OBITUARY NOTICES.

OTTILIE BLUM-BERGMANN.

1900—1937.

OTTILIE BLUM-BERGMANN received her early chemical training in Vienna under the direction of Professor Schlenk, and completed her thesis there on "The Structure Of Indophenine." In 1921 she proceeded, together with Professor Schlenk, to Berlin University, where she worked as his assistant until, in 1933, owing to the political situation in Germany, she was compelled to leave the country. After a few months' stay in London she accepted a position in the Daniel Sieff Research Institute, Rehovoth, Palestine, where she continued her scientific work in collaboration with her husband, Dr. Ernst Bergmann, until her death, which occurred on May 16th, 1937, in her thirty-seventh year.

Her work in Berlin was concerned mainly with the chemistry of the alkali organic compounds, and stereochemical questions, according to the general trend of work in Professor Schlenk's laboratory. Later she turned her attention to the chemistry and synthesis of aromatic compounds allied to the steroids. She explored the possibilities of building up the indene system which is one of the fundamental features in the molecular structure of these cyclic compounds, and she applied the experience so gained to the actual synthesis of representatives of this group. She showed that some of her products had oestrogenic properties, which, at that time, was uncommon with synthetic compounds.

Of her recent work, the synthesis of methylcholanthrene, *cyclo*pentenotriphenylene and 2 : 3-*cyclo*pentenophenanthrene may be mentioned. Following the tradition of Professor Schlenk and his co-workers, she remained always interested in theoretical problems and at the time of her death had just completed two papers on the mechanism of the Wurtz–Fittig reaction and the addition of ketens to ethylenic bonds.

HAROLD DAVIES.

MAY SYBIL BURR.

1887—1937.

MAY SYBIL BURR (née Leslie) was born on August 14th, 1887, at Woodlesford (W.R., Yorks). Her scientific bent was clearly indicated when she graduated with First Class Honours in Chemistry at Leeds in 1908. In the following year she was elected to an 1851 Exhibition Science Scholarship and proceeded to Madame Curie's laboratory at the Sorbonne, where for two years she worked on problems connected with the radioactivity of thorium and its disintegration products. Renewal of the scholarship for a third year permitted her to spend some time with Rutherford at Manchester.

Her teaching career began with a post as science mistress at the Girls' High School, West Hartlepool, and this was followed by experience as Assistant-Lecturer in Chemistry at University College, Bangor.

From 1915 to 1918 she acted as chemist-in-charge of laboratories in H.M. factories concerned with the manufacture of high explosives at Litherland (Liverpool) and Penrhyndeudraeth (N. Wales) and in this capacity contributed effectively towards the solution of urgent technical problems.

She returned to Leeds in 1918 as Assistant-Lecturer in Inorganic Chemistry and was subsequently transferred to the Department of Physical Chemistry, where she took an important share of the teaching work both as lecturer and as assistant in charge of the laboratory.

In 1923 she married Mr. A. H. Burr, Lecturer in Chemistry at the Royal Technical College, Salford, and later moved to Scotland, where her husband became Head of the Chemistry Department at Coatbridge Technical College. On his decease in 1933 she took up the investigation of various kinetic problems and was thus engaged until a month prior to her death, which occurred on July 3rd, 1937.

Mrs. Burr's reputation as a scientific worker was deservedly high; on the list of women graduates of the University of Leeds her name is the only one distinguished by the award of the D.Sc. degree. In addition to her published original work, she wrote the section on the alkaline-earth metals in Friend's well-known "Text Book of Inorganic Chemistry," and (in collaboration with J. C. Gregory) the section on beryllium and its congeners.

As a teacher she was exceptionally gifted and spared no effort to remove the difficulties encountered by students in their contact with scientific problems whether of chemical, physical, or mathematical nature.

Her aptitude was, however, by no means confined to science and it may be recalled that her contact as an undergraduate with the Department of English Literature led to the expert opinion that she would most certainly achieve distinction in the Faculty of Arts if she cared to forsake the study of chemistry.

To her intimate friends she was known as a woman of the highest ideals, of wide human sympathies and of great earnestness of purpose. Her reticence and innate modesty limited the circle of her acquaintances, but such restriction would doubtless count for very little in comparison with the respect and sincere regard of those who were privileged to enjoy her confidence.

H. M. Dawson.

JOSEPH BERNARD COLEMAN.

1859—1937.

Coleman was born at Arnold, Nottinghamshire, in 1859, and died at his residence in Norwich on July 11th, 1937. His name is well known in the world of analytical chemistry, largely on account of the books on this subject of which he was co-author. In 1879 he took up a Royal Exhibition at the Royal College of Science, Dublin, and after a brilliant career as a student he obtained the Diploma with first place on the examination list. In 1892 he was appointed to University College, Nottingham, ultimately becoming Senior Demonstrator and Lecturer in Pure and Applied Chemistry. Here he became associated with the late Dr. Clowes, an association which continued actively up to the time of his colleague's death in 1923. He was elected a Fellow of the Institute of Chemistry in 1887 and he was a member of the Society of Chemical Industry. In 1895 he came to the South Western Polytechnic Institute, Chelsea, as the first Head of the Chemical Department, and remained at this post up to the time of his retirement in 1924. His work and interests centred principally round the teaching of analytical chemistry. He was a finished analyst, and a clear teacher. During his work with Clowes, they conceived the idea of writing a practical book on quantitative analysis which should embody their experience of teaching the subject, and should serve to smooth the somewhat thorny path of the average chemical student of those days. The book was first published in 1891, and was an immediate success. It has run through thirteen editions. A shorter volume on the same lines was published in 1891. He collaborated in several other books on practical chemistry, qualitative analysis, and practical agricultural chemistry. These works were under constant revision. He did not believe in resting on his oars, and the results are seen in the continued popularity of most of these works. In his early days at Nottingham, he was Assistant Consulting Chemist to the borough from 1887–1894. During the war he was engaged in the work of collecting matter for the Chemical Information Committee on Lubricants, of which he was Chairman, for the Department of Scientific and Industrial Research.

It will be gathered that these activities, combined with his teaching and departmental organisation, left him little leisure for research. His published papers and articles deal with analytical methods and laboratory equipment.

Coleman was a man of outstanding personality and indomitable will, an able organiser, withal attractive and of a cheerful temperament. He was always ready to consider suggestions, which were, however, subjected to critical examination. He was very careful to satisfy himself of the reliability of any matter included in the books written with his co-authors. His insistence on correct experimental procedure, his sense of justice, and his

keen interest in the students themselves, and in their social and athletic activities have left his impress on hundreds of his old students now working in all parts of the world.

J. C. CROCKER.

JOSEPH COWPER.

1866—1937.

JOSEPH COWPER, who died on November 28th, 1937, was born in Penrith on January 16th, 1866. Leaving Mr. James Briggs' school at Sockbridge House in that town at an early age, Cowper was apprenticed to Mr. Redfern, of King Street, and became a qualified chemist and druggist at 21 years of age, and for two years managed a business for the late Mr. Senier at Norwood. He then returned to Penrith and became proprietor of the business where he served his apprenticeship. Under his able guidance the business grew rapidly and in 1899 was converted into a limited liability company, of which he was Chairman until, in 1921, at a comparatively early age, he decided to retire. Apart from long and constant association with the Tradesmen's Association, Cowper took little part in local affairs. He was, however, a prominent Freemason and a keen collector of antiques, upon which he was a recognised authority.

He was elected a Fellow of the Society in April, 1888.

FREDERICK JONATHAN DOWN.

1855—1937.

F. J. DOWN, who died at his home at Harpenden, Hertfordshire, on October 17th, 1937, aged 82 years, was born in Cheshire in 1855. He joined the Society in November, 1884, attaining his jubilee as a Fellow in 1934. As a young man, Down read chemistry and studied in Germany under Fresenius, afterwards taking an appointment with the Blaydon Manure and Alkali Company Ltd. Later, he was attracted to electrical engineering, particularly electric lighting, and secured the representation of the American Thomson–Houston arc lighting system for Great Britain. He became a partner in the firm of Laing, Wharton, and Down, which carried out much pioneering work in the extension of the use of electricity for all forms of lighting and power and from which the British Thomson–Houston Company developed. He took an active share in forming the Overhead Lines Association and in recent years his business was concerned with the provision of appliances for the construction of systems for overhead distribution of current.

Down was a man of untiring energy and genial personality. He carried on his work almost to the last, and he will be greatly missed by a large circle of business associates as well as by his many personal friends.

C. T. GIMINGHAM.

CHRISTOPHER MAURICE WALTER GRIEB.

1885—1937.

C. M. W. GRIEB died at Munich on July 14th, 1937, in his 53rd year as the result of a motor accident while spending his summer holiday in Bavaria.

On leaving school Grieb proceeded to University College, London, where he studied under Sir William Ramsay and Professor J. Norman Collie, obtaining his B.Sc. (Hons.) at the end of the three years' course. After a further year spent in carrying out research with Ramsay, Grieb was appointed Analytical Works Chemist to Messrs. Lorimer and Co., Manufacturing Chemists and Druggists at Islington. In 1909, he became Chief Chemist to Messrs. R. Fry and Co., Mineral Water Manufacturers at Brighton, and after a short stay there, entered the services of Nobels Explosives Co. at Polmont as Chief Laboratory Chemist, becoming after four years Works Manager at their filling factory at Perranporth, Cornwall.

In 1919, he was appointed Chief Chemist to the Mond Nickel Co. at Clydach. Here he was in charge of the experimental and research work in connection with all processes and plant. He specialised in the analysis of precious metals and their recovery from ores and residues and in the manufacture of liquid nickel and iron carbonyl. In conjunction with R. H. Jones, he published a paper entitled " Phosphides of Nickel : The Reaction between Phosphorus and Nickel Carbonyl " in the *Journal* for 1932.

Possessed of an even temper, patience and persistence, Grieb was very conscientious in all his work, and was a good linguist. He took a prominent part in the social life of the Works, and in particular with the Carbonyl Dramatic Society and the Works Orchestra. He acted as Chairman of the South Wales Section of the Institute of Chemistry from 1926 to 1928, and of the South Wales Section of the Society of Chemical Industry in 1934. He was elected a Fellow of the Chemical Society in February, 1907.

He is survived by his widow and two sons.

EMILE MOND.

ROBERT OSWALD HALL.

1905—1937.

ROBERT OSWALD HALL died suddenly (the result of an accident) on November 28th, 1937.

He was born on June 24th, 1905, and educated at Wakefield Grammar School from 1916 to 1923. In 1924, he entered Leeds University, where he took the Honours Chemistry course, holding the Lord Kitchener National Memorial Scholarship from 1925 to 1929. In 1927, he gained 2nd Class Honours in the degree examination, becoming a B.Sc., and was also granted the Walker-Wilson and Clothworkers' Research Scholarships in Textiles.

During the following three years, Hall took part in a general study of the hygienic properties of clothing, and investigated the laws governing the transmission of water vapour through textile fabrics as a function of their structure and the nature of the component fibres. An account of the work is to be found in the thesis on " The Ventilating Properties of Textile Materials and Fabrics," for which he was awarded the degree of Ph.D. at Leeds University in 1930. The same year, he was elected an Associate of the Institute of Chemistry, and was appointed an Assistant Chemist in the Government Laboratory, Clement's Inn.

In February, 1931, Hall was appointed Research Fellow of the Textile Department, Ontario Research Foundation, Toronto, where he remained for three years. Here he carried on a series of investigations relating to the quality and specifications of textile materials as used in the motor-car industry. This work led him into a number of separate lines of research of a fundamental character. Thus, in regard to the colour of fabrics, he devised an instrument by which it was possible to determine the fugitivity of dyes, under controlled conditions of temperature and moisture, but under intense illumination, which greatly accelerated the fading. He was appointed to draw up standards of fastness acceptable to the two branches of industry concerned. Other aspects of his work were concerned with standards of length measurement in relation to the atmospheric humidity and hence the moisture content of textile materials. In addition to such problems as these, which were undertaken on account of their immediate importance to industry, he found time to pursue enquiries of a more academic character, particularly an investigation of the absorptive behaviour of the wool fibre in relation to the degree of swelling.

Early in 1934, Hall accepted an offer of the position of Research Chemist with Messrs. C. W. Martin & Sons, Ltd., Bermondsey, S.E.1., in connection with their processes in dressing and dyeing furskins. During the past three years, he carried out fundamental research on the behaviour, under different conditions, of the individual fibres constituting the fur and pelt of skins. For these investigations he worked out a special technique in microscopy which led to some extremely novel and interesting results. Other problems investigated by him included " singeing " of hairs, bleaching of ermine, and unhairing of fur seals. His abilities as a physicist proved of great value in work connected with the conditioning and drying of skins.

Hall represented the best type of scientist, logical, clear-thinking and of wide experience; by reason of these qualities his views commanded respect and attention. In addition to his extensive activities in industrial research work, he was a keen sportsman and athlete and obtained his colours at Leeds University for boxing. He represented the University at the inter-varsity boxing competitions in London and Manchester, and was also a prominent member of the University team of harriers, taking part in many of their cross-country events.

His loss will be felt not only by scientific workers who had come in touch with him, but by his colleagues and friends who were attracted by his cheerful disposition and sound judgment. He leaves a widow and one child.

Hall was elected a Fellow of the Society in February, 1937.

R. E. GARROD.

SIR HERBERT JACKSON.*

1863—1936.

EMERITUS PROFESSOR SIR HERBERT JACKSON, K.B.E., F.R.S., was born at Hampstead on March 17th, 1863. From King's College School he entered King's College, London, in 1879 and worked as student, Daniell Scholar, and Student-Demonstrator under Professor C. L. Bloxam until the latter's retirement in 1887, much of his work being carried out in Professor Bloxam's private laboratory. He was appointed Lecturer in Chemistry shortly after John Millar Thomson had succeeded Bloxam, became Assistant Professor in 1902, and Professor of Organic Chemistry in 1905. In 1907 he was elected a Fellow of King's College and on the retirement of Thomson in 1914 was appointed Daniell Professor of Chemistry. He resigned from this position in 1918, with the title of Emeritus Professor, on his appointment as Director of Research of the British Scientific Instrument Research Association.

During the whole of his 39 years at King's College Jackson associated himself closely with the various athletic and social activities of the College, making contact with and gaining the affectionate regard of the students of all faculties. Among the students in Science and Engineering, and particularly among the students specialising in Chemistry, he earned the reputation of being an inspiring teacher and an attractive lecturer, while his skill as an experimenter, his fertile imagination, and his versatility were recognized by all who had any close contact with him or intimate knowledge of his work.

Having regard to the large number of investigations in which Jackson interested himself while at King's College, his publications were remarkably few. About 1890 he began work on the production of fluorescent and phosphorescent materials, and made a considerable study of the behaviour of such materials when excited by ultra-violet light or by exposure to the electric discharge in low-vacuum and high-vacuum discharge tubes. The discharge tubes which he used were constructed throughout by himself, and he produced a number of types for the purpose of investigating how the brightness and distribution of the phosphorescent effects obtained could be modified by changing the form of the glass envelope, by fitting electrodes of different shapes, and by altering the disposition of the electrodes. In the course of this work he discovered that in high-vacuum tubes fitted with concave cathodes, the response of the phosphorescent material used as the anti-cathode could be restricted to a comparatively small area at or near the centre of curvature of the cathode, and that, in some cases, the phosphorescent material became considerably heated in this area. He also used tubes fitted with anti-cathodes made of non-phosphorescent materials, including metals, to investigate the possibility that such materials might emit invisible phosphorescent radiations when excited in an electric discharge tube. To detect any ultra-violet radiation which, originating at the cathode, might be transmitted through the glass walls of the tube, he used screens of phosphorescent materials held close to the tube and in some cases observed that the screens glowed visibly.

* Reprinted by permission from the *Proceedings* of the Royal Society.

His interest throughout this work was in the phosphorescent effects rather than in the mechanism by which they were produced. His views regarding that mechanism, stated many years later in conversation, were that the electric discharge caused the cathode to emit ultra-violet radiation which, falling on the anti-cathode, excited the phosphorescent response on the anti-cathode material. The glow of phosphorescent material held outside the tube was considered to be a "secondary" phosphorescence excited by ultra-violet radiations present in the "primary" phosphorescent emission from the anti-cathode. The fact that radiations emitted by the anti-cathode could penetrate the glass walls of the tube, and could excite a screen held outside the tube, was taken to indicate that the wavelength of the radiation emitted by the anti-cathode was not shorter than 3000 A.

There can be no doubt that the response of the phosphorescent screens held close to the tube was, in some cases at any rate, due to *X*-rays emitted by the anti-cathode and that, had the observations been viewed from a different standpoint, Röntgen's discovery might have been considerably anticipated. At no time, however, did Sir Herbert Jackson advance any claim to be the original discoverer of *X*-rays, or countenance any suggestion that such a claim might be made on his behalf. Throughout these investigations he had considered that he was dealing with comparatively long-wave ultra-violet radiations and he expressly stated on several occasions that the characteristic penetrating power of the radiations emitted by the anti-cathode was neither discovered nor suspected by him.

In a paper read on March 5th, 1896 (Proc., **12**, 57) Jackson described a discharge tube, fitted with a concave aluminium cathode and an inclined platinum anode, which he had made and used during January, 1894, and with which, or with a replica, he had been able to reproduce all the effects described in Röntgen's original announcement made in December, 1895. This tube, the original Jackson "focus-tube," was used in May, 1896, for a demonstration of *X*-rays at a Conversazione held at the Royal Society; its main features were subsequently adopted universally for the construction of all "gas" *X*-ray tubes.

In 1898 he gave a discourse on phosphorescence before the British Association at Bristol, and in 1900 he dealt with the same subject in a series of juvenile lectures at the Royal Society of Arts.

Jackson's other scientific activities between 1890 and 1914 were numerous and diverse in character and are very inadequately represented by those described in any published records. He made an extensive study of the weathering of stones in Westminster Abbey, Canterbury Cathedral, and other public buildings, and carried out a considerable amount of work in the experimental treatment of stones to prevent or retard decay due to weathering action. He also interested himself in problems connected with laundry-work, investigating the action of alkalis, soaps, oils and chemical solvents on fabrics of various types, and as detergents for the cleansing of fabrics soiled in different ways. This work formed the basis of the lectures and practical course given to special classes arranged at King's College, which were attended by launderers from a wide area. The practical value of the course-work and of the advice which Jackson was able to give on problems submitted to him by those attending the classes was highly appreciated, and the importance of the step which he took when he put his chemical knowledge so effectively at the service of the laundry industry has been increasingly recognised. His investigation on the action of detergent and bleaching agents was later described in two series of Cantor Lectures given before the Royal Society of Arts in 1907.

Published papers describing his investigations included a joint paper with D. Northall Laurie, contributed to the Chemical Society in 1905, relating to the reactions of carbon monoxide on ammonia. Further joint papers with Laurie, "On the Behaviour of Vapours of Methyl Alcohol and Acetaldehyde with Electric Discharges of High Frequency," and "On the Behaviour of Acetylene with Electric Discharges of High Frequency," were contributed to the Chemical Society in 1906. He also gave, in the same year, a course of juvenile lectures on Combustion and Flame at the Royal Society of Arts. An investigation carried out in collaboration with Professor Bottomley, on the growth of plants in atmospheres devoid of carbon dioxide but containing various proportions (1—70%) of carbon monoxide, was described in the *Proceedings* of the Royal Society (1904, **72**, 130).

In this investigation it was found that green plants could grow in such atmospheres and that starch was formed in the plants during their growth.

Of his other work in pure chemistry there appears to be no written or published record, and he seems to have relied almost entirely on his memory to keep track of the investigations which he carried out. The extent and variety of those investigations could be estimated from the collection of preparations, labelled in his own handwriting, which he preserved for many years and, to some extent, from his note-books. Most of his note-books contained schemes of investigation drawn up in considerable detail, followed by notes on a few preliminary experiments but, apart from an occasional note or formula jotted down later, gave no indication of the extent to which the investigation had been pursued or of the results which had been obtained in the later stages. From such records as he preserved, it is clear that he paid attention to the production and collection of vapours and gases, including rare gases, in a high state of purity, to a study of colloidal suspensions and of their behaviour in the presence of alkalis, salts, and acids, to the devising of sensitive tests for various poisons, and to methods of separating metals having closely similar chemical properties such as neodymium and praseodymium. But although some idea of the work which Jackson carried out could be obtained from his specimens and preparations, and from such notes as he had kept, the best evidence of its extent and variety was, undoubtedly, the wealth of information which he could bring to bear on almost any problem brought to his attention, and his insight into the fundamental chemical relations underlying the many problems on which he was asked for an opinion.

Many chemical problems encountered in industrial practice were also handled by him while he was at King's College, although, on account of the confidential character of most of this work, it was little known. It included such things as a study of methods of promoting crystallisation of solids by heating them in the presence of various salts, problems relating to the dispersion of clays in colloidal suspension, the production and testing of refractories, and many others. His interest in the chemical reactions which occur between solids at high temperatures and with the associated changes of physical structure was later extended to a study of pottery and porcelain in general, and was the foundation of his work on Chinese and other Oriental ceramics.

He also worked on problems encountered in the manufacture of gun-cotton and suggested modifications in the manufacturing processes with a view to retarding deterioration such as might lead to spontaneous ignition of the gun-cotton when kept in store.

Outside his purely chemical work and his work on phosphorescence, Sir Herbert Jackson's activities extended to any subject involving chemical processes and to any form of instrument or apparatus which might be of use in chemical investigations. In the early days of " wet plate " photography he experimented on the preparation and sensitising of emulsions and on methods of developing plates coated with the various experimental emulsions which he produced. Later he investigated the action of many reducing agents with a view to their use as photographic developers and produced special developers for ordinary plates and for plates to be used in colour photography. He also worked out a variety of unusual toning baths for photographic prints and experimented, in fact, on every chemical process involved in photographic technique. He invariably acted as demonstrator at the many public lectures on photography given by J. M. Thomson, and his dexterity in photographic manipulative processes of all kinds contributed greatly to the effectiveness and success of those lectures. Jackson's interest in photography was not, however, confined to the chemistry of photographic processes. He was an enthusiastic but discriminating amateur photographer with a good eye for " composition," as is shown by the subjects which he selected for his stereoscopic photographs and for photography in colour, as well as by his large collection of prints and lantern slides.

The use of the spectroscope in chemical analysis was another subject to which Sir Herbert Jackson paid considerable attention, mainly in connexion with the detection and identification of minute amounts of inorganic materials present as colouring agents or as impurities in drugs, glasses, metals, salts, etc., or introduced during manufacture into papers, fabrics, dressed leathers and similar materials.

Optical instruments of all kinds appealed strongly to Sir Herbert Jackson but the

instrument which he used more than any other was the microscope. He had made extensive use of the microscope throughout his scientific work for the examination of his various preparations and to follow out the effects produced by heat and other treatment on clays, porcelains, fibres, etc.

In addition he had interested himself in all the more usual types of microscope objects, in the technicalities of microscopy, and in the instrument itself. As a result he was adept in the adjustment and use of the microscope and its accessory apparatus, and familiar with the appearances of an extraordinarily wide variety of objects under the microscope when illuminated in different ways. He was also well acquainted with the diffraction effects produced by minute structures and with the way in which such effects could be varied by altering the conditions of illumination under which the structures were examined. His translation of what he saw under the microscope was invariably sound but the value of his work with the microscope was enormously enhanced by the fact that he could consider his observations in the light of his extensive chemical and other scientific knowledge. His deductions drawn from the microscopic examination of some fragment or specimen often indicated a line of investigation which gave an almost immediate solution of the problem in hand, whether that problem related to the nature of the fragment or specimen, to the method by which it was produced, or to the nature and cause of corrosion or other form of deterioration which the fragment or specimen had suffered.

Jackson was always ready to put his knowledge of the microscope at the disposal of others, and he would at any time undertake either the complete examination of a specimen referred to him for his opinion or would demonstrate how the examination could best be carried out; it was a privilege and a pleasure to work with him on such occasions and to be allowed to benefit by his experience. He regarded his microscopes and microscopic equipment with a very real affection, and the enthusiasm with which he threw himself into every subject in which he became interested was exemplified in its extreme form in his microscope work.

During the first few months of the Great War Jackson's advice was sought on a variety of problems including the production of toluene, the manufacture of certain drugs, and work connected with the Censor's Office. He served on many of the Committees dealing with the production and supply of essential war-materials, but the outstanding feature of his war-time activities was his work on glass. This was undertaken, in the first place, for the Research Committee of the Institute of Chemistry, and in a very few months he developed batch mixtures for some ten varieties of glass, the formulæ for which were published in the *Journal of the Institute of Chemistry*, April, 1915. These included ordinary soda-glasses for laboratory glass-ware and for *X*-ray tubes, and a number of special glasses, such as combustion-tube glass, a chemically inactive glass for ampoules, miners' lamp glass, and others.

Later, for the Ministry of Munitions, he undertook the development of formulæ for a wide variety of optical glasses, and he also worked out batch mixtures for thermometer glasses, opal-backings for thermometers, glasses for artificial eyes, vitrite for the capping of electric lamps, and a special heat-resisting glass comparable in properties and composition with the " Pyrex " glass which was produced commercially several years later.

Most of this work on glasses was done during the evenings in a small laboratory which he had fitted up at home. The records and specimens which he kept show that the number of experimental melts which he made was considerably in excess of 500 and he developed successful formulæ for the production of more than 70 varieties of glasses. Throughout this work he was continually consulted by the glass manufacturers and made frequent visits to glass works to assist in overcoming the inevitable difficulties which arose in the initial stages of production on the large scale. It is impossible to speak too highly of the value and importance of his work on the production of glass during the War period. In recognition of it and of his other war-time services, he was created Knight Commander of the British Empire in 1917 and was elected to Fellowship of the Royal Society during the same year.

In 1919 he delivered the Sir Henry Trueman-Wood Lecture at the Royal Society of Arts, on " Glass and some of its Problems " (1920, 68), and in March, 1927, he gave

a discourse before the Royal Institution on "Some Colouring Agents in Glasses and Glazes."

The reputation which Sir Herbert Jackson had enjoyed for many years among members of the optical industry, enhanced as it was by his war record, led the Council of the British Scientific Instrument Research Association to invite him to become its first Director of Research when the Association was formed in 1918 under the Research Association Scheme of the Department of Scientific and Industrial Research. His analytical habit of mind and his almost intuitive insight into the essentials of a problem, combined with his broad outlook and remarkable experimental ability, fitted him admirably for a position in which the problems to be investigated covered so wide a range. Members of the Association soon came to look upon Sir Herbert Jackson as a friend to whom they could refer almost any problem with the certainty that, although a complete solution might not be immediately forthcoming, he would be able to put forward useful suggestions, or to outline a scheme of investigation which should lead to the problem being rapidly solved. In many cases he would refer to some experiment which he had carried out many years before, would describe the results which he had obtained, and would then suggest that the experiment should be repeated with, perhaps, some modification which would cause it to bear more directly on the problem under consideration. It was difficult at times to realise how one man's experience could have covered so large a range, but his memory was never at fault, and his chemical insight was such that when modifications of his original experiments were tried his predictions were usually found to be correct. In dealing with the widely varied problems put forward by members of the Association, the wealth of information on which Sir Herbert Jackson could draw in this way was invaluable.

Sir Herbert Jackson's interest in clays, porcelains, and glasses led almost inevitably to his taking up the study of ancient glasses and ceramics. His technical knowledge of clays and clay mixtures and of their behaviour at high temperatures, coupled with his skill and experience as a microscopist, enabled him rapidly to discover the nature of bodies and to make a close estimate of the conditions under which they had been fired. Similarly, his knowledge of glasses and of the effects produced by various metallic oxides as colouring agents in glasses of different types, enabled him quickly to identify the nature of a glaze and of the colouring agents used to produce particular effects in glazes. He made a special study of certain Chinese glazes and contributed much valuable information regarding their nature and how they were produced. He also investigated a number of glasses of archæological interest, and, in particular, identified the nature of, and successfully reproduced, a previously unknown scarlet Egyptian glass of ancient origin.

Sir Herbert Jackson had held office as President of the Röntgen Society, 1901—1903, and as President of the Institute of Chemistry from 1918—1921. He was an Honorary Fellow of the Royal Microscopical Society. He was for some time a member of the Senate of the University of London, Governor of the Imperial College, and Chairman of the Technical Optics Committee of the Imperial College. He became a member of the Royal Institution in 1924, and was a Manager of the Institution from 1930—1932 and 1934—1935.

During his period as Director of Research of the British Scientific Instrument Research Association he served on many Government scientific and advisory committees including the Interdepartmental Scientific and Technical Committee on Optical Glass, the Adhesives Committee, the Stone Preservation Committee, the Building Research Advisory Committee, the Advisory Committee on Scientific Research of the London, Midland and Scottish Railway, and others of equal importance.

On his retirement from his position as Director of Research of the British Scientific Instrument Research Association he was appointed Consultant to the Association, and was a member of the Research Committee of the Association up to the time of his death.

He was of a happy disposition, an interesting companion and a man of great personal charm; he will be gratefully remembered by his old students and former colleagues and by a wide circle of other friends.

H. Moore.

HERBERT EDWARD KIRBY.

1859—1937.

HERBERT EDWARD KIRBY, who was born in London on June 22nd, 1859, was educated at the Merchant Taylors' School, and later studied Pharmacy at the School of the Pharmaceutical Society in Bloomsbury Square, passing the Major examination in 1886.

Kirby had been associated for over 60 years with the firm of Messrs. H. and T. Kirby and Co., Ltd., Willesden Green (Manufacturing Chemists), founded by his father; for many years he was the Managing Director, and in 1932 became Chairman on the death of his brother, Sir Woodburn Kirby.

One who knew him intimately writes: "He took little or no part in public affairs but had long been associated with Church and Social work and was particularly interested in the welfare of young people, for whom he always had a kindly word of encouragement and quite a few owe much to his friendship. He was essentially an English gentleman of the old school, a type all too rare in these modern times; his high standard of living was an example and inspiration to everybody who came in contact with him. He was a born optimist and his charm of manner and courtesy made him beloved by all; he will be sadly missed by everyone who knew him." He was in business as usual the day before his death, which took place suddenly from heart failure on August 12th, 1937. He leaves a widow and two adopted sons.

Kirby was elected a Fellow of the Chemical Society on December 2nd, 1886.

H. E. CRESSWELL.

DUNCAN SCOTT MACNAIR.

1861—1937.

DR. DUNCAN SCOTT MACNAIR, who died at Letchworth on November 27th last at the age of 76, was one of the 12 inspectors appointed in 1893 to take charge of the scientific and technical instruction under the Science and Art Department, which was then being developed.

Macnair was born in Glasgow in 1861, and at an early age showed an enthusiasm for chemistry. He left school at 15 to become assistant in the laboratory of R. Tatlock, the Glasgow City analyst. After three years here, he transferred to the laboratory of the Tharsis Copper Co., and then in 1881 the Government sent him to Cyprus as assistant to the public analyst. A laboratory was established there under great difficulties, but two years later the post was discontinued, and he returned.

For two years he studied chemistry, physics, and mineralogy at Owens College, Manchester, under Sir Henry Roscoe, Professor Schorlemmer, and Sir Arthur Schuster, and he then returned to Glasgow for two years as a teacher in Allan Glen's School, and lecturer in the Glasgow and West of Scotland Technical College.

In 1888 he went to Würzburg and after only one year's study and research under the eminent professor Emil Fischer he was awarded the doctorate "Summa Laude" for work on furfuran and its derivatives.

With these qualifications he took up work in the East London Technical College, now Queen Mary's College, and inspired many students by his teaching. One of his chief discoveries was a method of analysing a mixture of chlorides, bromides, and iodides, at that time a complex problem. During the same year he took the B.Sc. degree with honours at London University when he was specially distinguished in chemistry, being placed second, and qualifying for the University scholarship in that subject.

Three years later, in 1893, he became an inspector, and was appointed to look after the scientific classes in Western, and later in Southern, Scotland. He settled in Edinburgh, and his visits to schools are remembered by many of the teachers for his sympathetic and practical advice. In 1927 he retired and settled at Letchworth, where he had a large circle of friends, who shared in his pleasure in music and games, especially billiards and

golf. He was valued for his generosity, kindliness and helpfulness. He was the author of two school textbooks on science, and for over 50 years a Fellow of the Chemical Society. He married Dora, daughter of Mr. Andrew Matthews, and leaves two sons and a daughter.

A. S. MACNAIR.

STEFAN MINOVICI.*

1867—1936.

THE President announced the death at the end of December of Professor Minovici, of the University of Bucharest. M. Delaby, the General Secretary, delivered the following memorial lecture on our eminent Roumanian colleague.

Stefan Minovici was born in 1867 at Râmnicu-Sarat (Roumania). After having successfully passed the examinations for the physicochemical licentiate's degree of the University of Bucharest in 1893, he attended the Chemical Institute in Berlin and for two years filled the position of assistant to the eminent organic chemist, Emil Fischer (1894—1896). His stay in Germany culminated in his obtaining the diploma of Doctor of Chemistry of Berlin University.

On his return to Roumania, Minovici was appointed, almost simultaneously, legal chemist to the Minister of Justice and Professor in the École Supérieure de Pharmacie. Two years later, he became Assistant Professor of the University of Bucharest. In 1911, he was a member of the Higher Council of Industrial Hygiene and in 1912 he became full Professor in the University of Bucharest. Finally the Faculty of Science of the same University entrusted to him the Chair of Organic Chemistry in 1924, and the following year he was appointed Director of the University Chemical Institute.

The work of Stefan Minovici belongs chiefly to the fields of legal chemistry, toxicology and industrial hygiene, of analytical chemistry, which he taught for a number of years, and, lastly, of organic chemistry, in which he was trained at the start of his career during his stay in the laboratory of Emil Fischer.

In the first of these fields he was interested in graphology—he was President of the Roumanian Society of Graphology and a member of the corresponding societies in France and Germany—and he constructed an apparatus for the detection and examination of forgeries in documents; he also studied the application of intense electrical illumination in distinguishing superimposed inks. The problem of the localisation of poisons did not fail to attract his attention: he solved it, for example, in the case of acute poisoning by arsenic and barium; he had also to deal with a case of poisoning by potassium cyanide, and in an instance of mercurial poisoning he studied the action of mercury salts on sheet aluminium. He drew attention to a characteristic and particularly sensitive reaction of picrotoxin; that of an alcoholic solution of anisaldehyde on its sulphuric acid solution. His investigations on the air of Bucharest may also be mentioned in this connexion. Several lectures which Minovici gave can also be cited: blood from the point of view of medico-legal chemistry, legal graphology, alcohol and alcoholism, etc. He was an ardent advocate of the unification of methods of legal arbitration and made a communication on this subject to the Congress of Applied Chemistry held in Rome in 1906.

In analytical chemistry Minovici devoted himself to the determination of certain ions by simple means. Here are some examples: the volumetric determination of potassium by use of the bitartrate, which is titrated acidimetrically, or by precipitation as picrate, with glycerol as the medium; the determination of copper as the ammonia complex $Cu(NH_3)_4SO_4$, which is titrated acidimetrically in presence of methyl-red, and the gravimetric determination of manganese as manganous iodate.

His attraction to organic chemistry is manifest from his first researches. In the year that he took his licentiate's degree (1893), he published his first memoir on the benzenesulphonic esters of the trihalogenated phenols; he nitrated them and showed that, in the esters of trichlorophenol and tribromophenol, nitration took place in the benzene-

* Reprinted by permission from *Bull. Soc. chim.* (Mémoires, 1936, **3**, 341) and translated by Dr. H. J. Emeléus.

sulphonic nucleus. He then undertook a series of elegant researches on the aromatic oxazoles and imidazoles, generalising the reaction by which his teacher, Fischer, prepared diphenyloxazole by condensing benzaldehyde with its cyanohydrin, mandelonitrile. In the same way amino-nitriles were found to combine with aldehydes, leading to the corresponding imidazoles, which were also obtained by heating the oxazoles in alcoholic solution with ammonia at 300°. These cyanohydrin condensations were to be studied several times and under varied conditions in the course of his work : in presence of hydrogen chloride a diazine was formed; condensation of aldehydes and cyanohydrins in presence of phosphorus pentachloride gave him compounds formed from two molecules of nitrile and one of the aldehyde; the same condensation in presence of thionyl chloride resulted in other substances produced by the union of two molecules of arylchloroacetamide with one of aldehyde. Minovici was also interested in stereochemical problems and resolved phenylaminoacetic acid, succeeding in obtaining the lævorotatory form; the optical inverse could not be isolated.

These studies and many others which cannot all be mentioned here show that our eminent colleague possessed to a high degree the technique of the organic chemist. But his principal researches were directed towards the study of the constitution, function and metabolism of cholesterol. Numerous derivatives of this sterol, such as halogenated compounds and oxidation products, were obtained in his expert hands, these pioneer researches going back for more than twenty years. Recently Minovici was engaged with the major problem of the origin of cholesterol in the organism, and at the end of last year our sister society, the Société de Chimie Biologique, invited him to come and present the main results on this subject before a crowded meeting. The mechanism which he conceived, based on numerous experiments, elucidated the important part played by oleic acid in the formation of cholesterol; in addition, the eminent lecturer developed the relationship between squalene and cholesterol. In presenting the Pasteur Medal to him as a token of appreciation and admiration, the President, M. Baudouin, invited him to return to France, where he loved to stay, and give an account of the conclusion of these researches. An implacable destiny determined otherwise, however. He had also commenced some studies on the bile acids, the relationship of which to the sterols has now been demonstrated.

We cannot recall here all the researches emanating from the hive which the laboratory of analytical chemistry and the laboratory of organic chemistry of the Faculty of Sciences of Bucharest became under the energetic leadership of Stefan Minovici. A hundred original memoirs with the most diverse themes are listed in a review, which appeared last year, of the scientific activity of the master who presided with such distinction over the destinies of Chemistry in this friendly nation.

What may be said, too, of his teaching work? Four important volumes have come from his authoritative pen, forming a treatise on analysis which the author modestly entitles " Theoretical and Practical Manual of Analytical Chemistry " : one volume is devoted to qualitative analysis, a second to quantitative analysis (gravimetric, volumetric, electrometric and gasometric), a third to toxicology, and the last to biological analysis.

Many scientific societies have been honoured in counting him among their members. In the Roumanian Chemical Society Minovici played a very prominent part : he was its general secretary, and was its president when the sad news of his death came to us. A member of our Society since 1912, he reserved from time to time for our *Bulletin* the first communication of his publications. The Council has shown its sympathy and admiration for our colleague by making him an Honorary Member of our Society and by offering him the medal struck with the effigy of Lavoisier. The Biological Society of London and the Polish Chemical Society also bestowed on him the title of Honorary Member.

The Roumanian Government appointed him as a delegate at numerous international gatherings : at the International Congress of Applied Chemistry held in Vienna (1898), in Paris (1900), in Berlin (1903), and in Rome (1906); then, after the war, at the Congress of the International Union of Chemistry at Brussels (1921), Lyon (1922), Cambridge (1923), Copenhagen (1924), Washington (1926), Madrid (1934), etc. . . . In 1925 he was nominated vice-president of this organisation.

He often came to France, and took a very active part in various chemical gatherings :

as a token of recognition of his loyalty to our country, the French Government appointed Stefan Minovici an Officer of the Legion of Honour.

We reiterate to the Roumanian Chemical Society, to the University of Bucharest, and to the family of our eminent colleague the very sincere condolences of the French Chemical Society. They have been presented verbally at the funeral of Professor Minovici by our colleague M. Fabre, General Secretary of the Société de Chimie Biologique, who was in Roumania at the time, and was kind enough to represent us.

ARTHUR WILLIAMS MORGAN.

1892—1937.

In the death of Arthur Williams Morgan on October 10th, 1937, at the early age of 45, the world of science in general and of pharmacy in particular, lost one of its most gifted and charming men. His was a type of personality encountered only too infrequently. Always bright and cheerful, ready with advice and help whenever they were needed, one always felt the better for " a word with Morgan."

Born in South Wales, Morgan was attracted to pharmacy and in due course became a Member of the Pharmaceutical Society. During the Great War he served in the Royal Army Medical Corps from 1914 to 1916, being then invalided out. After the War he settled in Bedford and in addition to guiding the destinies of three pharmacies, found time for many public activities. He was President of the Local Branch of the Pharmaceutical Society, a Governor of the Harpur Trust and a member of the Advisory Committee of Bedford Technical School. Until forced to resign owing to ill health, he was a member of the Rotary Club of Bedford.

The funeral service took place at Holy Trinity Church, Bedford, and was attended by representatives of the various public bodies, of the town and county, in which Mr. Morgan was interested. He was elected a Fellow of the Chemical Society in December, 1929.

F. H. Webb.

FREDERICK CHARLES THOMPSON.

1891—1937.

Frederick Charles Thompson, M.Sc., died on September 4th, 1937, at the age of forty-six years. Born in Lancashire, he moved to Leeds at an early age and spent the greater part of his life in this city. He attended the Cockburn High School and in 1908 was awarded a City of Leeds Scholarship tenable at Leeds University. Two years after graduating with an honours degree in chemistry, he obtained an honours degree in the Chemistry of Leather Manufacture, and later was admitted to the degree of Master of Science of Leeds University. In 1913 he was appointed demonstrator in the Leather Industries department under the late Professor H. R. Procter, D.Sc., F.R.S. He became lecturer in 1925 and in the meantime had been appointed to the position of research assistant in the Procter International Research Laboratory. Keenly interested in the applications of protein chemistry, he carried out a number of investigations independently and in collaboration with Professors H. R. Procter and D. McCandlish, and Mr. W. R. Atkin. He was associated with the publication of more than thirty papers, the majority of which appeared in the *Journal* of the International Society of Leather Trades' Chemists. A complete list of his publications is to be found in the October (1937) issue of that journal. Thompson was actively interested in the Leather Chemists' Society, and after serving as chairman of several of its commissions, was elected to the Presidency in 1932. Much of his work was of scientific and practical importance. For example, it had long been known that methods of assessing the acidity of vegetable-tanned leather left much to be desired. Working in conjunction with his colleague W. R. Atkin, a method was devised for determining in a reliable manner the " acid value " of leather. It was shown that strong acids could only be present in harmful quantities when

the p_H of the leather was lower than a suggested value, as determined by the Atkin–Thompson method. Shortly after this method was published it was incorporated in British government specifications, as it offers a reliable means of assessing the liability of vegetable-tanned leather to undergo acid deterioration—a matter of particular importance in leathers used by the fighting services.

In the quantitative determination of tannin in commercial tanning materials, a disintegrated purified raw hide powder is used as a reagent in the official method of analysis. Considerable difficulty and many disputes arose through some unknown variable in successive lots of the material prepared by the authorised manufacturers, which caused the official method of analysis to show disturbing differences in tannin content in a given sample of tanning material. An ingenious investigation by Thompson and Atkin established the trouble as being due to a small variation in the calcium content of different hide powders. As a direct result of this work, a uniform supply of hide powder has become available to leather chemists throughout the world, and a much greater degree of concordance has been secured in the assessment of commercial tanning materials than was previously possible.

In recent years Thompson collaborated with Dr. J. Gordon of the Leeds University Medical School in research upon the complex subject of immunity, and several of their papers have been published in the *British Journal of Experimental Pathology*.

Thompson had many University activities as tutor and member of the local Committee of the Association of University Teachers. His other interests were varied but chiefly connected with the Boys' Brigade and music. As a violinist he was associated with several local amateur orchestras. He married in 1919, and his wife survives him.

D. McCandlish.

GEORGE RICHARD TWEEDIE.

1857—1937.

George Richard Tweedie, of " Meadlands," Hillborough, who died at his residence on October 17th, 1937, aged 80, was a Justice of the Peace for the Liberties of the Cinque Ports and had been a Fellow of the Chemical Society since June, 1879. Born in London, his father was William Tweedie, a Scotsman, at one time Publisher in the Strand and the originator of the A.B.C. Time-Table, besides an ardent Temperance Reformer. Trained as an analytical chemist at the Regent Street Polytechnic, Tweedie was for many years a lecturer on popular chemistry, witchcraft and folklore, besides practising and teaching chemistry in the Isle of Thanet, where he resided between 1886 and 1899. He was a keen member and one time President of the local photographic Society of that period when the art was in its infancy.

Keenly interested in politics, and the Liberal Party of those days, he took up political work in 1892 and was associated as agent with Parliamentary elections in that period in Thanet, Isle of Wight, Romford, etc.

He married first in 1883, Alice Mary, daughter of Alderman John Dunning of Middlesborough, Yorks, by whom he had a son and a daughter who both survive him. John Dunning was an ironmaster, a Militant Quaker and associated with the Peases. Not being a Member of the Society of Friends, a good deal of procedure was necessary to enable Tweedie to marry a Quakeress. Moving to South Bucks in 1900, living at High Wycombe, Marlow and Slough, as Liberal Agent he fought elections on behalf of Sir John Thomas and Arnold Herbert which brought him into contact with many well-known men of the day. Leaving South Bucks in 1910, he resided in the New Forest for some years and then moved to Southfields, London, and during the War was able to do useful work as a chemist on the staff of a large manufacturer.

His first wife died in 1919, and in 1921 he married Miss Emily H. Douse at Wimbledon Park. In 1924 he moved to Hillborough, Herne Bay, where he resided until his death.

He was the author of many articles on diverse subjects and his two books " Hampshire's Glorious Wilderness " and " Yesterday " show him a master of English and the possessor

of an acute mind and retentive memory. A man of high principle, teetotaller and non-smoker, kindly, with a strong sense of humour, he was greatly esteemed. Deafness during his later years prevented active participation in public affairs.

M. G. TWEEDIE.

JOHN AUGUSTUS VOELCKER.

1854—1937.

DR. J. A. VOELCKER, who died on November 6th, in his eighty-fourth year, was the second of the five sons of the late Dr. Augustus Voelcker, F.R.S. He was born on June 24th, 1854, at Cirencester, where his father was Professor of Chemistry in the Royal Agricultural College, and some of his early schooldays were spent at a preparatory school in the not distant town of Berkeley. In 1864 his father—who had become Consulting Chemist to the Royal Agricultural Society in succession to the late Professor Way—resigned his professorship and removed to London, where the education of his sons was continued at University College School. At the end of his school course, where he began chemistry under the late Temple Orme, John went on to University College, where he took successively (with Honours) the degrees of B.A. and B.Sc., his chemical teacher being the late Professor Williamson. During his studentship most of his vacations and other available "off-times" were spent in the laboratory of his father in Salisbury Square, Fleet Street, and as it happened that the writer of this notice was at that time a pupil of Dr. Augustus Voelcker this led to an early and lifelong friendship.

During Voelcker's years at University College he found an outlet for physical energy on the racing track, establishing a reputation as a long-distance runner and becoming the first secretary of the College and Hospital Sports Club. His interest in athletics was maintained throughout his life, he having been an active member of the Committee of the London Athletic Club (of which he was twice President) and of the Thames Hare and Hounds, whose cross-country runs he rarely failed to attend. When the natural waning of muscular adaptability reduced his personal participation in the more strenuous forms of athletics to that of an interested spectator he took up shooting and fishing as his outdoor recreations and became skilled with the "dry fly." This reference to the sporting side of his life is made here because the writer considers that it was not without its bearing on his character and life-work.

On leaving University College Voelcker went to Giessen, where he took chemistry under Professor Naumann and agriculture under Professor Thaer, and obtained his doctor's degree for a dissertation dealing with the molecular composition of apatite and other forms of naturally occurring calcium phosphate. Later in life, on the occasion of the visit of the Royal Agricultural Society to Cambridge in 1894, he received from that University the Honorary Degree of M.A.

After his career at Giessen he returned to work with his father, by whom he and his brother E. W. Voelcker were later taken into partnership under the title of Dr. Augustus Voelcker & Sons.

Some time before this the laboratory in Salisbury Square had become supplemented by a second laboratory built as an annexe at the rear of the premises of the Royal Agricultural Society in Hanover Square, and it was chiefly here that Voelcker worked until the death of his father in December, 1884, when he was appointed in succession to him as Consulting Chemist to the Society, an appointment which he held up to the time of his death, covering a period of over fifty years.

During this long tenure of office he naturally came into personal association with most of the well-known leaders of agricultural thought and practice and had opportunities of visiting farms in most parts of the country and of familiarising himself with diverse systems of husbandry and stock management. Of these opportunities he was keen to avail himself, and he had a characteristic habit of making meticulous notes of all that he observed, preserving them for reference in his advisory work which brought him a constant flow

of correspondence; and the advice that he was able to give soon came to be generally received with well-justified confidence.

In addition to the busy routine of analytical and advisory work for members of the Royal Agricultural Society there devolved upon him, immediately on his appointment, the no light burden of the virtual direction and management of the Woburn Experimental Station at Crawley Mill Farm, which had been established in 1876 on the estate of the Duke of Bedford and carried on up to this time under the superintendence of his father in association with the Council's Chemical Committee.

The expenses of this station were defrayed by the Duke of Bedford up to the year 1910, when his financial support was discontinued in view of a grant of £500 per annum made by the then newly established Development Commission. All further expenditure on the farm and station was undertaken by the Society up to the year 1921, when its Council unfortunately decided to abandon the work. Hereupon Voelcker, loath to contemplate the "scrapping" of Woburn and all that it stood for, courageously obtained from the Duke of Bedford the transference of the lease of the farm to himself, and with monetarily self-sacrificing devotion and with only the aid of the grant of the Development Commission carried it on at his own risk for five years until, in 1926, it was taken over by the Lawes Agricultural Trust. Voelcker, however, remained Honorary Director of the Station until 1936.

The establishment of the Woburn Station was originally for the purpose of practically testing the comparative residual manurial value of highly nitrogenous and low nitrogenous feeding stuffs from the point of view of compensation to outgoing tenants for foods consumed on the farm, in view of the conclusions derived from the earlier work of Lawes and Gilbert; and, incidentally, for the repetition, on a very different type of soil, of the experiments on the continuous growth of grain crops which had long been carried out by Lawes and Gilbert at Rothamsted; but much other experimental field work had been added from time to time. A further important addition to the Woburn investigations was made in 1897 by the bequest to the Royal Agricultural Society of £10,000 by the late Mr. E. H. Hills, for the purpose of experiments on the influence on plants and soils of what were then regarded as less commonly occurring chemical elements. This led to the establishment of a local laboratory and pot-culture station. Investigations under this bequest were carried on by Voelcker for twenty-three years with the local assistance at first of Dr. H. H. Mann, and later, successively, of H. M. Freear, J. Crabtree and A. Blenkinsop, until, in 1921 the Society, on relinquishing its connection with Woburn, made over the Hills Bequest to the University of Cambridge. Up to this time the multifarious Woburn researches, both in the field and in the pot-culture station, were recorded yearly in the long series of reports by Voelcker printed in the volumes of the *Journal* of the Royal Agricultural Society, and were, perhaps, not very much known outside of the circle of readers of that Journal. The side of the work constituting the field experiments has, however, been lately focused (in 1936) in the volume of "Fifty Years of Field Experiments at the Woburn Experimental Station" by Sir John Russell and Dr. Voelcker.

As regards the primary original object of the field experiments the results have been of momentous, and at the same time disappointing, interest inasmuch as that they have persistently indicated that, at any rate, on the type of land exemplified by the light Woburn soil, the superiority of the residual manurial effect of feeding-stuffs rich in nitrogen as compared with those of the less nitrogenous and more farinaceous foods has not been in accord with long established assumption. Apart from the Woburn results investigation at Rothamsted and elsewhere on the composition of farmyard manure as affected by the foodstuffs consumed in making it and by the chemical changes incidental to its storage, had been leading to the conclusion that the original tables of Lawes and Gilbert, bearing upon the question of compensation to outgoing tenants for the unexhausted value of their contributions to the soil, called for revision. This revision was undertaken by Voelcker and Sir A. D. Hall, whose modified compensation tables were published in a joint paper in the *Journal* of the R.A.S.E. for 1902. A further paper on the subject by Voelcker and Hall appeared later in the *Journal* of the R.A.S.E. for 1913, in which still further modifications were made of the earlier tables, and this later version, with revision from time to time

by Voelcker in view of fluctuations in the market value of nitrogenous, phosphatic and potassic fertilisers, is still generally accepted in England for compensation valuations by the Central Association of Tenant-Right Valuers; but the practical experience on the Woburn Farm has done much to emphasise the danger of their too literal application without regard to variations of soil and local conditions.

One of the most spectacular results in Voelcker's field work on the Woburn Farm was the demonstration that the long-continued use of sulphate of ammonia on soil deficient in lime may result in the almost complete suspension of fertility owing to the leaching out of the original lime of the soil in the form of soluble calcium sulphate; with, however, the further consolatory experience that fertility could be completely and promptly restored by a dressing of lime, thus indicating the simple means by which the otherwise beneficent effects of sulphate of ammonia can be enjoyed on land naturally poor in lime without fear of deterioration.

The recent book of Russell and Voelcker contains no record—beyond a mere passing reference—of the special pot-culture work carried out under the Hills Bequest; but a brief summarised account of it was contributed by Voelcker himself to the R.A.S.E. *Journal* for 1923. The special elements or substances of which the effects were tested included manganese, lithium, barium, cæsium, cerium, strontium, lead, zinc, tin, chromium, copper, boron, arsenic, iodine, bromine, fluorine, and " radio-active " ores.

An important temporary diversion of Voelcker's activity occurred in 1889, when, at the request of the Indian Government, the Secretary of State for India decided to send out from England an agricultural chemist to make a tour of enquiry in India and to advise upon the course to be pursued for possible improvements in Indian agriculture. For this duty, on the recommendation of the late Sir James Caird, Voelcker was chosen and, with the permission of the Society, he visited India and spent a full year making two extensive tours of the Empire. The result was a report of some 450 pages on " The Improvement of Indian Agriculture " (Eyre & Spottiswoode, 1894). This report had a far-reaching effect on the subsequent development of Indian agricultural education and of the pursuit there of agricultural chemistry, largely encouraged by the work carried on for many years in India by Voelcker's former assistant, the late Dr. Leather, who was sent out as an immediate consequence of Voelcker's report. Although Voelcker's report was received at the time with much congratulatory approbation, the conferment on its author of the distinction of C.I.E. was delayed until as recently as 1928; it was then given presumably as a consequence of a new enquiry instituted under the auspices of Lord Linlithgow, when attention was redirected to the report of 1894.

Voelcker had been a member of the Chemical Society for fifty-three years and served on its Council in 1891 to 1895 and 1902 to 1904. In earlier days he was a constant attendant at our meetings and usually contributed to the discussions on any matters relating to agricultural chemistry, but he made no contribution to our *Journal* for the reason that the main results of his research work were, as has been already mentioned, contributed to the *Journal* of the Royal Agricultural Society. He was one of the leading members of the Society of Public Analysts, and occupied its presidential chair in 1901 to 1902. For many years and up to the time of his death he was a member of the Committee of the London Farmers' Club, of which, in 1908, he was elected Chairman, a distinction which he especially valued in view of his father having occupied the same position thirty-three years earlier. He was also a member of the Advisory Committee appointed to assist the Ministry of Agriculture under the Fertilisers and Feeding Stuffs Act of 1926.

He was consulting chemist to the Royal Horticultural Society, as well as to the Royal Agricultural Society, and also to the Bath and West of England Society; and he acted as Official Agricultural Analyst for Buckinghamshire, Oxfordshire, Middlesex, Northamptonshire, Northumberland, the East Riding of Yorks, the Isle of Ely, and the County Borough of Oxford. Under the Food and Drugs (Adulteration) Act he was (jointly with his nephew, Mr. Eric Voelcker) Public Analyst for the Counties of Northampton, Buckingham and Oxford, and for the County Borough of Banbury.

This notice would be incomplete without reference to yet another side of his activity which the writer feels that he would not have liked to be left unrecorded. When his father

came over from Germany he settled first in Edinburgh and there became a devoted adherent of the Presbyterian Church. His religious enthusiasm was passed on to his son, who was an active member of the congregation of St. John's Presbyterian Church, Kensington, which he attended regularly from 1870 onwards. He became a deacon in 1884, and an elder in 1897, acting for the last twenty-four years as Sessions Clerk; and he did much outside work in connection with church extension in the community to which he belonged. Strong, however, as was his own religious conviction, this was unmarred by sectarian prejudice or by lack of tolerance for views which differed in religious or philosophical complexion from his own.

In personal and professional matters his attitude was always dominated by a strict sense of truth and straightforwardness, and there were sometimes occasions when, in matters of scientific interpretation or of administrative policy, he found it not easy to yield to argument based on views which happened not to be consonant with those to which he had felt himself conscientiously impelled. But any differences which thus arose were seldom allowed to interfere with personal friendship, and his essential amiability of character was aided by the possession of a happy endowment of that sense which sometimes throws oil on troubled waters—the sense of humour. The knowledge acquired during his long and wide experience was always ungrudgingly placed at the disposal of any colleague who sought his advice or assistance; and his genial presence and handsome figure—bowed a little in his declining years—as well as his loyal friendship will be affectionately remembered by very many and—if he may be forgiven for yet another personal allusion—by none more than the writer.

Voelcker married in 1884 Alice, eldest daughter of the late Mr. W. Westgarth, formerly of Melbourne, and leaves one son and two daughters. His eldest son died in early infancy, and his second son lost his life in the War.

BERNARD DYER.

JEAN BAPTISTE SENDERENS.

1856—1937.

JEAN BAPTISTE SENDERENS was born in 1856 at Barbachen, a small village in the canton of Rabastens-de-Bigorre in the Hautes-Pyrénées. He was educated at the Collège de Garaison and at the Institut Catholique at Toulouse, where he obtained his licentiate and doctorate in science and subsequently the licentiate and doctorate in philosophy. While still a student, Senderens attracted the attention of E. Filhol, then professor in the faculty of science at Toulouse; and much of his earlier work was the result of this collaboration. Senderens remained at Toulouse, as professor of chemistry, until the war, when he became attached to the Poulenc factory at Vitry-sur-Seine. Finally, with advancing years, he returned to Barbachen, not however to rest but rather to continue working, in the well-equipped laboratory which he had set up, in the peace of his native village, where he died on September 26th, 1937, at the age of 81. Senderens was in holy orders, and became first an abbé and later a canon. He was the recipient of many honours. He shared with Sabatier the Jecker prize in 1905; and he was a chevalier of the Légion d'Honneur and membre correspondant of the Académie des Sciences; but his lasting memorial, linked with that of Sabatier, will for all time be found in the wide and ever increasing application of catalytic hydrogenation—above all with nickel—both in general chemistry and in industry. He was elected an honorary Fellow of the Chemical Society on March 18th, 1920.

Senderens' scientific work may be divided into three periods, corresponding to his association with Filhol, with Sabatier, and to a later period during which he worked both independently and together with Aboulenc, largely on catalytic dehydration and esterification. His first paper, published with Filhol in the *Comptes rendus* in 1882, contained a study of the action of sulphur on solutions of metallic salts; and this was followed by a series dealing with similar reactions and with various phosphates, arsenates

and antimony compounds. So far, although his papers show signs of clear thought and careful experimental technique, his career had been relatively uneventful.

His collaboration with Paul Sabatier, which was to give rise to the work with which his name is chiefly associated, began in 1892 with an investigation of the action of oxides of nitrogen on metals, in the course of which it was observed that reduced copper or cobalt absorbs nitrogen peroxide with the formation of so-called nitro-copper or nitro-cobalt. This work may be regarded as the direct precursor of that on catalytic hydrogenation; for, on substituting ethylene for oxides of nitrogen and leading this gas over finely divided nickel with the object of seeing whether addition products similar to those formed by copper with nitrogen peroxide or by nickel with carbon monoxide could be obtained, it was found that decomposition of ethylene occurred, accompanied by the formation of ethane and other products. The possibility of the hydrogenation of ethylene was realised; and, in the same year, Sabatier and Senderens showed experimentally that ethane could be prepared smoothly and quantitatively by leading a mixture of ethylene with an excess of hydrogen over nickel which had been freshly reduced from its oxide at a moderate temperature. Further work showed that cobalt, copper and iron, in addition to platinum, possessed the same properties as nickel, and that the reaction was a general one which could be applied not only to ethylene but also to its homologues and to other unsaturated compounds, including acetylene and its derivatives. It may be noted that, while Sabatier and Senderens were undoubtedly the discoverers of the hydrogen-activating properties of the nickel group of hydrogenation catalysts, the catalytic activity of platinum for the hydrogenation of acetylene to ethane had been noticed by de Wilde in 1874.

An extension which had the widest influence in organic chemistry generally began with the employment, in 1901, of nickel for the hydrogenation of benzene. It was found that *cyclo*hexane, which had previously been made with difficulty by the reduction of benzene with hydriodic acid, could be easily prepared by leading a mixture of benzene and hydrogen over nickel. Cobalt and platinum-black were, under Sabatier and Senderens' conditions, less satisfactory catalysts, and iron, copper and platinum sponge were stated to be relatively inactive; but the reaction was, as before, found to be a general one which could be used for the hydrogenation of benzene homologues as well as for condensed rings such as naphthalene: further, it was observed that the hydrogenation of an aromatic ring was readily reversible and that it differs in this respect from the hydrogenation of an ethylenic or acetylenic bond in an aliphatic chain.

The next step was the catalytic reduction of oxygen-containing groups. Nitrobenzene was, as was to be expected, easily reduced catalytically; but, under Sabatier and Senderens' conditions of working, there was a tendency towards the reduction also of the ring, with formation of *cyclo*hexylamine and condensation products. More important from a preparative standpoint, since it could not be obtained by reduction with nascent hydrogen, was the production of methane by the hydrogenation of carbon monoxide or dioxide with nickel or cobalt. Copper, on the other hand, was found only to cause the reduction of carbon dioxide to monoxide; and the somewhat milder hydrogenating properties of this metal, compared with nickel, were also utilised in other reactions in which stepwise hydrogenation is possible. Thus, styrene was converted principally into ethylbenzene on hydrogenation with copper, whereas nickel induced the saturation also of the ring, with production of ethyl*cyclo*hexane; and amylacetylene gave, respectively, amylethylene and the saturated paraffin.

In 1903, Sabatier and Senderens investigated the hydrogenation of phenol. In the presence of nickel, this was converted into *cyclo*hexanol, which, at higher temperatures, passed by loss of hydrogen into *cyclo*hexanone; but, by selecting the conditions and the catalyst, either substance could be obtained. In the same year the catalytic reduction of aldehydes and ketones was studied. Benzaldehyde, on being hydrogenated with nickel, gave principally toluene, the oxygen being removed, and there was some decomposition to benzene; but acetone and other aliphatic ketones, which were hydrogenated by Sabatier and Senderens at a somewhat lower temperature, readily gave *iso*propyl alcohol and its homologues, the oxygen being retained; and later work showed that the production

of hydrocarbon or of an alcohol was a function of the activity of the catalyst and of the temperature. Work was also carried out on the reversed reaction, namely, on the dehydrogenation of alcohols to aldehydes or ketones by passage over finely divided metals.

Sabatier and Senderens had by this time built up a far-reaching structure, which was only limited by their adherence to their original hydrogenation technique. This involved in each case the passage of the substance to be hydrogenated, as a vapour or gas, over the catalytic metal; and, consequently, the enlargement of scope brought about by liquid-phase hydrogenation was left to others. A direct industrial extension of Sabatier and Senderens' work was made in about 1910 (although the first relevant patent dates from 1903) by the employment of nickel for the large-scale hydrogenation of unsaturated glycerides for the production of so-called hardened oils, a process which has become of primary importance in the oil industry both as a manufacturing method and as a control of the price of natural stearin.

In about 1907, Senderens turned from the further development of hydrogenation to the study of catalytic dehydration. The dehydration of alcohols to ethylenic hydrocarbons or, at lower temperatures, to ethers, by passage over catalysts such as alumina, aluminium sulphate, aluminium silicate and silica, was examined; and the results obtained did much to extend and systematise our knowledge of a field which had already been investigated to some extent by, for instance, Ipatiev. A further reaction to be examined in considerable detail by Senderens was the production of ketones by the elimination of carbon dioxide from carboxylic acids. Squibb had shown, in 1895, that acetone was formed by leading the vapour of acetic acid over heated calcium oxide or carbonate. Senderens studied first the use of alumina and, later, that of thoria or zirconia. Of these substances, thoria was found to be most effective, and the reaction was extended to the general preparation of higher and of mixed ketones, also of aldehydes. At about this time (1911) Senderens' collaboration with Aboulenc began with the publication of a series of papers on catalytic esterification.

Then came the war. Save for a single paper in 1915 on the employment of nickel and of nickel oxide as catalysts, Senderens' time became occupied by his work at Vitry; and for approximately five years no further papers appeared. During his stay at the Poulenc works, his personality won for him the friendship of many among the staff and directors, especially that of M. Camille Poulenc.

Much of Senderens' work in the years immediately following the war consisted of further studies of catalytic dehydration, carried out in many cases in collaboration with Aboulenc; but he also continued, to some extent, the development of hydrogenation, and an interesting departure from his vapour-phase technique is given by his work on the catalytic hydrogenation of lactose and of polyphenols, which was carried out in the liquid phase. Senderens continued each year to contribute papers, principally on catalytic subjects, his final work being on the elimination of hydrogen halides from monohalogenoparaffins such as propyl chloride, and on some reactions of benzoyl chloride (*Compt. rend.*, 1937, **204**, 1296), published when he was over 80. He thus was able to work effectively up to the time of his death, and he died in full possession of the clearness of thought and the high degree of manipulative skill which had always distinguished him.

By his death we have lost the co-founder of a completely new section of chemical knowledge. Whether or not this knowledge of catalytic hydrogenation would have come in the course of natural evolution, had not Sabatier and Senderens chanced to investigate the action of ethylene on nickel, it is difficult to say; but, certainly, by virtue of the pioneering work of these two investigators immediately before and during the early years of the century, the foundations of catalytic hydrogenation were securely laid. The world is poorer for the passing of a great experimentalist.

E. B. MAXTED.