OBITUARY NOTICES.

WILLIAM CARRICK ANDERSON.

1871—1948.

WILLIAM CARRICK ANDERSON was born at Brechin on August 29th, 1871. He was educated at Brechin High School, Glasgow Academy, and the University of Glasgow, where he graduated B.Sc. in 1893 and M.A. in the following year. At the University he achieved early distinction in chemistry by winning the Joseph Black Medal and the Mackay Smith Scholarship, but the breadth of his interests was shown, at that early date, by the award to him of class prizes in Latin, Greek, Logic, and Natural Philosophy. While an undergraduate, he spent summer vacations in the laboratories at Anderson's College (now the Royal Technical College), and there is no doubt that his association with Dittmar during these periods contributed to his outlook.

Appointed to the teaching staff at the University in 1896, Anderson became Lecturer on Metallurgical Chemistry in 1900, the post from which he resigned in 1904 to seek the wider opportunities of private consulting practice. In these early years of teaching he continued to use the opportunities of the long vacations by attending courses at the Royal School of Mines, the Royal Mint, and the Polytechnicum at Zurich.

As a young graduate Anderson began a systematic study of the chemistry of coal and its utilisation, a subject which, in spite of the variety of technical investigations falling to his lot as a consultant, was to remain a primary interest throughout his active career. It was for his researches on this subject that he was awarded the degree of D.Sc. by the University of Glasgow in 1899. During thirty odd years of consulting practice he carried out research work on widely varied problems of technical importance such as the manufacture of shellac, preservation of timber, corrosion of metals, and the manufacture of tea, an investigation which led him to visit India and Ceylon in 1908, illustrating the characteristic thoroughness and care which he applied to his work. A more than passing interest in economics is reflected in Anderson's work, and he undoubtedly enjoyed being a severe critic of many undertakings which fell short of the standards of his outlook.

In addition to the publication of the results of his investigations, Anderson contributed many articles on chemical topics to the popular press. He had a ready pen and a gift of expression which only thinly veiled his keen sense of humour.

The grandson of a clergyman, Anderson had a deep-rooted and life-long affection for his church and at the time of his death was Senior Elder of Wellington Church in Glasgow.

Anderson was happy in his family life and he felt keenly the death of his wife, Jessie Gibson McKerrow, two years ago, at a time when he himself was in failing health; he is survived by a son and two daughters.

J. BELL.

WILLIAM CULLEN.

1867—1948.

WILLIAM CULLEN, who for at least two generations held a unique position in the chemical and metallurgical world, died at Edinburgh on August 15th, 1948, at the age of 81. Born in Glasgow, Cullen was educated at Hutchison's Grammar School and at the Andersonian College (now the Royal Technical College) where he was assistant to Professor Dittmar for seven years. After a subsequent course in metallurgy at Freiburg, he entered Nobel's Explosives Company as a chemist, and began a lifetime's connection with the explosives industry. He served for eight years with Nobels and three with Kynoch's Ltd., and in 1901 went to South Africa as general works manager of the British South African Explosives Company, a post he filled with conspicuous success during the difficult period of the Boer War and its aftermath. It was in South Africa that he blossomed into full maturity and became one of the leading personalities in the industrial and educational fields there. His vigour and versatility are shown by the fact that he became director of his company, President of the Chemical, Metallurgical, and Mining Society of South Africa, Honorary Secretary of the South African Association for the Advancement of Science, and Chairman of the South African Red Cross Society, served in the Johannesburg Mounted Rifles, of which he became second in command, and later was C.O. of the Imperial Light Horse for eight years. He was a close friend of Lord Milner and General Smuts. On the educational

side, Cullen was particularly associated with the founding of Witwatersrand University, which recognised his invaluable services by conferring on him the LL.D. degree in 1925.

On his return to England in 1915, Cullen joined Lord Moulton's staff at the Department of Explosives Supply, and started a record of all-round service here which is equalled by few scientists and surpassed by none. He became in due course President of the Institution of Mining and Metallurgy, President of the Institution of Chemical Engineers, and President of the Society of Chemical Industry. For some years he was Honorary Treasurer of the Universities Bureau of the British Empire, Member of the Advisory Council on Mineral Resources, and Chairman of the Consultative Committee on Base Metals at the Imperial Institute. He retained throughout his life a particular interest in South Africa, but any industrial matter affecting the Empire anywhere was certain to attract his attention and receive his sympathetic consideration.

But the foregoing bald outline of the high lights of Dr. Cullen's very full life cannot give any clear idea of the lovable personal qualities of the man himself. A most genial companion, an entertaining conversationalist, and a fluent public speaker, he was at home in any company. He had that old-world charm of manner which was as pleasing as it is now rare. He was a pioneering adventurer, always ready to help any good cause, and he was a source of encouragement particularly to the younger scientists to whom he showed great kindness while impressing on them the necessity for service and hard work. He himself was a born leader with tremendous drive. For many years he suffered acutely from an internal malady which would have embittered and probably overcome smaller men, but Cullen by sheer will-power carried on his good works and refused to give in, though he had practically been served with his death-warrant: after his cure had been fortuitously effected, he declared that the joy of living a normal life again was something no words could express. This experience no doubt helped greatly to make him the kind, genial, tolerant person we knew.

The writer by a fortunate chance happened to be a fellow-passenger on one of Dr. Cullen's frequent trips to South Africa, and no one could have wished for better company than that of himself and his charming first wife. She unfortunately died early in 1945 leaving Cullen a very lonely man. He is survived by his second wife, a married daughter (Mrs. Donovan), and three sons.

Cullen was a great man whom it was a privilege to know, and we who are left are the poorer for his passing.

J. Weir.

FREDERICK ALFRED MASON.

1888—1947.

Frederick Alfred Mason was born on June 22nd, 1888. He was the son of Alfred W. Mason, an artist, and his wife Victoria, who were then living at 21 Queen Square, London, W.C. His early education was at Merchant Taylors' School, whence he proceeded in 1906 as Sir Thomas White Scholar to St. John's College, Oxford. In 1909 he took a first in Chemistry, and the following year was elected into a senior scholarship of his college. With this he went to the University of Munich where he took his Doctorate of Philosophy in 1912. He proceeded to the Oxford M.A. in 1919 and was elected a Fellow of the Royal Institute of Chemistry in 1922.

His whole chemical career was spent in research, teaching, and educational administration. He was appointed a demonstrator at the Royal College of Science in 1914, but two years later joined the staff of British Dystuffs Corporation, undertaking research at Blackley and Oxford. In 1926 he returned to teaching, being appointed in succession to Professor Rowe as Lecturer in Tinctorial Chemistry and Dyestuffs at the College of Technology, Manchester. He was appointed to be one of His Majesty's Inspectors of Schools in 1931 in the technological branch, and by his promotion to Staff Inspector in 1935 became the leader of the small band of inspectors of pure and applied chemistry. As such he had a profound influence on the teaching of chemical subjects in technical colleges and in the formulation of the policy of the Board (now Ministry) of Education in these matters. In particular, he brought to fruition the recently adopted schemes for National Certificates in Pure and Applied Chemistry in conjunction with the Royal Institute of Chemistry. His tact and quiet but effective manner made him an admirable colleague, and his loss is keenly felt by those who worked with him at the Ministry and on public bodies as well as by many of the teachers of chemistry in the technical colleges.

Mason's first research work at Oxford was with F. D. Chattaway on the preparation of

halogen derivatives of malonanilide and related compounds (*J.*, 1910, **97**, 339); later, he published an oxidative study of papaveraldine with W. H. Perkin, Jun. (*J.*, 1914, **115**, 2013). During the first World War he published some work on intermediates for synthetic local anæsthetics, with A. T. King, and, after joining the staff of British Dyestuffs Corporation Ltd., he engaged in a long period of activity in dyestuffs chemistry, during which he published a number of papers in the Journals of the Chemical Society, the Society of Chemical Industry, and the Society of Dyers and Colourists on the preparation of naphthalene and quinoline derivatives and on the constitutions of dyes. He was active in work on the revision of the Colour Index and its Supplements.

Mason died quite suddenly on September 19th, 1947. While on holiday at Bognor Regis he was called back to London for an important conference, and expired immediately on his return. He leaves a son and daughter of mature age by his first marriage, and a widow and two younger children of his second marriage, to all of whom the profound sympathy of his numerous friends is accorded.

P. C. L. Thorne.

SAMUEL EDWARD SHEPPARD.

1882—1948.

Samuel Edward Sheppard was born on July 29th, 1882, in Catford, London, S.E., and died on September 29th, 1948, in Rochester, New York, U.S.A.

After attending St. Dunstan's College, Sheppard entered University College, London, in 1900, and in 1903 received the degree of B.Sc. by research, submitting a thesis on the theory of the photographic process which involved a repetition of the work of Hurter and Driffield with the use of improved apparatus and the physicochemical methods developed since that work had been done. His first papers were published jointly with C. E. K. Mees in 1903 and dealt with the kinetics of development. After graduation, Sheppard equipped a laboratory in his house, and there continued work on photographic science, publishing a long series of papers jointly with Mees until in 1906 he was awarded the D.Sc. degree for a thesis which was published with that of Mees by Longmans Green and Company in 1907 under the title " Investigations on the Theory of the Photographic Process."

In 1906 Sheppard was awarded an 1851 Exhibition Scholarship for two years and went to Marburg, where he worked with Karl Schaum, a professor of photochemistry and the editor of the *Zeitschrift für Wissenschaftliche Photographie*. Sheppard's work was on the structure in solution of sensitizing dyes and particularly of pinacyanol, the red sensitiser discovered only a short time before by Homolka of the Hoechst Dye Works. The study of the structure and behaviour of dyes like pinacyanol continued to attract Sheppard's attention throughout his entire life. After a year in Germany, Sheppard went to Paris, where he worked with Victor Henri at the Sorbonne on colloid chemistry. The time that Sheppard spent in France and Germany gave him an excellent knowledge of the language and a wide acquaintance with the scientific men of those countries, so that throughout his life he felt himself a citizen of the world and particularly at home in France and Germany.

On his return to England in 1908, Sheppard found himself rather at a loose end, but eventually went to Cambridge and worked in the department of agricultural chemistry, where he studied the colloidal properties of bread doughs.

In 1913 Sheppard was invited to take charge of the sections of physical and colloid chemistry in the new research laboratory organised by C. E. K. Mees for the Eastman Kodak Company. The first five years at Rochester were spent principally on a study of the physicochemical properties of gelatin, and a number of papers were published dealing with the measurement of the viscosity of gelatin solutions, the measurement of the jelly strength and the elastic properties of gelatin jellies, the setting and melting points of gelatins, the drying and swelling of gelatin, and the structure of gelatin in solution, in the jelly, and in the dry state. These early papers deal primarily with the definition of the properties to be measured, with methods of measurement, and with instruments for making the measurements. As soon as the methods were so perfected that reproducibility was possible, it became evident that further progress in the realm of the physical and chemical properties was dependent on the nature of the sample. This work culminated in 1929 in a description of a procedure for making a standard gelatin by methods easily reproduced in the laboratories. A scientifically valuable by-product of this work was the manufacture and consequent availability of such a standard de-ashed gelatin to

laboratories in general, biological as well as chemical. This line of work resulted in a series of papers in 1930 on the structure of sols and gels, papers which, at a time when the basic difference between these systems and ordinary solutions was poorly defined, clarified the differences and were a very helpful contribution to the discussions then occurring in the literature.

During the First World War, the Kodak Research Laboratories were approached by the Submarine Defence Corporation with a problem relating to the use of finely divided coal as a fuel, the material being a waste product from the handling of coal. Sheppard found that, by the use of resin soaps as dispersants, powdered coal could be made into a stable suspension in fuel oil, and this material was utilised on a fairly large scale under the name " colloidal fuel ". The patent that Sheppard obtained for this was assigned to the Submarine Defence Corporation.

After the First World War, Sheppard began to turn his attention to the structure and properties of silver halide emulsions, and his first work took the form of a study of the distribution of the sizes of the silver halide grains in an emulsion, the intention being to work out the relation between this distribution and the sensitometric properties of the material. Thus began a long series of studies that are not yet completed though much progress has been made in the last thirty years. At the same time, working with Dr. Ludwik Silberstein and with Mr. A. P. H. Trivelli, Sheppard began to consider the action of light on the halides and the nature of sensitivity, and about 1923 a series of papers was published on the theory of photographic sensitivity and of exposure, which resulted in the presentation of the concentration speck hypothesis, according to which the sensitivity was related to discontinuities in the silver bromide lattice, presumably due to some foreign substance. At the same time a very notable group of studies was going forward on the measurement of size frequency distribution, which led to the development of microscopic methods by which the grain-size frequency distribution could be measured for practical silver bromide emulsions.

The well known sensitising property of gelatin in the photographic process led to a systematic study of the difference between photographic gelatins in their sensitising power and the nature of the substance in gelatin which conferred sensitivity. By a painstaking series of analyses, it was found that the sensitiser inherent in natural gelatin was concentrated in the liquors obtained by the acid treatment of the raw material after liming, and eventually it was found that the chemical properties of the sensitiser corresponded to those of allylthiourea and that therefore the gelatin sensitiser was essentially one which could produce silver sulphide specks in the silver bromide crystals.

This discovery is perhaps the greatest advance made in Sheppard's scientific career. All further study of the photographic properties of gelatin, of the nature of the sensitivity of silver halides, and of the latent image have been conditioned by it. Its publication won for Sheppard instant recognition. He was awarded the Adelskōld medal of the Swedish Photographic Society in 1929, the progress medal of the Royal Photographic Society in 1928, and the honorary fellowship of the Royal Photographic Society in 1926. In 1928 he delivered the Hurter and Driffield Memorial Lecture to the Royal Photographic Society, and in 1930 received the Nichols Medal of the American Chemical Society.

From that time, Sheppard's scientific work covered a prodigious range of knowledge. Besides the work on the latent image, he studied such matters as the photovoltaic effects—that is, the electrical response of silver halide to light—the colloidal structure of film base materials and their physicochemical and elastic properties, the nature of development, and particularly the nature of dye sensitising, the absorption of sensitising dyes to silver halides, the structure of the layers which they formed, and their sensitising effects.

Sheppard realised that the solution of the problem of dye sensitising would involve not only the coupling of the dye to the silver halide lattice by absorption but an understanding of the nature of the absorption of light by the resonance structure of the dye. Thus he studied the absorption spectra of dyes in various solvents, in vapour phases, and when adsorbed to surfaces. This is the field which was chiefly engaging his attention when his health failed.

The work thus far mentioned has been referred to the central theme, namely, the science of photography. The generalisation of his thought in terms of application to physical and colloid chemistry was characteristic of Sheppard. For example, his studies of the water equilibria of gelatin, the drying and swelling of gelatin, and the nature of the viscosity phenomena, led to allied studies of systems involving other polymeric materials, such as the cellulose esters. His work in viscosity led to the resuscitation of an earlier suggested but forgotten relationship between viscosity and temperature which gives a valuable insight into the nature of viscous flow. This relationship, which was simultaneously rediscovered by Andrade, is now fundamental in any consideration of viscosity. Thoughts on the nature of gelatin solutions,

cellulose ester solutions, and similar colloidal solutions, were probably responsible for his work on the electrophoresis of dispersions of rubber latex and his exceedingly valuable inventions relating to the electro-deposition of rubber. It is an interesting commentary on the diversity of his scientific work that the investigation on rubber came to its climax almost simultaneously with his discovery of the sensitising materials in gelatin.

While never robust, Sheppard enjoyed good health until a few years ago, when he began to have trouble with his eyes, which culminated in the loss of one eye from glaucoma. At the same time, his heart was affected and continued to fail until in January 1948 he found it necessary to resign from his position with the Kodak Company.

In 1912 Sheppard married Miss Eveline Lucy Ground; she and a son, Samuel Roger, survive him.

Sheppard's scientific career offers a contrast to that of many of his colleagues in the academic laboratories of the world. Very early in his life he became associated with an industrial laboratory, at a time when industrial laboratories were often chiefly analytical laboratories devoted to process control. But this association with technology did not only result in inventions and discoveries of great value to the art of photography, but also in a series of publications in the scientific papers of the world, papers which have ranged widely over many of the branches of physical and colloid chemistry. The rich diversity of his work may be ascribed to the conjunction of two circumstances: the driving curiosity which he possessed, fundamental in a scientist, and the complex art of photography, which, not only in its primary phenomena but in most of its associated procedures, was replete with facts for which the current knowledge had no explanation. Particularly among scientists of recent days one sees men whose whole life is spent with one technique, with the elaboration and enlargement of knowledge in one field, but photography took Dr. Sheppard from gelatin and biochemistry to latent image and quantum theory, from plasticity and cellulose esters to dyes and absorption spectra.

More than any other single worker, Sheppard has been responsible for our present knowledge of the theory of the photographic process. He explored every section of the chemistry of that process, and everywhere his studies brought light.

C. E. K. Mees.