years the Milk and Dairies (Consolidation) Act of 1915 has now been put into force, whereby very wide powers are given to the Authorities to secure cleanliness in the production and sale of milk. The clauses relating to tuberculosis will enable infected supplies to be traced to their source and the cause of infection removed. This Act, if effectively applied, will, without doubt, have a far-reaching effect in diminishing the appalling loss of life due to the consumption of milk from infected sources.

In my last address I referred to the Report of the Committee on the Fertilisers and Feeding Stuffs Acts, and expressed the hope that the Society might be given an opportunity of consulting with the Ministry while the Bill was under discussion. Subsequently a further Committee was appointed, and your Council gave instructions that a letter be addressed to the Ministry commenting on the omission from this Committee of any Official Agricultural Analyst for England and Wales, though a representative of Scottish Analysts (Dr. Tocher) was included. To this the Ministry replied that it was their intention to invite a number of representatives of various interests to make their observations and to ask them to confer with the Committee. In this connection the Committee proposed, at a later date, to invite Mr. F. W. Arnaud, among other persons, to criticise the schedules then being printed; Mr. Arnaud's name having been suggested by the Society as one official Agricultural Analyst who might be co-opted. Eventually these schedules were submitted to the Society, and were considered by a Committee composed of representatives of the Society and the Institute of Chemistry, together with representatives of the Ministry; various suggestions were then made by this Committee which were favourably received, having been supported by evidence given by Mr. Arnaud before the Advisory Committee of the Ministry when he represented both the Society and the Institute of Chemistry.

Much time and consideration has been devoted by us to the great question of the Analysis of Prescribed Medicines, and I should not like to tell you how many times this particular item has appeared upon our agenda, but, as a result of many recommendations made more or less officially, especially that a conference should be arranged between the Officers of the Ministry of Health and representatives of the Institute of Chemistry and ourselves, in order to establish a *modus vivendi*, they have only resulted, to my regret, in an arrangement having been made,

apparently with the full approval of the Ministry, between certain particular Analysts and various local Authorities, whereby the analyses of such Prescribed Medicines under the Insurance Act can and will be carried out at certain arranged fees. The attention of our Society was fully drawn to evidence given by the Retail Pharmacists' Union and the Chemists' Defence Association before the Royal Commission of National Health Insurance on the subject of the testing of such Prescribed Medicines.

The trend of this evidence was to question the competence of Public Analysts as a whole to undertake the analysis of Prescribed Medicines on behalf of Insurance Committees, and it was felt that grave imputations of this nature could not be allowed to pass unchallenged.

Accordingly a statement was prepared by a Joint Committee of the Institute and ourselves, and was submitted to the Royal Commission, in which we stated that Public Analysts had been entrusted with the analysis of medicines long before Insurance Committees were appointed or thought of, and would still be required to analyse medicinal preparations in the course of their duties under the Food and Drugs Acts, whatever might be the views held by pharmacists whose preparations and dispensings were thereby controlled.

On the question of competence, the attention of the Commission was drawn to the very nature of the training of Public Analysts, and to the fact that, under the "Regulations as to Competency of Public Analysts" to hold appointments under the Sale of Food and Drugs Act, candidates were required to have undergone a rigorous examination, by an examiner approved by the Ministry of Health, in the subjects of Therapeutics, Pharmacology and Microscopy, and to have proved their familiarity with the drugs and preparations of the British Pharmacopoeia.

Further stress was laid on the fact that the accuracy of Public Analysts up to the present in the analysis of drugs, etc., had been very rarely questioned, and that when adverse reports had been furnished by Public Analysts, almost invariably the Government Laboratory, when appeal was made to them, had confirmed the Public Analyst.

We have, however, this one modicum of consolation in that we are given to understand that our Memorandum referred to above will be printed in the Official Records of the Proceedings of the Royal Commission, and due regard will be paid to these views expressed by us before any decision is taken.

As you are aware, a new edition of the *British Pharmacopoeia* is now in course of preparation, and, as the duties of some of us would include many important points not altogether unconnected with this standard work, it is a matter of great satisfaction for us to know that the General Medical Council have invited us to select two representatives to confer with the Pharmacopoeia Committee and to discuss with them general questions relating to the proposed revision. We have accordingly asked Messrs. Chapman and Hinks to attend on our behalf, and I am sure you will agree that we shall be extremely well



served by these two valued and experienced members whose views will doubtless be of the greatest value to the Committee.

As your representative I attended various meetings of delegates of the National Dairy Congress at the Ministry of Agriculture and Fisheries, and it seemed highly probable that arrangements might be made whereby such Congress might synchronise with the Royal Agricultural Show to be held in 1926, but eventually it was found that there were certain insuperable difficulties, and for the time being, at any rate, the matter appears to be held in abeyance.

One point upon which I should desire to say a few words within the limited time at my disposal is the relation of the Public Analyst to superannuation under the Local Government schemes in force, and, as no doubt you or some of you are aware, certain Local Authorities have schemes more or less of their own under the special Acts of Parliament relating thereto, in some few of which the Public Analyst has been included, but the "Local Government Officers' Superannuation Act" at present is optional, and there is every prospect that this Act may become compulsory rather than permissive.

Should it, however, become compulsory, the position of the Public Analyst does not appear to be fundamentally affected, but from enquiries which have been made where Local Authorities have adopted the Act, it appears that whole-time Public Analysts participate with other Officers, but the position of part-time Analysts is very different, as in the generality of cases, so far as can be ascertained, they have not applied to be placed on the "established list," as there is much indecision as to the possible benefits to be derived, and it would seem probable that much of this indecision is due to the idea that superannuation might mean compulsory retirement at a certain age.

We do, however, know that cases exist in which when application has been made to be placed on the "established list" it has been refused on the ground that the appointment is not a permanent one, but is either terminable at the wish of the Local Authority, or is an annual appointment or terminable only under approval of the Ministry of Health.

Our Sub-Committee upon this subject has done much work by questionnaire, etc., which shows there are very many variants in the terms of appointment; but surely there must be some legal limit, so that Public Analysts may know how they stand, and in my opinion, at any rate, the position should be ascertained once and for all, and not be allowed to continue in this most unsatisfactory condition, and which, again, if I may give it as my own private opinion, is very largely due to indecision and apathy on our part. The whole question has really a very heavy bearing upon security of tenure; if one be included in such a scheme as may shortly obtain, much is done to increase this security, but I admit there are difficulties in perhaps adjusting contributions in relation to fees; yet surely matters of detail are very different from matters of principle, and I sincerely trust that not only will our Sub-Committee not fail to obtain the legal ruling as to our position as quickly as ever possible, but also will not hesitate in keeping the Public Analyst fully alive to *his* part of the scheme; and let us hope that my successor may very

shortly be able to tell you how you *do* stand when authoritative opinion is available.

Perhaps at this stage I might be permitted to mention that during the past year, invitations were accepted by me from the following to dinners and other functions:—The Chemical Society, British Science Guild, Institute of Brewing, Metropolitan Water Board (Opening of Littleton Reservoir by the King and Queen), Society of Clerks of the Peace for Counties, National Physical Laboratory Inspection, Institution of Chemical Engineers, British Chemistry Dinner. With the exception of the last-named dinner, which I was unable to attend—but am pleased to acknowledge my thanks to Mr. P. A. E. Richards, who so kindly deputised for me—it was my pleasure and privilege to represent the Society.

I have further to report that as your President I received numerous cards of invitation to attend meetings, etc., of the various kindred Societies.

Amongst other and numerous pleasures I would like to place on record my great pride in holding office as your President during the jubilee year of the Society, when to mark the historical importance of the occasion the Officers and Members of the Council, past and present, had the honour of entertaining Dr. Dyer to dinner. At this function it was my privilege, on your behalf, to present an address to Dr. Dyer in recognition of his fifty years' membership of the Society, during which period, in addition to having held office both as Secretary and President, he has consistently worked and given his best endeavours for the good of the S.P.A., and, I am happy to say, continues to do this to-day. I feel sure it is our united wish that he may long be spared to join in our various movements and to give us the benefit of his wide and ripe experience of men and matters. On the occasion to which I have just referred there were present no fewer than two-thirds of the past and present members of Council now on the list, which is abundant proof—if such were wanting—of the high esteem in which Dr. Dyer is held amongst his fellows.

In connection with the activities of the Council you may remember that the growing duties of the Hon. Secretary have had our most careful consideration, and it was decided to combine the duties of editor of *THE ANALYST* with those of Secretary, in order that the routine work attaching to the post should be attended to by a Secretary, and thus leave the Hon. Secretary more time to attend to the more technical side of the work. The wisdom of this step has been abundantly proved, for the results have clearly shown that the new arrangement has made for efficiency and smooth working, and the Council have every reason for satisfaction in this matter.

Seeing that you all have practical proof of the extension of scope and the high standard of our Journal, it is, perhaps, unnecessary for me to refer in too great detail to the present status of *THE ANALYST*, but, without question, we can justly claim to rank amongst the number of real scientific publications of the day. There is undoubtedly a growing inclination for our members to communicate papers of acknowledged worth, and we welcome these and most cordially extend our invitation for more contributions. Here I would say what an excellent plan we

have found it to be when authors of papers have sent to us beforehand a resumé of their efforts, as this helps a more extended and cogent discussion. We must, however, all freely recognise that the success of *THE ANALYST* is very largely due to the unceasing efforts of our Editor, and we should indeed prove most ungrateful if we did not accord him our very best thanks, not only for all that he does, but for the manner in which he does his important work. That he is most ably supported by the Publication Committee and our untiring abstractors is also abundantly proved by the growth, not only of the paper, but also by its expansion in ground covered. I am sure you will join with me in according to them all our deep and grateful thanks for all they have done to achieve such successful results. In these days of high taxation we are rarely allowed to lose sight of money matters, and it is to the lasting credit of our Treasurer that we can feel that our finances in his most able hands are splendidly controlled; his statements to the Council are always crisp, concise and comprehensive, and, to my own knowledge, our Treasurer's efforts are always directed to the safeguarding and advancement of the interests of the Society. Indeed, whilst I am not aware of any Scottish ancestry, I feel sure he could graduate with the best from the North of the Tweed in the difficult art of husbanding of pence and controlling expenditure, so that we have good reason to congratulate ourselves upon the efficient wholehearted service rendered by Mr. Hinks.

We must not, and do not, forget, either, the work of our Hon. Secretary, Mr. Bolton. During the many years he has laboured for our Society he has never flagged; his endurance and energy will ever stand out, and, if I may be allowed to offer a personal tribute to him and his work, I would say that without his ever-ready help and assistance my work would have been almost an impossibility, seeing that from the point of distance from the scenes of activity alone, some one has to be at hand to guide the erring footsteps of the President and keep him fully posted in all that transpires, and this especially during the past few months when my absence from amongst you has been most marked. I cannot thank him sufficiently for his constant help in trying, as far as lay in his power, to keep me posted in all that I ought to know, but doubtless this has also enabled him, with his usual caution and canniness, to keep back from me that which in his opinion *should* be kept back, and so to him I tender my personal thanks, and am quite sure that you as individual members of the Society most cordially thank him for all that he has done for us.

Again, a note of the personal; for indeed I should show myself most ungrateful if I did not refer to the wonderful manner in which I have been helped and supported by our Vice-Presidents, as well as by all our other Officers, as for a time when unfortunately it was an utter impossibility for me to be in my place, our Vice-Presidents have not only saved the position, but have done for me that which I feel would not have been so well done had I been there, and the kindly offers of help and support have proved to me that there still exists in the world that which some people claim to be extinct, but which I know to be very much in being, 'the milk of human kindness,' and I am indeed proud to feel that I have had their

support and more than generous help, my gratitude for which mere words are impossible to express.

Turning to the Council generally, I can only tell you that you may have had better, you may have better in the future, but I am convinced it would be impossible for you to have had a finer body of men to watch your interests than those over whom I have had the honour and pleasure to preside; keen to a degree, and always ready to criticise in the most friendly manner, honestly trying to reach wise and sensible decisions even under, at times, most difficult circumstances, not fearing to speak out for or against their colleagues in their various opinions and, above all, giving their time ungrudgingly, for the attendances at meetings have been very large, frequently requiring additional chairs to be brought into the room. All of these facts go to show that they had their hearts in their work, and I can assure you the interests of you all, varied as they are, have been in most capable hands, and I should wish to take this opportunity of tendering to them my unadulterated thanks for kindly consideration shown to me, and, if as I fear has been the case on many an occasion when I have appeared either unutterably stupid, pig-headed or even objectionable to them collectively and individually, would beg to assure them that my "bark was worse than my bite," and the fact of my having been brought in contact with men of such varied temperament, varied views and varied outlook (nay, even varied methods of expressing approval or disapproval) will ever be regarded by me as the finish of my education, and from this association I have learned much.

It would seem probably to be entirely out of order for me to make any reference to the result of the Ballot which is to be declared later this evening, but seeing that your Council were so very unanimous in the selection of a proposed list of Officers and Council for the ensuing year that it may be taken for granted you will elect those Members put forward, I feel I must make a short reference to one or two changes which will probably follow within a very few minutes as to the constitution of the Society: You have to elect a new President. A name has been put before you for adoption, which I am perfectly certain will meet with unanimous support, that of Mr. E. R. Bolton. After all, I cannot but feel sorry for him in several respects—if, as I anticipate, you should elect him to the important office which I am about to vacate, you will have actually removed him from that position which he has filled with such admirable tact and ability for the last 11 years, for very many of which he was so intimately associated with my highly esteemed predecessor, Mr. P. A. E. Richards, over which period he has not missed, I believe, a single Ordinary or Council Meeting—in fact, I think I am right in saying that he has attended every Ordinary Meeting of the Society since he first became a Member in 1905. The sympathy of every right thinking man and woman will go out to anyone who "loses his job" through no fault of his own except that his "bosses" see fit to turn him out, but he has this consolation, that "he goes up one"—personally I think he goes up or will go up very much more than "one," and this may serve to temper the severity of the blow which removes him from his so much beloved Minute Book. I hope sincerely he will live to overcome his deprivation,

and personally I have but little doubt but that he *will*, and make an equal, if not superior, mark upon the annals of the Society in his new sphere of action.

I must not anticipate too much, however, for in these days of the secrecy of the ballot box one never knows what surprises may be in store, but I think again I am pretty safe in assuming who will be Mr. Bolton's successor, a member of our Society who has already distinguished himself in his help and activities for the Society, who, in my humble opinion, under that air of reticence and bashfulness, will prove a most worthy successor, for he is a man of ideas and sound ideas at that. In Mr. Arnaud you will most certainly have a man of high ideals and honesty of purpose which he has shown in his help to the Society in many ways in the past, and when it comes to his taking his new position and in due course to represent us upon official occasions, you will have the satisfaction of knowing our affairs to be in most capable and energetic hands.

It would, however, be most reprehensible on my part if I failed also to make reference to the work of Mr. Pelly, who is retiring from his position of Assistant Hon. Secretary after many years of yeoman service. I should wish to tell Mr. Pelly before you all how much I personally have appreciated his work; at our usual pre-Council meetings when, as you are aware, I have made a point of trying to familiarise myself with the programme we have had in front of us, Mr. Pelly has been at my right hand, though usually separated by a space occupied by the Hon. Secretary, but he has been there, and the kindly and systematic interest he has taken in his work for the Society deserves the highest thanks of us all, myself to a marked extent, for the attention he has shown to me when trying to probe the inner secrets of the Minute Book and correspondence relative to the Society.

Together with the very real pleasure I feel in according my thanks, I have also the great regret that, owing to health reasons and a most anxious time occasioned by these misfortunes, I was prevented from attending the whole of the meetings this year. To have done so was my continued ambition during my term as your President, and I can assure you that my inability to have fulfilled my programme has been a most bitter personal disappointment. I have the feeling that, through no fault of my own, I have unwittingly thrown a large share of my own responsibilities on to other shoulders, and yet, in having to do this, I have found what a great help can be forthcoming from friends, to whom I offer my sincere thanks.

The whole experience has been such, that, whilst I commenced with many old friendships, I have found that these have been without exception intensified, and this alone has been a wonderful stay and help to me. I have no cause to regret the time I have been prominently associated with the various Members of the Council; on the contrary, I feel under a debt of obligation to them, whilst, without being unduly immodest, I feel I can say with truth that it has been my privilege to make many new friends.

These features have contributed very largely to what has been for me a most happy experience and will be a wonderful memory.

Upon occasion, you may not have subscribed to my views in their entirety, but I am led to hope that, on the whole, we have ultimately agreed as to what

might be the soundest policy in the affairs of the Society, for this has been my sole desire.

At the conclusion of my last address I dwelt at some length upon the state of chemistry as a profession and the constant changes which are being manifested. It is in the nature of all things to change, and also very natural, I imagine, for one to become rather more sensitive to change as the years pass; but future conditions and prospects will eventually be in the hands of the younger generation who are constantly, and rightly, coming into their own.

Therefore, without unduly voicing opinions of an old school, I would venture to suggest that there is a fine tradition in the profession; a tradition to be treasured, preserved, and, wherever possible, to be enhanced.

Do not forget, I would say, that in the process of healthy and honest rivalry there is always room for the helping hand; keep the welfare of the whole prominently in view, for with a concerted effort towards this idea, the future of the profession in general will not be other than worthy of a noble past.

In conclusion, I would once more in all sincerity thank you for the honour you have conferred upon me in asking me to hold office as your President during the past two years, and assure you that, whilst I am only too conscious of my own shortcomings, I have appreciated the consistent kindness shown by you all towards me and the very great help that I have received at your hands.

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## The Occurrence of Arsenic in Apples.

By H. E. COX, M.Sc., Ph.D., F.I.C.

*(Read at the Meeting, February 3, 1926.)*

ALTHOUGH the discovery of traces of arsenic on apples and other fruit is not new, it is only within the last few months that important quantities have been found or that any cases of illness have been traced to this cause. The varied statements which have appeared in the daily press, as a result of certain Police Court proceedings in respect of contaminated apples, have not all been correct, so it seems desirable to detail to this Society some of the facts.

There is clear evidence that no arsenic is natural to apples; and further that such contamination is not likely to arise through the soil. Dr. Voelcker's experiments at Woburn have shown that vegetables grown in arsenic-contaminated soil are quite free from this impurity. The possibility of contamination by spraying has been considered from time to time in the past, and so recently as September last, the Ministry of Agriculture discussed the presence of arsenic in 24 samples of apples and found quite negligible quantities in 20, and only in one sample a quantity exceeding 1/100th of a grain per lb. So long ago as 1846 the use of arsenites for the destruction of insects was forbidden in France, but the order seems now to have

lapsed, possibly because of statements in American papers that the poison does not enter into the plant treated, and that that remaining on the surface completely disappears in three weeks. In October last two cases of apparent poisoning by apples were reported to the Medical Officer of Health by the Borough of Hampstead, and suspicion fell upon certain imported Jonathans. On examination of these I found them to contain:—

Arsenic as arsenious oxide 8 parts per million  
Lead .. .. . 28 do.

on the whole apple, or 40 and 110 parts per million, respectively, on the skin. This rather large quantity means that a person eating one of these apples of an average weight of  $\frac{1}{4}$  lb. would take a dose of 3 or 4 milligrams of lead arsenate.

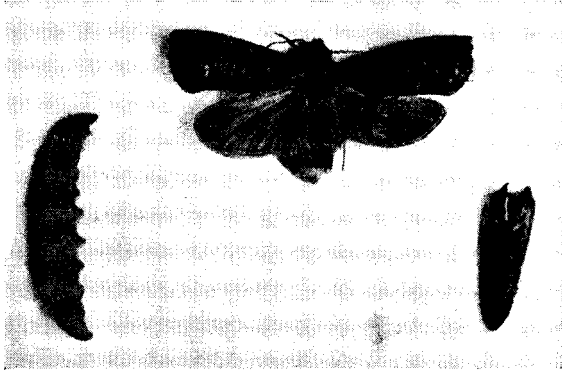
Following on this, a number of samples were taken and examined, with results as under:—

Variety.	No. of Samples.	As <sub>2</sub> O <sub>3</sub> Parts per million.
Jonathan	2	Nil
"	10	0.5-1.0
"	3	1.0-1.5
"	1	1.6
"	1	4.0
"	3	5.0
"	1	10.0
"	1	15.0
Unknown	3	Nil
King David	5	0.5-1.0
Newtown	2	0.5-1.0
"	3	1.0-1.5
"	1	3.0
"	1	4.0
"	2	5.0

So far as my information goes, all these are American apples, but it is somewhat disquieting to find that out of a batch of 39 samples examined, only 5 were quite free from arsenic. A number of English and Canadian apples examined up to the present date have been found free from such contamination.

In considering the question of whether or not these quantities might induce poisonous symptoms, it may be pointed out that in several instances the quantity of arsenic is equivalent to a pharmacopoeial dose of arsenic; boys or other persons might conceivably eat several apples, including the skins, and so take a dose which might be regarded as somewhat large in relation to their age. In the case of adults there is the further point, to which reference is made in the Final Report of the Royal Commission on Arsenical Poisoning (p. 12, § 30), that evidence was given of numerous instances of exceptional susceptibility to poisoning by arsenic, including a case in which symptoms of poisoning followed the medicinal administration of a single dose of one-fiftieth of a grain. The Commission pointed out that there was no doubt that many persons are specially susceptible.

ORIGIN OF THE ARSENIC.—There can be no reasonable doubt that the presence of the arsenic is due to the use of arsenates as insecticides and the spraying of the fruit. The most troublesome pest is the codlin moth (*Carpocapsa pomonella*), (see Fig.). In the U.S.A. it appears that this moth has been known to affect as much as 100 per cent. of unsprayed fruit, and that by the use of lead arsenate



*Carpocapsa pomonella*. Imago, larva and pupa.  $\times 2$ .

sprays the extent of the infection can be reduced to about 4 per cent. The codlin moth is well known in England, but its ravages are not so extensive as in the States.

The dangers of such a spray process would appear to be obvious, but investigations abroad seem to have given the dangerous impression that it may be applied with impunity. It is recognised that spraying during the flowering stage may lead to the enclosure of arsenic in the core of the apple, and that the absence of rain or too late spraying might render the presence of this poison on the edible part of the plant dangerous. According to Bourcart, to eliminate the codlin moth it is necessary to destroy it quite soon after the hatching of the caterpillar, as this lives on the leaves until such time as the apples are big enough to be penetrated. A first spraying is required immediately after the fall of the flower, and the second a week later; spraying during the flowering period is liable to kill bees or other fertilising insects.

It would appear that, owing to seasonal conditions last year, spraying took place at much too late a date, but laboratory experiments on washing the fruit suggest that this is not a complete explanation. It may be noted, too, that according to American authors no arsenic appears in the interior of sprayed fruit.

COMPOSITION OF THE ARSENICAL SPRAYS.—Although copper arsenite, copper aceto-arsenite, calcium arsenate and other arsenicals are all fairly efficient for the destruction of phytophagous insects, the particular one favoured for the codlin moth is lead arsenate, as it has no appreciable scorching action on the leaves. The chemistry of this compound, which is not quite simple, is discussed by Pickering (*Woburn Experimental Farm Report*, No. 6, 1906). When prepared from a solution



of lead acetate and sodium arsenate, as is usual, the formula is  $Pb_3(AsO_4)_2$  and some acetic acid is formed; when lead nitrate is used the arsenate is  $Pb_2H_2(AsO_4)_2$ . Pickering's formula for the spray is:—"Pure sodium arsenate (crystals), 35 ozs.; lead acetate, 70 ozs.; water, 100 gallons. Other formulae include small quantities of glucose to make insoluble lead arsenate adhere better to the leaves or fruit. The presence of such adhesives would appear to add to the dangers of the process.\*

It has been suggested that Bordeaux mixture may contain arsenic as an impurity, but it is doubtful whether any large quantity of arsenic in apples could be accounted for in this way.

The proportions of lead found in the samples examined were such as to render it certain that lead arsenate was the spray used.

**DISTRIBUTION OF THE ARSENIC.**—It has been freely stated that the arsenic has been wholly confined to the skin, and also mainly in the region of the stalk and the calyx. This is not quite correct; thus on some apples heavily sprayed in the laboratory the following results were obtained:

	1.	2.
On the whole apples .. ..	24	7 parts per million
On the skin .. ..	100	33 do.
In the "flesh" .. ..	3.3	1.3 do.

These apples had been suspended for 48 hours before testing. This seems to show that some absorption does actually take place, although the conditions were not quite the same as those obtaining in the field. The spray used was made up from Pickering's formula, in which the lead is in slight excess; it is quite likely that an excess of soluble arsenate would occasion a more considerable absorption.

Other samples have been found to contain small, though definite quantities in the core. This is due, doubtless, to the spraying of the flowers rather than to absorption. In one such apple, which contained 4.5 parts per million on the whole fruit, 0.75 part was found in the core.

With regard to the quantities which may appear on the surface, it may be remarked that Cook and McIndoo (*U.S. Dept. Agric. Bull.*, 1147, 1923) found an average of 286 parts per million on dry leaves having received lead arsenate spray. This gives an idea of the relatively large quantity of arsenic which might be found upon the surface of an apple.

**THE REMOVAL OF ARSENATE BY RAIN.**—Notwithstanding statements to the contrary, it is doubtful whether rain really can remove all trace of lead arsenate. This compound is very insoluble, and, besides the tendency to adhere mechanically, there is the possibility of absorption or some chemical combination with the proteins. Experiments on this point gave the following results:—Apples A and B were sprayed heavily and as equally as possible; A was tested after 48 hours, and B, after the same, time was washed in running water for 20 minutes. They were then found to contain:—

A. Unwashed .. ..	24 parts per million
B. Washed .. ..	5 parts per million

\* Since writing this paper my attention has been drawn to an advertisement for a particular make of arsenic spray which is "guaranteed not to wash off."—H.E.C.

Three other samples, C, D and E, were less heavily sprayed. C was examined in the unwashed state, D after washing in water and rubbing with the fingers, and E after scrubbing with a nail brush. They contained: C, 2.5 parts; D, 1.6 parts; and E, 1.5 parts per million.

These results indicate a small but definite retention of arsenic by the skin. Such retention is well known to analysts, as, for example, in the case of copper in peas or tin in canned fruit. It is clear that rain would not completely remove the arsenate, although most of it would be washed off. Lead arsenate is almost entirely removed from the outside by washing with rubbing in weak (2 per cent.) caustic soda solution.

#### DISCUSSION.

Mr. A. R. TANKARD said that in Hull he had analysed the skins and cores of many apples, but had not found more than  $1/45$  grain of arsenic per pound of apples. The pulp contained no appreciable quantity. He deprecated the prosecution of retailers in this country for the condition of imported fruit, and wondered whether the same attitude would be adopted when Australian apples began to arrive. As English apples were free from arsenic it would appear that lead arsenate was not used for spraying in this country. He also commented on the fact that plaice and other fish naturally contained up to 3 parts per million of arsenic, yet smaller traces in apples were strongly condemned.

Dr. LEVY asked how the arsenic was extracted for the purpose of determination.

Mr. C. L. CLAREMONT sought information as to the law in America regarding the free sale of articles of this kind. Were they allowed over there, more liberty in the use of poisons?

Mr. E. HINKS asked whether treatment with dilute acid was sufficient to extract all the arsenic, or had the author found destruction of the organic matter necessary?

Mr. JOHN WHITE said that the practice followed in Derbyshire was to request the retailers of apples containing an unduly large proportion of arsenic to withdraw them from sale or return them to the wholesale dealer. With regard to the removal of the arsenic by washing, he referred to a sample containing  $1/33$  grain of arsenic per pound. Apples from the same sample were washed by himself, and the quantity of arsenic was thereby reduced to  $1/170$  grain per pound. Apples from the same case were then washed by the vendor, the amount of arsenic remaining being  $1/50$  grain per pound, but a further lot washed by the vendor in presence of the inspector was found to contain only  $1/240$  grain per pound. It appeared that adequate washing of apples would reduce the arsenic substantially. His own experience was that practically the whole of the arsenic was contained in the rind. When the rind contained  $1/40$  grain per pound, the layer next to the skin and the core of the apple contained no arsenic.

Mr. WILLIAM PARTRIDGE drew attention to the uneven distribution of arsenic on individual apples in the same consignment. He quoted a case of four apples, three of which contained  $1/60$  grain per pound and one  $1/80$  grain per pound.

Mr. E. B. HUGHES contended that it was not safe to rely on washing; even when the apples had been cleared of bloom, four-fifths of the arsenic might remain. It was most prominent at the stalk, which could not easily be washed. Efficient sampling was difficult, and very often it was advisable to examine all cases of apples. He, also, had found very little arsenic in the layer below the skin.

Mr. S. F. BURFORD was anxious to know how to divide an apple into three equal parts for the purpose of sampling.

The PRESIDENT commented on the diversity of opinion and experience, and urged that an official inquiry should be made into the whole question.

Dr. COX, in his reply, regretted that it was necessary to prosecute retailers in order to draw attention to the trouble, but there was no other procedure established by the law; he also regretted that the opinion of the Public Analyst was not always asked for, nor, when obtained, acted upon. English apples were sprayed with lead arsenate, but at a suitable stage in their growth, and not shortly before the fruit was full grown and ready for picking. With regard to plaice containing arsenic, he submitted that it was natural to the fish, but that fact could not be accepted as an excuse for *adding* arsenic to other foodstuffs. The arsenic was extracted for determination by means of dilute hydrochloric acid and a little bromine. He, too, would like to know the law in America regarding the presence of arsenic in articles of food, and he agreed that in this country the Ministry of Health should give a definite ruling. It was true that all the arsenic could not be removed by washing the fruit with water, but its quantity could be reduced; possibly washing with caustic soda would remove it completely from the skin.

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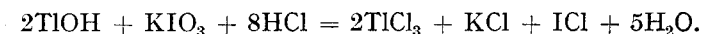
## The Direct Titration of Thallous Salts by Potassium Iodate.

By A. J. BERRY, M.A. (Fellow of Downing College, Cambridge).

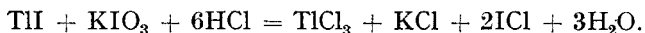
(Read at the Meeting, February 3, 1926.)

ANDREWS has shown that certain oxidisable substances may be analysed by direct titration with potassium iodate in presence of a high concentration of hydrochloric acid (*J. Amer. Chem. Soc.*, 1903, **25**, 756). Under these conditions iodine which is liberated during the reaction is converted into iodine monochloride, hydrolysis of the latter compound being suppressed by the great excess of hydrochloric acid present. The end point of the reaction is determined by the use of chloroform, the titration being carried out with frequent shaking, and is very clearly observed by the violet colour of the iodine dissolved in the chloroform vanishing.

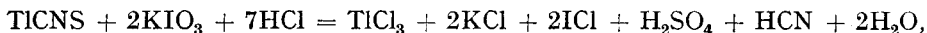
In connection with an investigation of the thallous thallic halides (Berry, *Proc. Camb. Phil. Soc.*, 1924, **22**, 363) it became desirable to confirm the composition of some compounds by an independent method. Preliminary experiments carried out upon a solution of thallous hydroxide of known concentration showed that quantitative oxidation to the tervalent thallic condition could be effected by potassium iodate when a large excess of hydrochloric acid was used, the reaction taking place according to the equation:—



Thallos iodide was also found to be capable of quantitative oxidation, but in this case one molecular proportion of potassium iodate reacts with one molecule of thallos iodide:—



As Jamieson, Levy and Wells (*J. Amer. Chem. Soc.*, 1908, **30**, 760) have applied Andrews' method to the titration of thiocyanates, some experiments were tried on thallos thiocyanate, and, again, it was found that oxidation took place quantitatively in accordance with the equation:



in which two molecular proportions of potassium iodate are equivalent to one of thallos thiocyanate.

The results of these preliminary experiments were invariably about two per cent. too low. Similar low results were obtained when mercurous chloride was titrated (*cf. Jamieson, Amer. J. Sci.*, 1912, **33**, 349). The concentration of the solution of potassium iodate was therefore verified by checking it with reference to very pure iodine, accurately calibrated measuring vessels being used. A standard solution of iodine (20.636 grms. per litre) was titrated with sodium thiosulphate. Measured quantities of the solution of potassium iodate were then allowed to react with excess of potassium iodide acidified with hydrochloric acid, and similarly titrated with sodium thiosulphate. In this case 25 c.c. of the standard iodine solution required 40.9 c.c. of sodium thiosulphate solution, whilst 25 c.c. of potassium iodate, treated as above stated, required 30.65 c.c. From these figures it was found that the concentration of the potassium iodate was 4.340 grms. per litre, as against 4.348 grms. per litre when prepared by direct weighing. As the agreement was within one part in five hundred, it was concluded that the salt was sufficiently pure to permit of standard solutions being prepared by direct weighing. The cause of the low results was therefore to be sought in another direction. It was subsequently found that the hydrochloric acid contained traces of chlorine, and, as quantities of 50 to 100 c.c. of the concentrated acid were used in each titration, the amount of free chlorine was quite sufficient to account for such irregularities as were observed. The hydrochloric acid was easily freed from chlorine by aspirating air through it for a few hours, and analyses carried out with the purified acid upon thallos salts of known composition were quite satisfactory. The following figures may be quoted by way of illustration:

(a) *Thallium sesquichloride*  $\text{TlCl}_3 \cdot 3\text{TlCl}$ .

0.524 gm. with about 80 c.c. of ordinary concentrated hydrochloric acid required 37.2 c.c. of potassium iodate solution (4.345 grms. per litre). This corresponds to 0.362 grms. of thallos chloride or a percentage of 69.1.

0.536 gm. with a similar quantity of purified hydrochloric acid required 38.6 c.c. of potassium iodate solution (4.345 grms. per litre). This result corresponds to 0.375 gm. or 70.0 per cent. of thallos chloride.

The calculated percentage composition of thallium sesquichloride is 69·8 per cent. of thallos chloride and 30·2 per cent. of thallic chloride.

(b) *Thallos thiocyanate.*

0·119 gm. with about 80 c.c. of ordinary hydrochloric acid required 43·4 c.c. of potassium iodate solution (4·345 grms. per litre), equivalent to 0·116 gm. of the salt.

0·115 gm. with a similar quantity of purified hydrochloric acid required 43·55 c.c. of potassium iodate solution (4·345 grms. per litre), equivalent to 0·116 gm. of the salt.

(c) *Thallos hydroxide.* A solution of this base was prepared directly from the metal by atmospheric oxidation in presence of water.

20 c.c. of the solution required 29·3 c.c. of standard sulphuric acid (2·47 grms. per litre), methyl orange being used as indicator. This is equivalent to 15·1 grms. of thallium (calculated as metal) per litre.

20 c.c. of the solution with about 80 c.c. of purified hydrochloric acid required 35·6 c.c. of potassium iodate solution (4·471 grms. per litre), equivalent to 15·2 grms. of thallium (metal) per litre.

TITRATION IN PRESENCE OF BROMIDES.—Special experiments upon a solution of potassium iodide of known concentration showed that the presence of potassium bromide does not interfere with this method of analysis. The iodide and iodate react completely in presence of the great concentration of hydrochloric acid before any liberation of bromine from the bromide takes place. The disappearance of the violet colour of the iodine in the chloroform takes place with great distinctness as the potassium iodate is added gradually from the burette, and the addition of iodate may be continued for a range of at least one c.c. before any visible yellow or brown colour due to bromine makes its appearance. It was therefore decided to verify the composition of thallium dibromide  $TlBr \cdot TlBr_3$ , and the following result was obtained.

0·853 gm. of  $Tl_2Br_4$  with excess of purified hydrochloric acid required 28·0 c.c. of potassium iodate (4·471 grms. per litre). This corresponds to 0·332 gm. of thallos bromide, or 39·0 per cent., in agreement with the value calculated from the formula.

The author desires to express his hearty thanks to Mr. Heycock for his interest in these experiments.

CHEMICAL LABORATORY, GOLDSMITHS' METALLURGICAL DEPARTMENT,  
UNIVERSITY OF CAMBRIDGE.

## Notes.

*The Editor wishes 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.*

### TITRATION OF AMMONIUM SULPHATE BY THE STEARATE METHOD.

UNTIL my attention was directed to the point by Mr. Raymond Ross (ANALYST, 1925, 50, 600) I had not tried the applicability to ammonium sulphate of my volumetric method of determining soluble sulphates. The pure salt has a slight acid reaction, but I find that the acidity is so slight that one drop of 0.1 *N* sodium hydroxide solution will neutralise (to the B.D.H. indicator) more than 50 c.c. of 0.1 *N* ammonium sulphate solution, and 10 c.c. of the latter, diluted to 0.025 *N*, require for neutralisation about 0.1 c.c. of 0.02 *N* stearate solution.

Addition of more stearate solution, owing to the very slight dissociation of the liberated ammonium hydroxide, turns the liquid green, not violet, but the colour changes it sufficiently to make a titration possible.

Ten c.c. of a solution of ammonium sulphate of approximately 0.1 *N* strength were diluted to 40 c.c., and the indicator and 0.5 c.c. of stearate solution were added. Barium chloride (0.1 *N* solution) was then added in excess, and the excess titrated back with stearate solution. One or two drops of barium chloride solution changed the green colour to a lemon yellow, and the solution was then used for comparison in the titration of other solutions containing known quantities of the ammonium sulphate solution.

The following table gives the results obtained in the titration of 40 c.c. of solution containing the undermentioned quantities of the standard ammonium sulphate solution:—

Ammonium sulphate solution.	Barium chloride 0.1 <i>N</i> .	Potassium stearate <i>N</i> /49	Difference 0.1 <i>N</i> .	Gravimetric determination	Titration + correction 0.22 in 10 c.c.	Error.
5 c.c.	5.05	2.85	4.47	4.57	4.57	—
	5.75	6.25	4.47			
7 c.c.	7.1	4.1	6.25	6.40	6.40	—
10 c.c.	10.75	8.75	8.97	9.15	9.17	0.02
	9.65	3.5	8.95		9.15	—
	11.05	10.25	8.95		9.15	—
11 c.c.	10.90	5.25	9.83	10.06	10.05	0.01
12 c.c.	12.35	12.75	10.75	10.98	11.00	0.02

The correction was deduced from the mean of the titrations of 10 c.c. of ammonium sulphate solution; it is approximately the same as that found for sodium sulphate in 0.02 *N* solution.

It will be seen that the error in the method is less than one drop in 10 c.c. of solution. In the absence of other weak acids or bases the acidity can be titrated

directly (*vide supra*) with a limit of error of one drop of 0.1 N in 50 c.c. The presence of weak acids such as hydrogen sulphide, carbonic acid, etc., would interfere, but these two acids could be removed by boiling the acid solution.

H. ATKINSON.

PUBLIC HEALTH DEPARTMENT, CAIRO.

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### A FORERUNNER OF "THE ANALYST."

IN the second edition of the *History, Gazetteer and Directory of the Counties of Leicester and Rutland* (London, 1863) there will be found under the heading of Ashby de la Zouch (p. 435) an account of Edward Mammatt, who was born in that town in 1807. He was totally blind from his seventh year, but, in spite of this disability, his marvellous memory helped him to attain success in many directions. He is stated to have been a brilliant lecturer on electricity, pneumatics, astronomy, and anatomy, and to have been awarded a gold medal by the Society of Arts for the invention of an instrument for writing letters and musical characters. He was an accomplished musician, and for forty years held the post of organist in the parish church. In addition to this, he acquired a good business training, became manager of the Burton Brewery, and held many public offices. He died in 1860, and is commemorated by a memorial window in the parish church.

For some years he was editor of a literary and scientific publication called "The Analyst." Reference to the British Museum Catalogue has shown that *The Analyst: A Monthly Journal of Science, Literature and the Fine Arts*, ran from 1834 to 1840, and was published quarterly from 1835.

S. F. BURFORD.

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## Legal Notes.

*Under this heading will be published notes on cases in which points of special legal or chemical interest arise. The Editor would be glad to receive particulars of such cases.*

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### EGGS: NOT OF THE NATURE, SUBSTANCE AND QUALITY.

ON January 4 a woman was summoned by an egg dealer at Reepham, Norfolk, for having, on November 25, 1925, sold to him eggs not of the nature, substance and quality demanded. The prosecutor stated that when the eggs were offered to him he had remarked that they looked like water-glass eggs, but that, having been reassured by the defendant's agent, he had said that he would take the eggs as new laid, and that if they were not she would hear more about it.

The inspector of a firm owning multiple shops gave evidence that when she examined the eggs by the lamp test she found 13 of the 18 were preserved. She handed the whole of the eggs to the County Analyst.

Mr W. Lincolne Sutton, County Analyst, said that 13 of the eggs gave evidence of the presence of water-glass, but that this was not obvious to him without analysis.

Mr. Vores, for the prosecution, said that, if he satisfied the Bench that new laid eggs were demanded, the prosecution must succeed. It was immaterial whether the defendant had authorised anyone to say they were new laid or not.

Mr. Hill, for the defence, said that he did not dispute that the eggs were sold to the prosecutor, and that nine of them were preserved. But the case was not going to be left there. Mr. Vores had to show that the defendant had committed a criminal offence and sold to the purchaser eggs not of the nature, substance and quality demanded. But Mr. Vores could not do this. He could not say that they were not of the nature and substance demanded, but only that they were not of the quality. It was very doubtful whether this section of the Act had any relation to prosecutions of this sort; if so, to what would it lead? It would mean that if a person went to a dairy expecting a new laid egg and received one that was not good, as often happened, every dairyman who sold an egg like that would be liable. Lord Coleridge said that the true construction of the statute was that where a person professed to sell a particular article and sold one adulterated by another substance, it must be taken to be to the prejudice of the purchaser. Here what was sold was an egg which had not been interfered with.

But if the case did come under the section, he submitted that it must also be shown that it was to the prejudice of the purchaser. In this case the prosecutor had said that they looked like water-glass eggs, and the shop inspector had said that anybody looking at the eggs must have known that they were water-glass eggs. But the prosecutor, after seeing them, had bought them, and if the Bench were satisfied that he knew they were water-glass eggs there could be no conviction, even if the case came under the Section.

If the Act of 1875 really applied to a case of that sort it would be necessary to prove what a new laid egg was. That would raise an interesting point of law. In the Sale of Food Order, 1921, it was laid down that a person could not sell as fresh or new laid any egg which had been imported, unless the description also included the word "imported" or the country of origin. Under that Order eggs imported from China or anywhere else could be sold as new laid if the word "imported" was used; otherwise an offence would be committed.

Mr. Vores observed that an egg that had been pickled in water glass lost its reputation and character with its complexion, and was no longer entitled to be called "new laid." He contended that the seller must call attention to the quality of the article before the transaction was closed, and the mere fact that the prosecutor said that one of the eggs looked like a water-glass egg did not relieve defendant of responsibility when she sent her eggs to him, when she knew that he bought only new laid eggs.

The Bench were unanimous in their decision to convict, and imposed a fine of £5 with £2 18s. costs. They agreed to state a case, if necessary, on the legal points raised by the defence.

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## Department of Scientific and Industrial Research.

### REPORT OF THE FOOD INVESTIGATION BOARD FOR THE YEAR 1924.\*

SINCE the scientific expedition to Australia to study the conditions of apple transport three reports (ANALYST, 1925, 50, 187) have been issued, and the work is being continued in Australia. The attack upon the problem of freezing beef is nearing the point of direct application owing to the gradual establishment of a rational basis. The various investigations carried out under the different sections is described in considerable detail and can only be noted in a general way.

\* Obtainable at Adastral House, Kingsway, W.C. 2. Price 3s. 6d. net.



SECTION I. THEORY OF FREEZING.—The study of the effect of rate of cooling and thawing upon the final distribution of water in a gelatin gel shows that if freezing be slow enough ice is only formed on the external surface, but if freezing be quick enough it is formed only in the mass. The minute structure produced by freezing was studied, and quantitative determinations made of the separated ice. Volume changes were also noted and the work is illustrated by many graphs. It was found that fertility of eggs was retained longest at 8–10° C., and below zero eggs die rapidly, but the life period is influenced by species of hen, feeding, etc., as well as by temperature. The change of the yolk to a stiff pasty mass on freezing was traced in part to protein being thrown out of solution in such a state that it was not re-dissolved on thawing (*cf.* ANALYST, 1925, 50, 71).

SECTION II. THE PRESERVATION OF EGGS AND MEAT.—A report on the cold storage of eggs is now in the press (No. 26). The investigation into the production of lactic and succinic acids in muscle has been continued with a view to explaining some of the anomalous facts in carbohydrate metabolism in general and in muscle in particular. Conditions governing the growth of *Staphylococcus aureus* are gradually being elucidated.

SECTION III. THE PRESERVATION OF FISH.—The difficulties of proceeding with this investigation at an inland station have proved practically unsurmountable, and the work has come to a standstill. A report (No. 25) has been issued of the conditions of transport of fish in this country and in France.

SECTION IV. PRESERVATION OF FRUIT AND VEGETABLES.—The study of the course of respiratory activity during the life of an apple is illustrated by many curves, showing, amongst other things, that a relatively sudden alteration in the level of respiratory activity occurs during the second phase of the apple's life, *i.e.* the change from growth to senescence, which is termed the "climacteric." An interesting record has been made from week to week of the condition of a collection of apples in store at 1° C., and a balance sheet constructed of the internal changes taking place. The acidity of stored apples falls regularly, and any fall from the straight line means that acidity is increasing at a greater rate than the concentration of acid would warrant, and indicates the onset of internal breakdown. Other studies include glycerol in apple tissues during storage; changes in the pectic constituents of apples during senescence in storage; microchemical studies of the senescent tissue of the apple; changes in the pentose-sugar content of the juice of apples during senescence in storage; volatile products of metabolism in the apple other than carbon dioxide; fungal invasion in relation to senescence; the mortality curve in a collection of apples; factors affecting the internal resistance of apple tissues by fungal attack; chemical factors responsible for the internal resistance of apple tissues to fungal attack; the seasonal variation in the sugar content of potatoes, and the effect of temperature of storage upon the sugar content. A test of the relative efficiency of four types of non-refrigerated apple stores and of two clamps showed that the four stores were equally efficient, but that the clamps were unsatisfactory. Cold storage at 1° C. and "gas" storage at 7° C. appear to be equally efficient for those apples not liable to premature internal breakdown, but effect of soil or locality and variety of apple are factors to be considered.

SECTION V. THE CHEMISTRY OF OILS AND FATS.—The method of preparation of long chain ketonic acids described in last year's Report has been found of very general applicability, and numerous natural substances have been synthesised for the first time. The work on glycogen has proceeded along the lines of determination of composition and properties of different specimens, acetylation and methylation. Great variations in reaction were found for different glycogens which had

no appreciable analytical differences, probably owing to the inorganic constituents being either chemically combined with the polysaccharide molecule or present as a solid solution. In connection with the work on fat formation by yeast it is possible that there is a correlation in the plant between phosphorus compounds and fat formation. Some elucidation of the nature of intermediate substances formed is thought possible through the study of the action of yeast on sodium lactate and other simple carbon compounds.

SECTION VI. ENGINEERING PROBLEMS IN REFRIGERATION.—Inflammability tests were made on nine heat-insulating materials. Experiments are in hand to supply missing physical data in respect of several fluids used or likely to be used as working substances in refrigeration. The behaviour of various substances subjected to a cycle of humidities and various temperatures was studied in a specially devised apparatus. The single horsehair is notable for the closeness with which it repeats its calibration line when subjected to several cycles of humidity, and the gold beaters' skin for the small time lag shown in reaching equilibrium after change of humidity. Several experimental instruments have been constructed as strong carbon dioxide measurers for use on board ship, and three are illustrated. An experimental form of apparatus for producing an air stream of definite and predetermined humidity is based upon the fact that the aqueous vapour pressure over a solution of calcium chloride is a function of the concentration. Instruments for indicating the rate of flow of ammonia or brine in a refrigerator plant circuit are receiving attention. A simple form of apparatus devised to facilitate the study of air currents amongst boxes stored in a cooling chamber has been usefully applied to the various cooling systems in common use, and more effective circulation of air is obtained if relatively large vertical channels are formed in preference to narrow horizontal ones.

D. G. H.

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## Federated Malay States.

### ANNUAL REPORT OF THE CHEMIST OF THE GOVERNMENT LABORATORIES FOR 1924.

THE Government Laboratories at Kuala Lumpur form one of the departments of the Institute for Medical Research, which also comprises a Pasteur Institute for the prophylactic treatment of rabies, a bacteriological and pathological department, and a malaria bureau.

The chemical work of the various departments is carried out in the Chemical Laboratories under the direction of Mr. R. W. Blair, F.I.C.

MEDICAL DEPARTMENT.—The chemical work comprises that done in connection with the Health Branch and the Hospitals Branch.

*Milk.*—According to the Sale of Food and Drugs Enactment, 1913, milk must contain not less than 3.25 per cent. of fat and not less than 8.5 per cent. of solids-not-fat. Of the 756 samples examined, 34 were below this standard for fat, and 258 for solids-not-fat. Three samples of condensed milk were examined. The prohibition of the importation into the Federated Malay States of machine-skimmed or hand-skimmed milk is under consideration.

*Water.*—Chemical analyses were made of 347 samples and bacteriological examinations of 41 samples. No complaints have been received of the Klang water supply, where the water is treated with chlorine.

*Sewage Effluents.*—Fifteen samples were examined to test the efficiency of sludge tank and septic tank installations.

*Toddy.*—According to the Sale of Food and Drugs Enactment, 1913, "toddy" must not contain more than 10 per cent. of alcohol by vol., or have an acidity exceeding 0·8 per cent. (as acetic acid). Of the 400 samples examined, none contained more than 10 per cent. of alcohol, but the acidity was exceeded in 2 cases. Two hundred and sixty-seven of the samples were from toddy shops under the control of estate managers.

**TOXICOLOGICAL ANALYSES.**—Thirty exhibits were examined for suspected poison. Six cases of human poison were investigated, and poison (*aqua regia*) was found in one case. Viscera from 8 cattle were tested for arsenic, which was found in 4 cases.

**VITAMIN EXTRACT.**—During the year, 7251 fluid ounces of extract were prepared from rice polishings for the treatment of beri-beri.

**TRADE AND CUSTOMS DEPARTMENT.**—The work consisted mainly in the examination of samples for assessment of duty, including 100 samples of alcoholic liquors, 44 samples of toddy, and 353 samples of chandu and substances suspected to contain chandu. Of these, 148 were found to be Government chandu, 24 illicit chandu, 10 chandu prepared from Government chandu dross, and 13 imitation chandu containing no opium. The number of samples of dross inspected during the year was 3906, of which 509 were analysed.

**POLICE DEPARTMENT.**—The 1224 samples submitted in connection with Court proceedings included 1046 of coins and coining materials. Of these, 877 were counterfeit and 4 were moulds.

Eighty exhibits were examined for blood stains in connection with murder cases, etc., and 34 of these gave positive reactions for blood, and 27 of them the reaction for human blood.

*Toxicological Analyses.*—Of 48 exhibits, 14 were human viscera, in 7 of which poison was detected. Morphine was found in 3 cases, opium in 1, arsenic in 1, sodium carbonate 1, and *aqua regia* in 1. Miscellaneous exhibits included one datura capsule, 2 ashes, one pill containing dirty cotton waste, two powders containing glass, and one sample of cooked rice in which powdered glass was found.

**OTHER DEPARTMENTS.**—Twenty-two samples were examined for other departments, including the Railway and Public Works Departments. Two samples of sealing wax were examined for the Post and Telegraph Department in connection with a prosecution for theft.

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## Variations in the Composition of Milk.\*

INTRODUCTORY.—This investigation was placed under the direction of Dr. Tocher by the Inter-Departmental Committee on the sale of milk in Scotland, its object being to ascertain the incidence of the variation in the composition of the constituent parts of milk in a sufficient number of individual cows. Samples were taken throughout the country by the official sampling officers, with every precaution to secure a specimen of the whole milking of each cow. The analytical results, obtained in duplicate or triplicate, are of 676 samples of milk (each sample being the milk of one cow) from cows of various breeds throughout Scotland in 1921–1922.

METHODS OF ANALYSIS.—Fat was determined by the Adams process; casein nitrogen in the precipitate obtained with 10 per cent. acetic acid, and albumin nitrogen in the precipitate obtained with tannin in the filtrate from the casein; lactose by Fehling's method after precipitation of proteins, etc., with colloidal iron; the refractive index in the filtrate from the treatment of 40 c.c. of milk with 10 c.c. of copper sulphate solution of  $n_D^{20} = 1.34124$ ; and the depression of the freezing point by means of the Hortvet cryoscope.

THE AVERAGE COMPOSITION OF THE MILKS.—A table is given showing the mean and standard deviations for the various characteristics studied; the following are the mean results from the milks of (1) the Ayrshire cows (341), and (2) of all the cows (676):—

	Fat. Per Cent.	Solids- not fat. Per Cent.	Lactose. Per Cent.	Ash. Per Cent.	Total Nitrogen. Per Cent.	Casein Nitrogen. Per Cent.	Albumin Nitrogen. Per Cent.
(1) Ayrshire Cows	4.085	8.753	4.568	0.691	0.512	0.381	0.118
(2) All Cows	3.953	8.864	4.635	0.700	0.508	0.380	0.116
	Freezing Point °C.	Refractometer reading, at 20° C.	Sp. gr. at 15.5° C.	Yield in lbs.	Weeks in milk.	Age (in years).	
(1) Ayrshire Cows	0.549	38.102	1031.12	13.399	18.979	6.15	
(2) All Cows	0.548	38.275	1031.52	13.919	19.481	6.18	

These figures show that when a fairly large number of milks are taken at random from individual cows and mean values only are considered, the percentage of butter fat is well above the minimum presumptive limit prescribed by the Board of Agriculture.

The corresponding figures of Droop Richmond (*Dairy Chemistry*, 2nd edn., p. 150) differ significantly from these figures, his average for butter fat being 0.21 per cent. less than the Scottish figure; albumin less by 0.340 per cent., and casein 0.576 per cent. greater. It is clear that Richmond's figures are those of samples from selected cows in one area, whereas the Scottish figures are from various breeds taken at random over the whole country. The new data are not comparable with the mean values of the Scottish Milk Records data, since they are the mean values for different individual cows from a sample of milk taken at one milking.

VARIATIONS IN THE PERCENTAGES OF CONSTITUENTS.—The method of Pearson (*Phil. Trans.*, 1895, 186 [A], 344–412) has been used to determine the nature of the frequency distributions, and a table is given showing the values of the frequency

\* Report by J. F. Tocher, D.Sc., F.I.C. Pp. 195 with 122 Tables and tabulated analytical results. H.M. Stationery Office, 120, George Street, Edinburgh; Adastral House, Kingsway, London. 1925. Price 21s. net.

constants for all the distributions and types of Pearsonian curves to which the data conform.

**SOLIDS-NOT-FAT DISTRIBUTION.**—The observed and theoretical values are given in a table and in a diagram (curve of Type IV.). The results show that if a very large number of samples were taken, 23.7 per cent. of the samples would give solids-not-fat below 8.5 per cent. The actual number was 167 out of 676, or 24.7 per cent.

In the milk of random groups of  $N$  cows ( $N$  varying from 2 to 20), 6.7 of the means in samples of 5 were actually found to fall below 8.5 per cent., and the table shows that in groups of 2 cows as many as 16 per cent. may reasonably be expected to give less than 8.5 per cent. of solids-not-fat.

The range of variation between the minimum and maximum values in the percentage of solids-not-fat was about 5 per cent. Theory shows a value as low as 6.6 per cent. in about 3 out of every 100,000 samples of milk from individual cows, and as high as 11.4 per cent. about 10 times per 100,000.

**LACTOSE.**—Curves of types V. and VI. fit the data for lactose distribution. Theory indicates a natural range of almost 4 per cent. between the minimum and maximum percentages of lactose in the milk from individual cows. In a very large collection of cows the percentage may be as low as 2.1 and as high as 5.7. In the actual data the range was from 2.7 to 5.5 per cent.

**ASH.**—The natural variations in the percentage of ash in the milk of individual cows range from 0.47 to 0.99 per cent. In about half of the cases the percentage lies between 0.67 and 0.72.

**TOTAL NITROGEN.**—The range of variation is from about 0.31 to 0.94 per cent. When total nitrogen is expressed as total protein there may be as great a difference as 4 per cent. between the minimum and maximum values in the milk of individual cows.

**CASEIN NITROGEN.**—The range of variation theoretically runs from about 0.21 to 0.71 per cent. The actual observations showed a range from 0.26 to 0.64 per cent.

**ALBUMIN NITROGEN.**—The range is from 0.07 to 0.22 per cent. About 50 per cent. of the values range from 0.100 to 0.132 per cent.

**SPECIFIC GRAVITY.**—Theory shows that a value as low as 1.0250, or as high a value as 1.0375, may occur in a very large series, say, 100,000 samples, but these are unusual. The actual minimum and maximum values observed were 1.0255 and 1.0361.

**REFRACTIVE INDEX.**—The curve (Type I.) shows that the range of values runs from 34.9 to 40.6 scale readings. The actual values observed were from 35.9 to 40.6. From the distribution of values shown in a table it is clear that variation is as prominent a feature of the refractive index as it is of the percentages of the various constituents of milk. Of the 676 samples, 8 (1.18 per cent.) gave scale readings below 36 (corresponding to  $n_D^{20} = 1.341240$ ). Hence, if the addition of water is to be determined from the refractive index, the scale reading 36 cannot safely be adopted for samples of mixed milk of small herds.

**FREEZING POINT.**—The theoretical values from Type III. curve range from 0.52° C. to about 0.62° C., and the observed values were from 0.50° to 0.61° C. The freezing point in not correlated with age, ash or butter fat, but is closely correlated with lactose. Development of acidity can be measured fairly accurately

from the corresponding increase in the depression of the freezing point by means of the equation—

$$y = 0.0587 + 0.00246 (x - 24.34),$$

where  $y$  represents the predicted increase in freezing point and  $x$  the acidity degree.\* The data obtained show that there is very little relationship between natural acidity and the corresponding freezing point value in fresh samples.

From a summary of all the results and a comparison of those given by Monier Williams (Food Reports, No. 22, H.M. Stationery Office) it can be stated that, on the average, the greater the natural acidity of the milk, the greater is the proportion of lactose present. When, however, souring definitely sets in, the relationship is reversed. The higher the degree of sourness or developed acidity, the less is the proportion of lactose.

Owing to the varying times at which the samples were received in the laboratory the distribution values given in the table cannot be the same as if the lactose and freezing point had been determined within 2 to 4 hours after milking.

**BUTTER FAT.**—The actual range in the distribution of the percentages of butter fat was from 1.66 to 7.50 per cent., whilst the theoretical percentages run from about 2.1 to 7.4 per cent. (Type IV. curve). Theoretically, over 12 per cent. of the total samples contain less than 3 per cent. of fat, whilst, of the 676 samples actually examined, 8.3 per cent. contained less than 3 per cent. of fat. These figures are discussed in comparison with those of Richmond and of Monier Williams, which, however, do not refer to single cows taken at random over a whole country. All three sets of observations show that wide variation is to be expected in the proportion of cows giving milk with less than 3 per cent. of butter fat during any given period.

**COEFFICIENTS OF VARIATION.**—A table is given showing the values of the coefficients of variation of the various physical and chemical characteristics of milk. The least variable are the physical constants (from about 3 to 5 per cent. of the mean values), closely followed by the percentages of solids-not-fat, ash and lactose.

**CORRELATION BETWEEN CONSTITUENTS.**—A fairly complete study has been made of the correlations between the proportions of the various constituents. It is shown that there is a uniform rise in the average percentage of solids-not-fat with ascending percentages of butter fat. Also, that the average butter fat percentage rises uniformly with ascending values of solids-not-fat percentage.

There is a positive correlation between the yield of milk and the percentage of lactose. The percentage of lactose falls during the lactation period, but the more milk a cow gives, the higher, on an average, is the percentage of lactose in the milk.

Taylor and Husband suggested that lactose affects the rate of secretion of milk by its influence on osmotic pressure. In other words, that milk is secreted at a rate which maintains the osmotic pressure practically constant. But freezing point is directly related to osmotic pressure, and the data here given show that osmotic pressure in milk is not constant, but varies from about 6.9 to 8.5 atmos. Since freezing point has the least relative variability of the physical constants, it is thus established that osmotic pressure is the least variable character in milk.

The correlation between yield and age is negligible, but solids-not-fat and ash are both correlated negatively with age ( $-0.15$  and  $-0.18$ ). Yield is also negatively correlated with albumin nitrogen (0.3) and casein nitrogen (0.4), and the positive correlation between lactose and yield has been mentioned.

\* 1 degree to 70 degrees of acidity = 0.009 to 0.630 per cent. of acid as lactic acid.

**PREDICTION FORMULAE.**—Richmond's prediction formula for solids-not-fat is discussed, and the relationship between the observed values and predicted values are given in a table. Another formula has been based on the *observed* specific gravities and the corresponding *observed* percentages of butter fat and solids-not-fat. With either formula the predictions are fairly good for commonly occurring values of solids-not-fat. When, however, the solids-not-fat are either fairly high or rather low the difference between the predictions may amount to about 0·5 per cent.

**WATER CONTENT.**—The percentages of water in the 676 samples ranged from 82 to 90 per cent. Taking the water distribution as a basis, the distribution of the percentages of water in the mixed milk of random groups of five cows was determined. The theoretical values range from 84·2 to 88·7. In 28 cases out of every 1000 the water content would be above 88 per cent.; in 5 cases out of every 1000 a water content above 88·25; and in 5 cases out of every 10,000 a water content of 88·5 per cent. Hence, if a sample of milk from a herd of 5 cows were found to contain only 11·5 per cent. of total solids, there would be a strong presumption that water had been added.

**GENERAL CONCLUSIONS.**—In view of the results obtained in this investigation, stress is laid upon the fact that the percentages of butter fat and solids-not-fat in a sample of commercial milk depend upon several factors, one of the most important of which is the number of cows whose mixed milk is represented in the sample. If the sample were from, say, 100 cows, one could be quite certain that the milk would be above the presumptive standard for these constituents. This factor should be borne in mind in every prosecution based upon the milk falling below this standard.

Other factors affecting the proportions of these constituents are the age of the cow, and the number of weeks the cow has been in milk when the sample was taken. About 40 per cent. of cows which have been 11 weeks in milk give solids-not-fat below 8·5 per cent., whilst of cows which have been, say, 41 weeks in milk, only 12 per cent. give milk falling below 8·5 per cent. of solids-not-fat. This is a biological phenomenon and not a feeding defect.

A point of practical importance to the dairyman is that, if he selects cows solely for their milk yield, he is selecting for a lower proportion of butter fat and a lower proportion of solids-not-fat, and that he gets a higher proportion of lactose than otherwise. A better measure of the milking capacity of a cow than either butter fat or solids-not-fat, is the average amount of butter fat each cow gives per milking. About a month after calving this average amount is about  $\frac{3}{4}$  lb., and the quantity gradually falls until after about 20 weeks it is about  $\frac{1}{2}$  lb., and after 45 weeks only about  $\frac{1}{3}$  lb.

It would appear from the results that if a sufficient amount of a balanced ration is given, the proportions of butter fat and solids-not-fat are practically the same for the same cow at the same definite stage of lactation—other variable factors being eliminated.

Possible remedies to reduce the variations in the constituents of commercial milk, so that a milk of constant good quality may be distributed are:—(1) That only the mixed milk of a fairly large herd should be supplied to the public. (2) To insist upon the selection of good cows, the selection being based on the yield of butter fat during an entire lactation period. (3) That a complete study should be made of the inheritance of yield of butter fat in mother and daughter cows.

## ABSTRACTS OF PAPERS PUBLISHED IN OTHER JOURNALS.

## Food and Drugs Analysis.

**Differentiation of "Regenerated" Preserved Peas and Preserved Green Peas.** C. F. Muttelet. (*Comptes Rend.*, 1926, 182, 238-240.)—The three ratios: nitrogen to sugars, nitrogen to cellulose and insoluble to soluble nitrogen—increase with the state of maturity of the peas and are practically independent of the variety. The two first values are much the same for ripe dry and raw peas, and "regenerated" peas, but the third value is higher for regenerated peas owing to the prolonged cooking they have undergone, whereby the greater part of the soluble nitrogenous material has become insoluble.

D. G. H.

**Chlorine in Bleached Flour.** A. Seidenberg. (*J. Assoc. Off. Agric. Chem.*, 1925, 8, 676-678.)—The chlorine present in bleached flour apparently occurs in, or with, the extractable fatty matter, the chlorine being readily soluble in the usual fat solvents. The discordant values obtained on determination of the chlorine are due largely to variations in the amount of fat extracted, the method by which the fat is extracted as completely as possible giving the most satisfactory results. The following procedure, which gives an extract equal to 1.25 per cent. of the flour, is recommended: Ten grms. of the flour are gently warmed in a 500 c.c. Erlenmeyer flask with 30 c.c. of 75 per cent. alcohol until evenly distributed, the liquid being then shaken thoroughly with 30 c.c. of 95 per cent. alcohol for 2 minutes. The cold liquid is shaken with 50 c.c. of ether, 100 c.c. of petroleum spirit (b.pt., 30° to 75° C.) being then added, and the flask again shaken. The whole liquid is transferred to a separating funnel, together with two portions of 25 c.c. of petroleum spirit used to rinse out the flask. The total liquid is then shaken with 30 c.c. of water and allowed to separate, and the lower layer is removed. A second washing may be done with not more than 10 c.c. of water. The upper, solvent layer, containing the extractable matter required, is drained into a beaker and evaporated slowly with 5 c.c. of 4 per cent. alcoholic potassium hydroxide solution.

T. H. P.

**Dugong Oil from Australia.** (*Bull. Imp. Inst.*, 1925, 23, 429-430.)—A blubber oil is obtained from the dugong (10-12 gallons per adult), a herbivorous aquatic mammal, and this is stated to be a substitute for cod liver oil. The semi-solid oil was free from any fishy smell, and had the following characteristics:—Sp. gr. at 15° C., 0.9242;  $n_D^{40}$ , 1.458; rotatory power at 40° C.,  $-0.12^\circ$ ; titre, 34.6° C.; acid value, 0.3; saponification value, 204.7; iodine value (Hübl, 17 hrs.), 52.3; unsaponifiable matter, 0.2 per cent.; and volatile acids (soluble), 0.3, (insoluble), 1.6 as c.c. of 0.1 N alkali solution required to neutralise 5 grms. of oil.

D. G. H.



**Determination of Galactonuric Acid in Pectin.** W. H. Dore. (*J. Amer. Chem. Soc.*, 1926, **48**, 232-236.)—Galactonuric acid is determinable in pectin by the method of Lefèvre and Tollens (*cf.* Nanji, Paton and Ling, *J. Soc. Chem. Ind.*, 1925, **44**, 253T), which consists in decomposing the substance by boiling it under a reflux condenser with 12 per cent. hydrochloric acid and collecting the carbon dioxide evolved, after first removing any furfural by aniline, and hydrochloric acid by granulated zinc. The results obtained are lower than those of Nanji, Paton and Ling. The method will be given in detail in a subsequent paper. Samples were also extracted with 70 per cent. alcohol, and the furfural content determined, but no apparent relation appears to exist between the yields of galactonuric acid and of furfural. H. E. C.

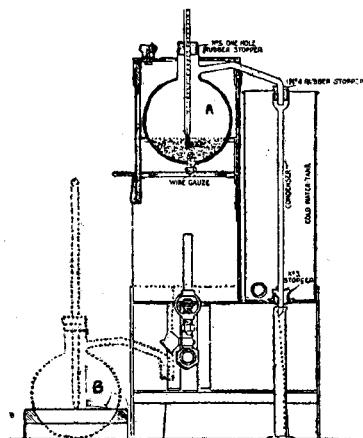
**Organic Acids of Tomatoes.** A. Borntträger. (*Zeitsch. Unters. Nahr. Genussm.*, 1925, **50**, 275.)—This paper summarises previous work on the occurrence of citric and other acids in tomatoes, and gives some results of an investigation of the nature of the free and combined organic acids, the determination of these acids and their manner of combination in the juice of the ripe and the unripe fruit, and the preparation of tomato conserves. The general conclusions are as follows:—The hard ripe tomatoes examined contained citric and malic acids in determinable quantities. They were free from all other acids, including oxalic, racemic, succinic, and lactic acids. In soft, though not over-ripe, fruit succinic acid was present. The citric acid content decreased on ripening and never increased. Malic acid was found to decrease in three out of six cases, and in the other three there was no change. When ripe fruit became soft, citric and malic acids disappeared. The total acidity of the unripe fruit decreased on ripening, except in the variety "Dell' Orto." The juice with the highest acid content, as shown by analysis, was found in the variety "Pizzutello," and that with the least acid in the "San Marzano." This result corresponded with their respective flavours. The alkalinity of the ash of the juice decreased on ripening, which is explained by increase in the water-content. Citric and malic acids (the only acids in sound fruit) were present as citric and malic acid or bicitrate and bi-malic salts, never as the neutral salts. The free acid was generally below 0.03 per cent., calculated as malic acid. The phosphate content of the juice decreased on ripening. If the variety "Dell' Orto" was artificially ripened in diffused daylight at 28-32° C., the juice contained an acidity of 0.69 per cent., as compared with 0.59 per cent. if ripened on the plant, but artificial ripening resulted in a considerable loss in weight (from 220 grms. to 177.5 grms.). R. F. I.

**Catawba Grape Juice.** B. G. Hartmann. (*J. Assoc. Off. Agric. Chem.*, 1925, **8**, 716-725.)—The results of the analysis of thirty samples of typical commercial catawba grape juice are given. In addition to tartaric acid, the juice contains a considerable amount of free acid, probably malic acid. The ratio of acid to sugar varies widely in different years, but only slightly for any one season. At 87° C. the juice is laevo-rotatory, and the laevulose increases and the total acidity decreases as the grape ripens; thus, low acidity and low polarisation at

87° C. suggest addition of water. The pure juices are practically free from sucrose, but addition of this sugar is followed by its inversion, owing to the comparatively high acidity. Bisulphite is always added as preservative; 0.3 gm. of sulphur dioxide per litre is sufficient for this purpose. The adulteration of the juice with water in the form of sugar solution may be detected and its extent measured by a

modification of Tissier and François's method (*Ann. Falsificat.*, 1914, 7, 251), on the assumption that the genuine juices are saturated with cream of tartar.

T. H. P.



vertical condenser, so that the water which distils over collects in a 25 c.c. cylinder graduated in fifths. Its volume gives directly the percentage of water in the cloves.

R. F. I.

**Formation of Urea and of a Substance giving the same Colour Reaction as Formaldehyde with Hydrazine, on Heating Vegetable Juices.** R. Fosse. (*Comptes rend.*, 1926, 182, 175-177.)—The juice expressed from the young green leaves of *Acer* and from *Phaseolus* plants, and centrifuged, gave, after warming for 5 minutes on the water bath, the same colour reaction as formaldehyde with hydrazine. At the same time urea was formed. After 20 to 25 minutes at about 100° C. 1 gm. of urea per litre was found in the juice of young ash leaves gathered in spring before flowering, whilst the unheated juice showed only a trace. The simultaneous formation of these two substances results from the hydrolysis of a ureide.

D. G. H.

**Determination of Nicotine in Tobacco.** H. Rundshagen. (*Chem. Zeit.*, 1926, 50, 42.)—Toth's method for the estimation of nicotine in tobacco (ANALYST, 1912, 37, 452) gives slightly high results, owing to the presence of traces of fats and resins. The following modification is, therefore, recommended:—Ten grms. of the dry powdered tobacco are intimately mixed with 2 grms. of calcium hydroxide, and the whole moistened with water and then triturated for at least 15 minutes. After complete mixture in this way the mass is ground up with a sufficient quantity of ignited plaster of Paris to produce a homogeneous powder. This is transferred to a flask and shaken vigorously with 50 c.c. each of ether and

petroleum spirit or toluene for at least 15 minutes. After centrifuging, the extract is filtered and an aliquot part of the filtrate is titrated with 0.1 *N* sulphuric acid, iodeosin being used as indicator; the result may be checked by polarisation. The advantage of using toluene is that it ensures a completely clear solution.

H. E. C.

**Ignition of Ether at Low Temperatures.** H. B. Dixon. (*Report to Joint Anaesthetics Committee of the Medical Research Council and Roy. Soc. Medicine. Lancet, 1926, 210, 258.*)—In view of the discrepancies between results published in scientific journals, and of the fact that a dental dressing syringe might easily be at a temperature above the danger point (200° C.) without the possibility of there being any risk occurring to the operator, the Committee have decided to issue a preliminary report on Prof. Dixon's experiments, without giving an opinion as to the actual cause of a recent fatal accident. When ether vapour was conducted into heated oxygen through a silica tube, equally heated, there was a delayed ignition at 220° C.—a figure to be regarded as too high rather than too low as a minimum ignition temperature. Other observers have put the ignition-point of ether in oxygen as low as 190° C. A peculiar difficulty exists in the determination of the ignition point of ether mixtures, because the vapour itself decomposes rather rapidly in contact with heated surfaces, and because the mixture may undergo a partial combustion with an almost invisible flame, and this may develop into the normal luminous combustion. It was found by Perkin that ether vapour began to show this incomplete combustion at 260° C., and A. G. White (Nobel's Explosives Co.) has observed a "cool flame" to start under certain conditions below 190° C. The normal ignition of the most inflammable mixtures of ether and air has been found by several observers to occur about 360° C., the ignition not being violent. But ether and oxygen form highly explosive mixtures in which the detonation-wave may be rapidly set up once the flame is started. The lowest ignition point of such mixtures of ether and oxygen is yet to be determined, but it is obvious that there is a special danger in bringing a heated body into contact with such mixtures. That the heated body is not visibly red hot is no guarantee of safety; the danger point begins at least 300° C. below visible redness.

## Biochemical, Bacteriological, etc.

**Soft Pork Studies. I. Formation of Fat in the Pig on a Ration Moderately Low in Fat.** N. R. Ellis and O. G. Hankins. (*J. Biol. Chem., 1925, 66, 101-122.*)—The results are recorded in detail of two experiments which deal with the formation of fat in the pig on a ration of (1) corn and skim milk and (2) corn and tankage, with and without alfalfa meal. Special attention is given, in respect of both quantity and quality, to the relationships of the ingested fat and the synthesised fat to the resulting body fat. The progressive hardening of hogs' fat on a ration containing a moderately low amount of softening fat such as is found in corn is accounted for as follows:—(1) The change from a soft fat, as found

in young, immature hogs, to a hard fat in older, mature hogs, was accompanied by an increased rate of fat deposition. (2) This increased rate of fat deposition caused a rise in the ratio of body fat derived from carbohydrate and protein (hard) to that derived from ingested fat (soft). (3) The change in the composition of the body fat resulted in a decrease in the iodine value and refractive index and an increase in the melting point. (4) The effects on the proportions of the fatty acids were: An increase in the per cent. of total saturated acids with the per cent. of oleic acid remaining nearly constant and a decrease in the per cent. of linolic acid. The total amount of linolic acid ingested was in excess of that in the body in late, as well as early, growth. It has been shown that linolic acid in the body of hogs follows the supply in the feed very closely. Its actual percentage varies through extremely wide limits. Linolic acid is not so essential a factor as oleic acid in adipose tissue. The drop in the per cent. of linolic acid in the fat, with the corresponding rise in the per cent. of saturated acids, explains the hardening of the fats in the experiments reported. Linolic acid has an extreme softening influence, and the saturated acids have the opposite effect. P. H. P.

**Quantitative Determination of Minute Amounts of Urea.** J. T. Wearn and A. N. Richards. (*J. Biol. Chem.*, 1925, **66**, 275-280.)—A technique is described by means of which amounts of nitrogen in the form of ammonia or urea of the order of 0.0005 mgrm. can be measured within a probable error of 10 per cent. The work was undertaken for the purpose of determining the urea content of the glomerular urine of frogs. Existing methods are adapted for the purpose. The essentials of the method consist in hydrolysis of the urea solution by heating with acid at 150° C. according to the methods of Benedict and Gephart (*J. Amer. Chem. Soc.*, 1908, **30**, 1760) and Folin and Wu (*J. Biol. Chem.*, 1919, **38**, 81), simultaneous Nesslerisation of the hydrolysed mixture and a known ammonium sulphate solution under identical conditions, as carried out by Folin and Farmer (*J. Biol. Chem.*, 1912, **11**, 493), and quantitative comparison of the intensities of colour produced by the method of Dale and Evans (*J. Physiol.*, 1920-21, **54**, 167). A table shows the results obtained when known portions of the standard ammonium sulphate solution were measured out and compared by an observer who was ignorant of their concentrations. Different amounts of Nesslerised hydrolysed urea mixtures were determined by this method, and the results are given. Comparator tubes contained different amounts of the Nesslerised standard ammonium sulphate solution. The one which most closely resembled the urea tube in intensity of colour was chosen, the two tubes were inserted into the mat of the comparator apparatus, and the colours were equalised by withdrawing and restoring fluid by means of a pipette. Each tube contained 1 c.c. of fluid originally. P. H. P.

**Determination of Cystine by means of Feeding Experiments.** H. C. Sherman and E. Woods. (*J. Biol. Chem.*, 1925, **66**, 29-36.)—Casein was chosen as the first material to which to apply the method of feeding experiments for the quantitative determination of cystine. Cystine, which is contained in casein,

is the first amino acid to be brought below the amount required for normal growth when casein is given to animals as sole protein and in insufficient percentage of the food mixture. Pure cystine was used as the basis for the establishment of the quantitative relationships. A basal diet is described in which cystine is the growth-limiting factor. When carefully standardised young rats are given this basal diet, with and without graded additions of cystine, it is possible to determine a direct linear or arithmetical relationship between the added cystine given and the added growth thereby induced, up to an added gain of at least 10 grms. in an experimental period of 6 weeks, induced by the addition of 0.025 per cent. of cystine to the basal diet, and probably up to 0.04 per cent. added cystine with an added gain of 17 grms. Parallel experiments with graded additions of casein to the same basal diet gave correspondingly graded responses in the growth rate. Tables and charts show the results. Within the range of growth increase in which the response to added cystine was in arithmetical proportion to its amount, it is believed that the response to the added casein is a measure of the cystine (or cystine plus nutritionally equivalent sulphur-containing radicles) furnished by the casein. Thus casein contains not less than 1.3 per cent. nor more than 2.5 per cent. of cystine, or, approximately three-eighths to three-fourths of the total sulphur in casein are in the form of cystine or of cystine plus other sulphur-containing radicles which are interchangeable with cystine in nutrition. The lower limit of the range of possible percentage of cystine in casein thus indicated by these feeding experiments is higher than the proportion of cystine obtained from casein *in vitro* by present analytical methods. With the development of a suitable basal diet for each, it should be possible to apply the same general principle to the quantitative determination of other nutritionally essential amino acids. The method should be useful for tryptophane.

P. H. P.

**Effect of Fermentation with Specific Micro-Organisms on the Vitamin C Content of Orange and Tomato Juice.** S. Lepkovsky and E. B. Hart. (*J. Biol. Chem.*, 1925, **66**, 49-56.)—Since both fermented corn (silage) and fermented cabbage (sauerkraut) are known to be free from vitamin C, attempts have been made to determine the cause for the disappearance of this vitamin. Fresh green corn and fresh cabbage are both effective antiscorbutic materials. The actions of several organisms occurring in silage have been studied, but it has not been shown that they destroy vitamin C. When orange juice or tomato juice is exposed to air protected by a cotton plug it loses its anti-scorbutic property; so a technique has been developed for this study involving the use of vaseline for exclusion of air from the fermenting mixture, and thus the destructive action of oxygen on vitamin C can be excluded. Although not all of the organisms occurring in silage have been included in these studies, yet it is probable that the destruction of vitamin C in masses of fermenting plant tissue is to be referred to the oxygen still retained in the mass. There is generally some oxygen present unless the silage is taken far from the surface or periphery of the silo. The experiments were carried out on guinea pigs.

P. H. P.

**Effect of Pasteurisation on the Infectivity of the Milk of Tuberculous Cows.** R. G. White. (*Lancet*, 1926, 210, 222-225.)—The object of this investigation was to determine whether the milk of tuberculous cows is rendered non-infectious for guinea-pigs when the milk is heated at 145° F. (approx. 62.5° C.) for 30 minutes and then rapidly cooled. This temperature and time were chosen as being the limits which should not be exceeded if the nutritive qualities of the milk are not to be injured, and are in accordance with the findings of Rosenau (*Hyg. Lab. Bull.*, Nos. 42 and 56, 1908) and the recommendation of the American Government for commercial pasteurisation of milk. The experiments were made with naturally infected milk from cows with tuberculous udders, with milk contaminated with tubercle bacilli, and with milk to which ground-up caseous material from tuberculous glands had been added. The samples of milk were heated at 62.5 for 30 minutes, cooled and used for the tests. They were also centrifuged at high speed, and the cream and deposit used for inoculations, after being suitably emulsified with the separated milk. Series of control animals were inoculated in the tests, and the results obtained proved the unsterilised samples to be infective. On the other hand, the results obtained with the same milks after heating showed that pasteurisation under the conditions mentioned ensures a non-infective milk, so far as *B. tuberculosis* is concerned.

## Agricultural Analysis.

**Computation of the Net Energy Values of Feeding Stuffs.** M. Kriss. (*J. Agric. Res.*, 1925, 31, 469-484.)—The author proposes and discusses in detail a modification of the method of Armsby and Fries for computing energy values by means of the respiration calorimeter. It involves the separate determination of the net energy required for maintenance, of the gain of energy by the animal, and of the heat increment value of the feed. For details it is necessary to consult the original paper. It is claimed that the method makes possible the computation of the net energy value of a feed for each of a series of periods, instead of giving one average value representing the results of two or more periods as accomplished by the earlier methods.

H. E. C.

## Organic Analysis.

**Determination of Traces of Carbon Disulphide in Small Volumes of Gas.** W. J. Huff. (*J. Amer. Chem. Soc.*, 1926, 48, 81-87.)—A modification of Harding and Doran's method suitable for small quantities is described. When the quantity of carbon disulphide is very small it forms a colloidal copper xanthate instead of a precipitate; in order to ensure precipitation it is necessary to have only a slight excess of acetic acid and a relatively large concentration of copper sulphate in relation to the disulphide. For the determination a volume of about 2 litres of gas is drawn through (1) 40 c.c. of 5 per cent. potassium hydroxide, (2) 6 c.c. of similar solution, (3) sulphuric acid, (4) glass wool for scrubbing, and (5) 2 c.c. of freshly prepared alcoholic potash solution contained in a specially

small absorption pipette prepared by blowing five pear bulbs on an ordinary piece of tubing. The alcoholic potash is washed out with a minimum quantity of water, and to it is added 0.7 c.c. of acetic acid and 4–5 c.c. of 0.01 *N* copper sulphate solution. After standing overnight the precipitate is filtered off, and the excess of copper is titrated back with 0.01 *N* thiosulphate solution. There is difficulty in the originally described method with the end point; to overcome this, it is necessary to evaporate the filtrate and washings to dryness on the water bath and take up the residue with dilute hydrochloric acid (5 c.c. of 1:15), then to add 1 grm. of potassium iodide and titrate in the usual way. It has been found possible to determine as little as 0.02 mgrm. of carbon disulphide in this manner, but larger quantities are preferable.

H. E. C.

**The Thiocyanogen Value. A New Constant of Oils and Fats. H. P. Kaufmann.** (*Arch. Pharm.*, 1925, (*Sonderdruck*), 1–47).—The most suitable solvent for using free thiocyanogen as a reagent (*cf.* ANALYST, 1925, 50, 577, 634) is anhydrous glacial acetic acid (obtained by distilling 99 to 100 per cent. acid over phosphoric anhydride, and collecting only the fraction distilling at 118° to 120° C. in a receiver with a calcium chloride seal to prevent absorption of moisture). In preparing the reagent the glacial acetic acid is divided into two portions in absolutely dry flasks with ground-in stoppers, and in one of these is dissolved the calculated amount of bromine (plus 5 per cent. excess) to give a solution of the required normality. In the second flask is suspended the quantity of pure lead thiocyanate (previously dried over phosphoric pentoxide) to react with bromine in the other flask (plus 50 per cent. excess)— $\text{Pb}(\text{SCN})_2 + \text{Br}_2 = \text{PbBr}_2 + (\text{SCN})_2$ . The bromine solution is added, with continual shaking, to the acid in which the lead thiocyanate is suspended, and the mixing continued until decolorisation is complete, after which the solution of free thiocyanogen is filtered through a dry filter from the lead bromide and excess of lead thiocyanate. It is standardised by adding a measured volume of it to potassium iodide solution (not *vice-versa*, or hydrolysis occurs), and titrating the liberated iodine with thiosulphate. To prevent polymerisation of the thiocyanogen the solution should be kept in the dark, and restandardised before use.

*Thiocyanogen Value of Fatty Oils.*—A weighed quantity (0.1 to 0.2 grm.) of the oil is dissolved in sufficient 0.1 *N* or 0.05 *N* solution of the reagent to give an excess of 100 to 500 per cent. of thiocyanogen. After the absorption (5 to 15 hours, according to the oil), the mixture is poured into an excess of an aqueous solution of potassium iodide, and the liberated iodine titrated. Simultaneously a blank determination is made with the thiocyanogen solution under the same conditions. For comparison, the results are expressed as iodine values.

Experiments with pure oleic, elaidic, erucic, and brassidic acids showed that the iodine values thus obtained agreed with the iodine values as determined by the method of Hanus. That is to say, with these acids (and their glycerides) the double bonds are quantitatively saturated with thiocyanogen. With fatty acids containing a triple bond, however, such as stearolic and behenolic acids, there was

no absorption at all of thiocyanogen, and linolic acid (tested in the form of its glyceride, linolin) absorbed only half of the thiocyanogen corresponding to its iodine value (*e.g.* iodine value, 169.1; iodine value from thiocyanogen value, 82.5). Hence linolic acid absorbs thiocyanogen only at one double bond. This affords a means of determining the amount of linolic acid in an oil by an indirect volumetric method. For example, a mixture of linolic, oleic and palmitic acids gave an iodine value of 110.36, whilst the iodine value calculated from the thiocyanogen absorbed was 62.37. Then if  $x$  represent linolic acid (iodine value, 181.09, iodine value from thiocyanogen = 90.54);  $y$ , oleic acid (iodine value, 89.9); and  $z$ , the saturated palmitic acid,

$$\begin{array}{rcccccc} \text{I} & x & + & y & + & z & = & 100 \\ \text{II} & 1.810x & + & 0.899y & + & 0z & = & 110.36 \\ \text{III} & 0.9054x & + & 0.899y & + & 0z & = & 62.37 \end{array}$$

whence,  $x = 53.0$  per cent.;  $y = 16.0$  per cent.; and  $z = 31.0$  per cent.

On applying this method to a number of oils the following amounts of the glyceride of linolic acid were found:—Castor oil, 1.15; olive oil, 4.9; arachis oil, 1st sample, 22.45; 2nd sample, 23.14; almond oil, I, 16.0; II, 14.8; rape oil, 33.1; and sesame oil, 36.8 per cent. The behaviour of linolenic acid and its glycerides towards the reagent is under investigation.

## Inorganic Analysis.

**Use of Uranous Sulphate in Volumetric Analysis.** G. Vortmann and F. Binder. (*Zeitsch. anal. Chem.*, 1925, 67, 269–276.)—Uranous sulphate can be used conveniently as a reducing agent of medium strength in a limited number of cases, *e.g.* the determination of ferric iron. The ferric chloride solution is treated with 10 drops of 10 per cent. thiocyanate solution and titrated at 60° C. till colourless. The uranous sulphate solution is made by dissolving 50 grms. of uranyl sulphate in 200 c.c. of water, strongly acidifying with sulphuric acid, and reducing with granulated zinc on a waterbath (about 40 minutes). After cooling and filtration, the solution is diluted to about 0.1 normality by standardisation against permanganate of known strength. Other determinations in which the reagent can be applied are those of manganese dioxide in pyrolusite, and nitric, chloric, and chromic acids; perchloric and bromic acids cannot be titrated accurately.

W. R. S.

**Separation of Silver from Lead.** G. Vortmann and O. Hecht. (*Zeitsch. anal. Chem.*, 1925, 67, 276–279.)—*A.* The nitrate solution is treated with 1.5 to 2.0 grms. of tartaric acid per 0.1 gm. of total metals, made slightly ammoniacal, and precipitated while warm with an excess of 10 per cent. ammonium phosphate solution. After cooling, the precipitate of lead phosphate is collected, washed with ammonium nitrate solution (1 : 500), ignited gently, and weighed. *B.* The solution containing 0.3 to 0.5 gm. of metals, is treated with 2 to 2.5 grms. of tartaric acid



per 0.1 grm., made weakly ammoniacal, boiled, and precipitated with 10 per cent. potassium iodide solution (about 10 c.c.). The precipitate of silver iodide is allowed to settle completely, washed 2 to 3 times by decantation with ammonium nitrate solution, and collected on a Gooch crucible dried at 130° C. It is then washed with very dilute nitric acid followed by pure water, and dried at 130° C.

W. R. S.

**Sensitive Method for the Detection, Separation, and Determination of Bismuth.** A. Girard and E. Fourneau. (*Bull. Soc. Chim.*, 1925, **37**, 1669–1673.)—If an acid solution containing an iodide and a trace of bismuth is shaken with a very small amount of a benzene solution of tetracetylammonium hydroxide,  $N(C_{16}H_{33})_4OH$ , the benzene layer assumes a red colour owing to the formation of the complex compound,  $N(C_{16}H_{33})_4I, BiI_3$ ; under the conditions given below, about 95 per cent. of the bismuth present passes into the benzene. Iron diminishes the sensitiveness of the reaction and also, when present as ferric salt, liberates iodine from the potassium iodide and thus colours the benzene brown, but its influence is annulled by adding sodium formate, formic acid, and sodium formate. Further, very many chemical reagents contain bismuth owing to contact with leaden vessels during manufacture and must be purified as described later.

The tetracetylammonium iodide contained in the mixture of compounds formed on passing gaseous ammonia into cetyl iodide at 200° C. is readily separated owing to its slight solubility in cold ether, and is recrystallised several times from petroleum spirit (bp. 80° C.). A solution of 10 grms. of the iodide in 250 c.c. of hot, pure benzene is shaken with two successive quantities of 10 to 20 c.c. of sodium hydroxide solution and, being then converted into the hydroxide and free from iodine, is decanted and diluted to 2 litres. After addition of 10 drops of acetic acid the solution is treated for a short time with pure animal charcoal and filtered into very clean flasks, which are kept in the dark; if no trace of iodine is present, it keeps indefinitely. Of this solution, about 100 c.c. are well shaken with a solution prepared by dissolving 200 grms. of sodium formate, 30 grms. of potassium iodide, 5 grms. of crystallised sodium sulphite and 5 c.c. of formic acid in 800 c.c. of water, and diluting to 1 litre. This treatment is repeated until the benzene layer, in a depth of 5 to 6 cm., appears quite colourless. The aqueous liquid is finally filtered and kept in the dark in well-stoppered flasks. This reagent changes gradually owing to formation of traces of hydrosulphurous acid, which is recognisable by immediate precipitation of black metallic bismuth and may be eliminated by vigorous shaking in a roomy flask.

To determine bismuth in animal organs or excreta, the material is freed from organic matter by prolonged boiling with a mixture of nitric and sulphuric acids in equal volumes, the resulting acid liquid evaporated to dryness, and the residue gently calcined in a pyrex dish; addition of a few drops of water to the hot ash facilitates its disintegration. When cold, this residue is stirred with 10 c.c. of the formate and iodide solution until completely dissolved, and the solution shaken vigorously for a minute in a test-tube with exactly 1 c.c. of the benzene tetracetylammonium hydroxide solution. The colour produced is compared with those

obtained with a series of tubes freshly prepared from a solution containing, per litre, 0.01 grm. of bismuth as the crystallised iodide, 30 grms. of potassium iodide, 5 grms. of crystallised neutral sodium sulphite and 5 c.c. of acetic acid. If the quantity of bismuth is sufficient for gravimetric determination, the decanted benzene solution is mixed with an equal volume of absolute alcohol and treated with a few drops of a solution of amylamine hydrosulphide in the alcohol-benzene mixture. The bismuth sulphide, flocculated if necessary by gentle heat or by addition of a few drops of 95 per cent. alcohol, is collected on a Gooch crucible, washed with benzene and then with absolute alcohol, and dried at 110° C.

T. H. P.

**Determination of Thallium.** W. Strecker and P. de la Pena. (*Zeitsch. anal. Chem.*, 1925, **67**, 256-269.)—*Sodium dithallium cobaltinitrite*,  $\text{NaTl}_2\text{Co}(\text{NO}_2)_6$ , obtained by precipitation of a hot solution (80° C.) of thallose salt by sodium cobaltinitrite (28.6 grms. of cobaltous nitrate and 50 c.c. of glacial acetic acid in 500 c.c., mixed with 180 grms. of sodium nitrite in 500 c.c.; about 40 c.c. are required for 0.25 grm. Tl) is a brick-red, coarsely granular precipitate. It is dried to constant weight in a Gooch crucible, after washing with dilute acetic acid followed by 80 per cent. alcohol. *Metallc thallium* may be precipitated quantitatively from its solutions by zinc or, preferably, magnesium. The excess of magnesium is removed by digestion with hot ammonium chloride solution. The moist thallium sponge is easily oxidisable in air or by dissolved oxygen; it is compressed by means of a glass rod, the solution decanted off, and the metal washed quickly with boiled water. While still covered with water the compressed sponge is transferred to a porcelain boat by means of a spatula. The boat is gradually heated in a current of hydrogen to 200° C., and the metal weighed after cooling in hydrogen. The sponge may also be alloyed with fused Wood's metal. Two grms. of this are melted in a beaker, poured into hot water, and united into one globule with the help of a glass rod. By immersion of the beaker in cold water the globule is quickly chilled; it is washed with alcohol and ether, dried in the air, and weighed. It is then added to the hot liquid containing the thallium sponge, magnesium having been removed as before. By warming over a small flame and inclining the beaker, the alloy is made to dissolve the thallium. After the fused metal has been stirred with a rod the beaker is cooled as before, and the solidified alloy washed, dried, and weighed. The increase in weight gives the quantity of thallium. The following *volumetric method* was worked out: The thallose solution is gradually treated with a potassium iodide solution (8.138 grms. per litre; 1 c.c. = 0.01 grm. Tl) while being stirred. When the turbidity becomes faint, 10 c.c. excess of precipitant are added, and the solution shaken and left to stand. When clear it is decanted through a pleated filter; the precipitate is washed once with a little water. The filtrate is treated with a few drops of a solution of nitrous acid vapours in strong sulphuric acid, and the liberated iodine is dissolved by shaking with xylene. After washing in a separator, the excess iodine is titrated with thiosulphate.

W. R. S.

**Separation and Determination of Bismuth by Hydrolysis.** L. Moser and W. Maxymowicz. (*Zeitsch. anal. Chem.*, 1925, 67, 248-256.)—The method is based upon neutralisation by means of a bromide-bromate mixture. The precipitation is quantitative, and the reaction extremely delicate. Ammonium salts and chlorides should not be present. The acid nitrate solution is cautiously treated with sodium carbonate solution until the precipitate formed re-dissolves slowly; the bulk being 200 to 300 c.c., solid potassium or sodium bromate (2 grms.) is added, and the solution boiled. Any turbidity at this stage is removed with a few drops of nitric acid. A 10 per cent. solution of potassium (sodium) bromide is added, drop by drop, to the boiling solution until a strong brown coloration and simultaneous precipitation occur. The liquid is then boiled till pale yellow, when more bromide is added, boiling being continued. When a further addition of bromide causes no change the solution is boiled to remove all bromine; it is advisable to add a few drops of bromate solution at this stage, as a test for the presence of an excess of the reagent. The pale yellow basic bismuth bromide is left to settle, collected, and washed with hot water. It is not suitable for weighing and is therefore converted into phosphate after solution in hot dilute nitric acid. This procedure separates bismuth from lead, copper, cadmium, and zinc. In the separation from lead, the first basic bromide precipitate contains a little lead, which however is not precipitated as phosphate.

Luff's method (*ANALYST*, 1924, 49, 249) was submitted to a critical examination, with the result that it is recommended to let the basic nitrate precipitate stand several hours in the cold before filtration; otherwise the results are apt to be slightly low.

W. R. S.

**New Confirmatory Test for Aluminium.** H. W. Estill and R. L. Nugent. (*J. Amer. Chem. Soc.*, 1926, 48, 168-169.)—The precipitate of supposed aluminium hydroxide is dissolved in dilute sulphuric acid and filtered; 5 c.c. of water are added and enough tincture of alkanet to make the solution a ruby-red colour. Ammonia is dropped in with vigorous shaking, until the colour changes to blue, and a further excess of 3 to 5 c.c. is then added. If aluminium is present, a purple precipitate is formed and rises to the surface in a few minutes, and from the bulk of the precipitate an approximate idea of the amount of aluminium can be formed. Under these conditions silicic acid and titanium<sup>''''</sup> give gray-blue precipitates and tin<sup>'''</sup> a red-brown one. Chromium, iron, tin<sup>''</sup>, mercury, bismuth, and lead give precipitates which cannot be confused with that of aluminium, Zinc, silver, copper, cadmium, cobalt, nickel, arsenic, antimony and manganese remain in solution.

H. E. C.

**Separation of Zirconium from Iron and Aluminium.** R. Lessing. (*Zeitsch. anal. Chem.*, 1925, 67, 341-352.)—The author finds that the following ammonium carbonate method yields very good results. The chloride or nitrate (not sulphate) solution, free from fixed alkalis, is treated with ammonium chloride (2 grms.), and a very small excess of dilute ammonium carbonate, and diluted to

400 c.c.; the whole is heated to 70° to 80° C. for 5 to 10 minutes. The iron-aluminium precipitate deposits well. The hot solution is filtered, and the precipitate washed with hot water so that the filter remains filled with liquid. The precipitate is dissolved in warm dilute hydrochloric acid, and the precipitation repeated as above. The second precipitate is free from zirconia, and is ignited and weighed as  $\text{Fe}_2\text{O}_3 + \text{Al}_2\text{O}_3$ . The combined filtrates are cautiously acidified with hydrochloric acid, and concentrated; the zirconium is precipitated by ammonia free from carbonate, preferably at 50° C.; the precipitate is well washed, ignited to constant weight, and weighed as  $\text{ZrO}_2$ . Titanium interferes: it remains partly in the precipitate, whilst the balance dissolves. Thorium, if present, accompanies the zirconium. The rare earths should be removed by a preliminary precipitation with oxalic acid. The method applies equally well to the separation of aluminium alone (or iron) from zirconium.

W. R. S.

**Electrometric Determination of Tellurium.** W. T. Schrenk and B. L. Browning. (*J. Amer. Chem. Soc.*, 1926, **48**, 139–140.)—Tellurium may be accurately determined in the presence of selenium, copper, and ferric iron by oxidation with dichromate and subsequent titration of the excess of dichromate with ferrous sulphate. The method is essentially that of Lenher and Wakefield (*ANALYST*, 1923, **48**, 464), with the exception that the titration of the excess is made electrometrically in the ordinary way so as to avoid the use of an outside spot indicator.

H. E. C.

**Analytical Chemistry of Rubidium and Caesium.** W. Strecker and F. O. Diaz. (*Zeitsch. anal. Chem.*, 1925, **67**, 321–341.)—Rubidium and caesium can be determined as *perchlorates*, like potassium, by evaporation with perchloric acid; the determination is accurate, as the salts are more insoluble than potassium perchlorate. Rubidium is quantitatively precipitated as *cobaltinitrite*, but the precipitate is useless for quantitative work as its composition is variable. Caesium is precipitated at 80° C. as coarsely-crystalline  $\text{Cs}_3\text{Co}(\text{NO}_2)_6 \cdot \text{H}_2\text{O}$ ; precipitation is quantitative after 12 hours' standing. *Rubidium chlorostannate*  $\text{Rb}_2\text{SnCl}_6$  is obtained when a concentrated solution of the chloride is mixed with an equal volume of strong hydrochloric acid and 2 volumes of strong alcohol, and the boiling solution precipitated with a boiling-hot, concentrated alcoholic solution of stannic chloride. The crystalline precipitate is collected after 4 hours' standing, washed with absolute alcohol, and dried at 110° C. *Caesium chlorostannate* is precipitated in like manner, but, being more insoluble, the stannic chloride precipitant can be made up in 2 parts of alcohol and one of strong hydrochloric acid. A critical study of Godeffroy's *antimony trichloride method* for caesium showed that the precipitation is quantitative in glacial acetic acid: 25 c.c. of the acid are added to 0.5 gm. of caesium chloride dissolved in very little water. The liquid is precipitated at about 100° C. with a cold saturated solution of antimony trichloride in glacial acetic acid after complete cooling, and subsequent 3 hours' standing, the precipitation is complete. This method can be used for the *separation of caesium from rubidium*.

co-precipitation of the latter is counteracted by addition of sodium chloride or, preferably, ferric chloride, a complex chloride of variable composition being precipitated ( $3\text{CsCl} \cdot 2\text{SbCl}_3 \cdot \text{FeCl}_3$ , also  $1/2 \text{FeCl}_3$ ). The mixed chlorides are treated with an equal weight of ferric chloride, and dissolved in a minimum of water. Glacial acetic acid (50 c.c. per grm. of mixed chlorides) is added, and the boiling hot solution is precipitated with antimony trichloride in glacial acetic acid as directed above. After one hour's digestion on the water-bath, the precipitate is left to stand in the cold for 12 hours, collected in a porous glass crucible (ANALYST, 1926, 51, 30), and washed with a 5 to 10 per cent. solution of antimony trichloride in glacial acetic acid. The precipitate is dissolved in dilute hydrochloric acid and the caesium determined as perchlorate. The filtrate is evaporated, and the rubidium determined as perchlorate after the removal of antimony and iron. If caesium predominates, a single precipitation is usually sufficient; but if the proportion of rubidium is high, it is advisable to re-precipitate the caesium compound. The error in 11 test separations was occasionally as high as 2 per cent., but in the majority of cases it was much smaller. The *separation of caesium from potassium* by the above method presents no difficulties. For the *separation of rubidium from potassium* the solution of the mixed chlorides in very little water is treated with one part of strong hydrochloric acid and two of alcohol. The bulk of the potassium chloride is thus precipitated; it is filtered off, washed with absolute alcohol, and weighed after drying at  $110^\circ \text{C}$ . The filtrate is treated as prescribed above for the precipitation of rubidium chlorostannate. After some hours' standing, the precipitate is collected, washed with absolute alcohol, dried at  $110^\circ \text{C}$ ., and weighed. The balance of the potassium is determined in the filtrate as perchlorate. Three test separations shown gave very close results. The *separation of potassium, rubidium, and caesium* is effected by dissolving the mixed chlorides in a minimum of water and separating the bulk of the potassium chloride as in the preceding separation. Caesium and rubidium are then precipitated together in the filtrate at boiling heat as chlorostannates, in the filtrate from which the rest of the potassium is obtained as perchlorate. The mixed chlorostannate precipitate is dissolved in tartaric acid solution, the tin precipitated as sulphide, the filtrate evaporated to dryness, and the tartaric acid destroyed by cautious ignition. The rubidium and caesium in the residue are separated by the antimony chloride method. Alternatively, caesium and rubidium may be precipitated and weighed together in one portion as chlorostannates, and the potassium determined as before. In another portion caesium is separated from the other two metals by antimony chloride, and converted into and weighed as perchlorate. This weight is calculated to caesium chlorostannate, which is subtracted from that of the mixed chlorostannates, giving rubidium by difference. The results of three test separations are very good.

W. R. S.

## Physical Methods, Apparatus, etc.

**Photographic Spectro-polarimeter for the Ultra-violet.** A. Cotton and R. Descamps. (*Comptes Rend.*, 1926, 182, 22-26.)—A spectro-polarimeter is described in which the rotation of the analyser produces a displacement of the image on the photographic plate, and which registers, not merely a definite number of images corresponding with the same number of values for the angle between the polariser and analyser, but also the continuous variation of the intensity accompanying the continuous variation of such angle. T. H. P.

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## Reviews.

THE CHEMICAL ANALYSIS OF FOODS. H. E. COX, M.Sc., Ph.D., F.I.C. Pp. 317. London: J. & A. Churchill. 1925. Price 18s.

In spite of the author's declaration that "the point of view is that of the requirements of public health and of the Sale of Food and Drugs Acts," a perusal of this book leaves the reviewer in some doubt as to its intention, or rather for whom it is intended. The author states in his preface that "To the specialist no text-book is really adequate or contains just that information which he seeks"; but why should it not? Despite disclaimers, a text-book must be judged upon its merits—whether it does, or does not, contain that information which is sought, and whether that information is accurate—unless its object is inspiration only. A treatise on analysis must be judged from the more obvious, if more utilitarian point of view. A book of this character is of use to the specialist or to no one, it being assumed that the specialist in this case is a person engaged upon the analysis of food, a branch of chemistry large enough to accommodate a number of specialists in a more restricted sense.

There are eleven chapters, usual sub-divisions of the subject matter being adopted. The size of the book (the pages are small and the type large) does not admit of exhaustive treatment; the relative amounts of space given to various matters become, therefore, of importance, and in this respect there is a want of balance.

Mustard, pepper and spices are not burning questions of the day, but they are given a great deal of attention. In this section, the author's contention that mustard flour contains between three and four per cent. of starch will not be accepted by most analysts. Bacterial food poisoning and rat-feeding experiments cannot be adequately dealt with in two-thirds of a page, and would have been better left alone. Infant foods require much attention, but they are allotted a page and a half, most of which is occupied by three tables of analytical

results: methods of analysis are dismissed in the sentence "Their analysis follows closely the lines of the examination of dried milks," which is hardly fair to the infant.

Baking powder receives considerable notice, but the very pressing questions of bleached and improved flour are inadequately treated. The benzidine reaction for the detection of persulphate is inaccurately described; benzoyl peroxide is stated to be an improver: all the notice chlorine gets is "chlorine, if used in moderation, is not detectable in the flour after a lapse of time after treatment; there can hardly be any question that it is undesirable"; the latter part of this statement would seem to be a reason for dealing with the matter fully. With the exception of a slight sketch of sedimentation from chloroform and the nitrite reaction, the quantitative determination of these or other additions to flour is not attempted.

The analysis of condensed milk, we are informed, "presents no special difficulty," and tables of results of analyses are given in which in all cases the sum of the water, the milk-solids and the sucrose is 100.00. It would seem that the useful determination by difference must have been freely used here, but that this is the case is left to be inferred. In the same chapter the statement, in connection with milk, that "broadly speaking, the fat from the food passes unchanged into the milk" cannot be allowed to pass unchallenged, and the method given for the determination of the solubility of milk-powders is very much open to question. With regard to sedimented dirt in milk the direction that "a microscopical examination of the sediment should be made" does not carry one very far.

Sugars, syrups, jams, and so forth are given a chapter. Here the treatment is fuller. Polarimetric methods, the Brown, Morris and Millar gravimetric process, the volumetric process with the Ling, Rendle and Jones thiocyanate indicator are described; a reference to the methylene blue indicator of Lane and Eynon would have been desirable. The description of iodimetric methods for sugar determination is sketchy; no caution is given as to the importance of the conditions of experiment, and the iodine equivalents of lactose and maltose given are strangely inaccurate. The inclusion of a full account of J. King's work on the detection and determination of pectin and agar in jam is a good feature in this chapter.

Oils and fats are accorded somewhat slight treatment. The methods for the determination of most of the usual "constants" are faithfully described; the detection of hydrogenised oils is dealt with, some doubt being thrown upon the certainty of the iso-oleic process of Bolton and Williams, perhaps rather a debatable point. No variant of the Bellier test is given, and acetyl value is not mentioned.

Cocoa and chocolate are given a fair treatment, with the exception of their microscopy; the difficult question of illipé fat is not referred to, and milk-chocolate might well have had fuller consideration.

In an appendix the recent Public Health (Preservatives, &c.) Regulations are given and the identification of prohibited colours is dealt with, but not in a

sufficiently extended manner to be of much service to an analyst who is called upon to ascertain whether a certain dye in a food is or is not one of those prohibited.

All the way through the book, indeed, the difficult points are slurred over and not followed up or, worse still, represented as being non-existent; this is not the way to "suggest to the intelligent worker lines on which further investigation can be made," which, according to the preface, is one of the author's aims.

The book is well produced and indexed; "butyrometer" is not a desirable contraction for "butyro-refractometer" (p. 271), and "under the polarimeter" is used in place of "by polarised light" (p. 50); it is a pity that the catalogue term "petroleum ether" is used throughout the book. As the author allows, microscopy is not given the prominence it deserves; he states his reasons for this.

The author gives a number of references to recent papers in *THE ANALYST*, and from time to time useful and unusual pieces of information are given. It will be gathered from what has been said above that the book does not go deep enough for a "treatise," and that it is not, unfortunately, in all respects a safe guide for the inexperienced.

E. HINKS.

A MANUAL OF CHEMISTRY. By ARTHUR P. LUFF, M.D., B.Sc., F.R.C.P., F.I.C., and HUGH C. H. CANDY, B.A., B.Sc., F.I.C. 7th Edition. Vol. II., Organic Chemistry. Pp. vii. + 267. London: Cassell & Co., Ltd. 1926. Price 6s. net.

The first volume of this book, devoted to inorganic chemistry, was reviewed in these pages in December last (*ANALYST*, 1925, **50**, 643). The present volume deals exclusively with organic chemistry, covering the ground usually required by candidates studying for the elementary examination in this subject held by the Conjoint Board and the Universities. As was the case with the first volume, the information afforded is clear, concise, and carefully revised to bring it up to date.

Commencing with General Principles, Ultimate Analysis and Classification of Organic Compounds, and passing on to a consideration of the general classes of Aliphatic Compounds, the authors conclude the theoretical section with an account of the more important Aromatic bodies.

The book also includes a useful chapter on Alkaloids and other substances of medicinal interest; this should prove of distinct value to students of medicine, even after they have qualified.

Part VI., dealing with practical organic chemistry and including descriptions of the preparation of various substances as well as methods for their detection and estimation, completes what should prove a most useful little treatise.

P. A. ELLIS RICHARDS.

CELLULOSE ESTER VARNISHES. By F. SPROXTON, B.Sc., F.I.C. Pp. xi + 178. London: Ernest Benn, Ltd. 1925. Price 15s. net.

This monograph contains a satisfactory account of the ingredients used in the manufacture of varnishes based on cellulose esters, as well as a statement of the



methods of manufacture. The introduction is a good and concise account of the origin and development of cellulose esters for varnish and other purposes.

The author presents his views clearly and in a manner likely to appeal to all readers who wish to have a concise statement of the present state of knowledge of cellulose esters. Thus, it will be agreed readily that the paragraph on page 28, dealing with the significance of viscosity of cellulose ester solutions, supplies in a few sentences all that is necessary to enforce caution in deducing molecular magnitude from viscosity determinations. The chapters dealing with cellulose nitrate and acetate are satisfactory and full enough for general use. In the analysis of cellulose acetate, alkali saponification is, no doubt, satisfactory for the acetate alone, but the reviewer has found that concordant results can be more readily obtained by acid hydrolysis and distillation when the acetate is mixed with softeners and plasticisers, particularly when anhydrous sodium sulphate is used to hasten the distillation.

The sections dealing with the physical properties of cellulose ester solutions are presented very clearly and satisfactorily, full references to the most recent work on viscosity, solubility, swelling and dispersion being supplied. The general reader will be grateful for the presentation of the subject here given. It is to be hoped, however, that the word "spersion" (page 61) will drop out of use, for the sake of euphony.

The chapter on the ingredients of cellulose ester varnishes is well worth study, because it states plainly the reasons for choosing particular ingredients, especially the solvents. The importance of the B.E.S.A. Specifications for acetate dopes is recognised, and it will be agreed that these Specifications form a sound basis for good commercial products. It may be noted, in passing, that the difficulties referred to on page 101 in manufacturing fermentation acetone have certainly been overcome, and that acetone of this character of high purity is being made largely. "Methyl" acetone is described on page 102 as being principally acetone and methyl alcohol, but many of those examined recently have contained upwards of 30 per cent. of methyl acetate. One is at a loss to understand why the term "methyl acetone" has been used so widely to describe this mixture; it seems to be another example of trade misapplication of chemical nomenclature, which one has to tolerate with some reluctance.

In the chapter on the manufacture of cellulose ester varnishes, attention is rightly directed to the necessity for strict specification of the ingredients, and to the unsatisfactory character of many varnish formulae published, because of the want of precision in defining the ingredients. Testing of the miscibility of castor oil with alcohol (p. 112) needs to be carried out rather carefully, because the oil is very sensitive to small changes in the strength of the alcohol. For this reason it is preferable to carry out the test by weight rather than by volume as described.

Considering the book as a whole, the work may confidently be recommended to those who desire the latest accurate information on cellulose ester varnishes.

**BLACKS AND PITCHES.** By H. M. LANGTON, M.A., B.Sc., A.I.C. Pp. xi + 179.  
London: Ernest Benn, Ltd. 1925. Price 15s. net.

This book is one of a series of monographs dealing with various branches of the oil and colour industry, and, in view of the importance of black pigments in the manufacture of paints and printing inks, its inclusion in the series is well justified.

After a general introduction dealing with the occurrence, classification and methods of preparing black pigments, the individual substances are dealt with in twenty-one chapters. They include graphite, carbon blacks, lampblacks, the black pigments, pitches of all kinds, bituminous fabrics, and bituminous paving materials.

In each instance details of manufacture and methods of analysis are given, together with full references to original papers. For instance, the relationship between the marks made by graphite on paper and its chemical composition, which was first established by the reviewer, is described at some length, with illustrations, and typical analyses of pencil pigments are quoted in full. The characteristics of graphite suitable for batteries might, with advantage, have been included as a subsidiary point in this chapter, since it is as cognate to the main subject as roadway and pavement construction (Chapter XXI.).

The chapter on carbon blacks is a valuable outline of the production, properties, analysis, and uses of these important modern pigments, and when supplemented by the information on the testing of black pigments for ink making (Chapter VII.), forms a very complete practical guide to this part of the subject. The difference between the physical characteristics of "short" and "long" carbon blacks is shown by two excellent photomicrographs taken by Dr. Thiessen.

In the sections dealing with pitches and bituminous materials the classification has been based, in the main, on Abraham's scheme, but, since this is essentially a practical book, the author wisely refrains from entering into the classification controversy, although he gives the necessary references for the use of those who do not wish to accept the scheme. The chemistry of bitumens and pitches and the methods of testing them are first discussed, and then come chapters on the asphalts, asphaltites, and the pitches from various sources, all of which are full of analytical detail. There is also a useful chapter on the examination of bituminous paints, varnishes and enamels.

The author has succeeded in collecting and critically summarising an immense amount of material scattered throughout scientific journals in all parts of the world, and all who have to use or examine black pigments may be grateful to him for providing them with a trustworthy handbook.

EDITOR.

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