

OBITUARY NOTICES.

ROBERT ADDIE.

1870–1934.

ROBERT ADDIE was born in Uddingston, near Glasgow, 64 years ago. His father was James Addie, of the firm of Robert Addie and Sons, for a long period well-known coal-masters at Langloan, Coatbridge, about 10 miles east of Glasgow.

Addie, in 1888, entered as a student in the laboratory of R. R. Tatlock and Readman, and made good progress in the study of theoretical and practical analytical chemistry. Those who knew him at that time remember him as an amiable and cultured young man, always on friendly terms with his colleagues. In the laboratory, a society known as The City Analyst's Society was constituted, and to it Addie read a paper on the "Recovery of Ammonia and Tar from Blast Furnace Gases," as practised at the Langloan Iron Works. The recovery of these by-products was comparatively new at that period and the sulphate of ammonia produced was crude compared with the present-day article.

Addie's bent was, however, in the direction of a more active life than that in a chemical laboratory. He left Tatlock and Readman's laboratory, learned the manufacture of steel with the Steel Company of Scotland, and later became manager at Ellesmere Port of the Smelting Corporation. He was there for several years, but the Works were ultimately closed down. He next set up as a consultant, and was engaged by a London syndicate to go to the United States of America to report on a mineral property. Then for some years he was Managing Director of The Zafra and Huelva Railways and afterwards Director of the same Company.

R. T. THOMSON.

WILLIAM DALRYMPLE BORLAND.

1863—1934.

WILLIAM DALRYMPLE BORLAND was born in London in 1863. He was educated privately and at University College, London, studying under Professor A. W. Williamson. In 1879, he entered the laboratory of Mr. Otto Hehner, where he worked for two years, and for a short period thereafter was Demonstrator at the Royal Veterinary College, Camden Town, under Professor Tuson.

Borland then joined the staff of the Explosives Co., Ltd., Stowmarket, and engaged in research and, under Mr. W. F. Reid, in the development of smokeless propellant powders. A little later, this work was taken over by the "E.C." Powder Co., Ltd., of which Borland became Consulting Chemist in 1887 and Managing Director in 1896.

In 1896, Borland was responsible for the production of "E.C. No. 3," an improved form of the smokeless powder devised by him in 1888. During the War he designed special works for the manufacture of guncotton for cordite.

In 1918, the "E.C." Powder Co. was amalgamated with Imperial Chemical Industries, Ltd., and Borland became Technical Expert in Sporting Powders and Ammunition, a position he occupied until the time of his death, on May 20th, 1934.

During the whole of his career, Borland devoted particular attention to the acquisition of knowledge of the manufacture and testing of propellant explosives, both at home and abroad, and much of his work was necessarily of a confidential nature and could not be published. His knowledge has been of great service to Imperial Chemical Industries, Ltd.

Apart from his scientific work, Borland was interested in architecture, music, and photography. He had a charming personality and was highly esteemed both as a man and as a technician.

Borland was elected a Fellow of the Chemical Society in April, 1884. He was a Fellow of the Institute of Chemistry and an Original Member of the Society of Chemical Industry.

RICHARD ARTHUR BUSH.

1863—1933.

RICHARD ARTHUR BUSH was born at Hackney on June 12th, 1863, second son of William James Bush, founder of W. J. Bush & Company (makers of essential oils and flavours), at that time at Bishopsgate St. Within. He attended a boarding school at Margate and, at the age of seventeen, a finishing school in Germany. Leaving this, he at once joined his father's business, working there during the day and studying chemistry under Professor Dunstan at night.

On the death of W. J. Bush the business was inherited by five brothers, including Richard. Under their guidance it developed more along chemical lines and increased materially. In 1896, at the age of only thirty-three, Bush found himself in a position to retire from the business, which at about that time was incorporated into a Limited Company. Of his accomplishments in a scientific way during his active business career, little is known. He spent much time at the Mitcham branch-factory of the Company and was known as an assiduous worker, keeping extraordinarily long hours. The writer knows only that the subject produced the first essential oil of elder flower made. Up to that time the distilled odour was known only as the "water." It is probable that much of Bush's other work was original, but it was, unfortunately, performed during a period in which publication was considered to be bad policy by industrial concerns.

On his retirement Bush worked fully as hard as he had during his business career. He became a local secretary for the National Society for the Prevention of Cruelty to Children, he took over the Rock Terrace Mission (attached to the Mitcham Parish Church), and he commenced a thorough investigation of the subject of spiritualism. His interest in this led him, years later, to found and guide the destinies of the Wimbledon Spiritualist Church. He wrote four books which are known in spiritualist circles, namely, "Whence have I Come," "The Larger Spiritualism," "Jesus Christ at Work," and "Sweet Corn from Heaven."

At the age of twenty-one Bush married Maude Rosamund Simmonds, daughter of G. R. Simmonds of Belsize Grove, Hampstead. He is survived by his wife, three daughters, and two sons. His eldest daughter predeceased him.

Bush, before his death, left an interesting message on his desk, to be broadcast to his relatives and friends on his demise: "As a Spiritualist who neither fears nor regrets death but rather welcomes it in due course as a step onward in the life eternal, I do not wish for any mourning either inward or ceremonial and I trust that no one will grieve me by disregarding this my wish. Let all bid me God-Speed and pray for a blessing upon my new life."

W. A. BUSH.

ROBERT MARTIN CAVEN.

1870—1934.

By his sudden death at the age of 64 on July 16th, 1934, a month after he had completed his course of lectures, the Royal Technical College, Glasgow, lost its highly esteemed and distinguished Professor of Inorganic and Analytical Chemistry, Robert Martin Caven, who had held the Chair since 1920.

Caven was born at Southampton in 1870 and received his early education from his father, the Rev. Robert Caven, B.A., and at Wyggeston Grammar School, Leicester, and later at University College, Nottingham, a period of four years' service with a wholesale chemist intervening between his school and college career. When he left college after graduating B.Sc. of London in 1892, he served for about three years as assistant to Dr. Hill, City Analyst of Birmingham, with whom he gained a valuable experience of which he often spoke in later years. In 1895 he returned to his old college, first as assistant lecturer in chemistry under Professor Frank Clowes and later as senior lecturer under Professor F. S. Kipping, F.R.S. This position he filled until the end of 1918 when he was appointed

Principal of the Technical College, Darlington. Although he was on the happiest terms there with all concerned, the constant administrative duties made little appeal and he welcomed the return to purely chemical work in Glasgow. In 1906 he married Ethel Mary, daughter of Stephen Willson, a pharmacist of Peterborough, by whom, with one daughter, he is survived. In all his interests both inside and outside the College he had the most loyal support of both wife and daughter.

Caven was beyond military age during the greater part of the War, but was glad to devote himself to chemical war work. He took some part in the preparation of large quantities of ethylene dibromide, the first stage in the preparation of a certain drug required by the army, and carried out an investigation on the manufacture of concentrated hydrogen peroxide. He also rendered gratuitous help to the City Analyst of Nottingham, who was devoting himself to the training of cadets.

Caven will be remembered chiefly for his contributions to the literature of his subject. To the teaching of chemistry he was sincerely devoted. As a result of a ripe experience in Nottingham he conceived the idea of systematising the subject on what appeared to be untraversed lines and in conjunction with Dr. G. D. Lander, then his colleague, he published in 1906 his first text-book, "Systematic Inorganic Chemistry from the Standpoint of the Periodic Law" (Blackie). In 1909 he gathered together his ideas on the teaching of qualitative analysis in his "Systematic Qualitative Analysis for Students of Inorganic Chemistry" (Blackie). His purpose was to build up qualitative analysis on thoroughly scientific foundations and to construct the analytical tables directly from the student's practical experience, a method which appeared seldom to have been adopted in English text-books. The remarkable success which met these efforts encouraged him further and several other text-books followed at regular intervals, amongst which may be mentioned: "A Short System of Qualitative Analysis" (1917) (Blackie); "Carbon and its Allies"—Vol. V of "A Text-book of Inorganic Chemistry" edited by Dr. J. Newton Friend (1918) (Griffin); "The Foundations of Chemical Theory" (1920) (Blackie); "Quantitative Chemical Analysis"—Part I (1923), Part II (1925) (Blackie); "Gas and Gases" (1926) (Williams and Norgate); "Atoms and Molecules" (1927) (Blackie); "Symbols and Formulæ in Chemistry" with Dr. J. A. Cranston (1928) (Blackie). At the end of 1933 he revised his "Short Course of Qualitative Chemical Analysis" and early this year completed the revision of Part I of his "Quantitative Chemical Analysis" as well as his "Qualitative Chemical Analysis." He acted as General Editor of "Manuals of Pure and Applied Chemistry" (Blackie) and himself contributed some volumes to this excellent series.

All his books bear the stamp of a great teacher and possess that literary charm which characterised everything that came from Caven's pen. He held very definite views on the education of the chemist and these appeared in the *Journal of the Society of Chemical Industry* during the war years. He wrote widely on a large variety of topics—travel, religion, popular science. He was an enthusiastic supporter of and a very frequent contributor to the series of popular articles on scientific subjects which appeared regularly in the *Glasgow Herald* over a period of five years, a scheme which had as its aim the enlightenment of the general public on the services rendered to the community by chemists and chemistry.

Caven's earlier research work was published in the *Journal of the Society of Chemical Industry* (1897—1900) and concerned qualitative and analytical work. In 1909, in the same *Journal*, he published a method of detecting and estimating chloride, bromide, and iodide in mixed solution. His work on "The Molecular Configurations of Phosphoryl Chloride and its Derivatives" and "Phosphoric Amidines," published in the *Journal of the Chemical Society* (1902—1903), earned for him the D.Sc. of London in 1902. There followed work on the dissociation pressures of alkali bicarbonates, the first paper in collaboration with Dr. H. Sand. In conjunction with Dr. E. B. R. Prideaux he published some work relating to the employment of ammonium nitrate in the manufacture of the explosive Ammonal. Two interesting Patents Nos. 106,247 and 108,372 (1917) bearing his name made a contribution to the problem of solution in water of "soluble glass," an account of this work appearing in the *Journal of the Society of Chemical Industry* in the following year.

Shortly after taking up his Glasgow appointment, Caven started a study of double salts

and published with colleagues in the *Journal of the Chemical Society* a series of papers on equilibria in systems of double sulphates, an investigation which he had purposed extending to other double salts. An interesting paper in 1932 describes the isolation of a new type of double salt in which a double sulphate is formed by combination of a bivalent and a quadrivalent sulphate—manganese and thorium. This work would doubtless have led to other equally interesting results. All his work on double sulphates is summarised, along with a theory of double salts, in the *Journal of the Royal Technical College, Glasgow* (1933 and 1934), which he himself was largely responsible for inaugurating. During the last two years he had been investigating the existence of double perchlorates, and published his first paper on this subject in the *Journal of the Chemical Society* this year.

During the tenure of his posts in Nottingham and Glasgow, Caven took an active part in promoting the interests of local chemical societies. For two years (1916—1918) he held the Chairmanship of the Nottingham Section of the Society of Chemical Industry and in Glasgow the Chairmanship of the Glasgow and West of Scotland local section of the Institute of Chemistry, an office which he held at the time of his death. He served on the Council of both organisations. In Darlington, while his work was largely administrative in a college chiefly devoted to engineering, he lectured to apprentices on iron and steel manufacture and metallography and to master painters on the chemistry of their trade. His popular lectures on experimental chemistry drew large audiences and were highly appreciated. It was because he regarded the teaching of chemistry as his life-work that he broke a happy connection in Darlington to come to the Chair in Glasgow.

Caven had outstanding gifts as a lecturer and public speaker. He was much in demand as a lecturer on scientific topics and many a worthy cause outside of chemistry found in him a most ardent supporter, in particular, the League of Nations. In March of last year he delivered before the Institute of Chemistry a lecture on Joseph Priestley, reflecting his special interest in the historical aspects of his subject. The son of a Baptist minister, he always took a warm interest in that denomination, having held many offices within the church, including the Presidency of the Glasgow Baptist Association.

The dominant characteristic of the man was a noble dignity, graciousness and courtesy. Of humble demeanour, he possessed fearless honesty and an unswerving devotion to the truth. He was keenly devoted to the highest interests of the College and of the Chemistry department as a whole. He spared not himself in the interests of his staff or his students. In the social life of the College he took a prominent part and has left his mark on many of its activities. His life was an active one from first to last and profound regret has been expressed on all sides that he was cut off only a few months before the rigour of the law compelled a retirement, which, though well-earned, was quite unsought.

W. M. CUMMING.

JUAN PEDIGE CHARLES CHANDRASENA.

1887—1934.

CHANDRASENA was born in Colombo on March 27th, 1887. Having passed the Intermediate Examination of the University of London, which at that time was the highest scientific examination held in Ceylon, he was appointed Demonstrator in Chemistry at the Ceylon Medical College on January 1st, 1914, Dr. A. F. Joseph at that time being the Professor of Chemistry. Shortly after his appointment the first examinations for the London Pass degree were instituted and Chandrasena was one of the first to pass this examination in the island. In 1920 he received a Government Scholarship and came to London, and worked for two years with Professor Thorpe and Dr. Ingold, receiving the Ph.D. degree and the Diploma of the Imperial College. On his return to the island he was appointed Lecturer in Chemistry at the then recently inaugurated Ceylon University College, and this post he held to within a year of his death, when, on the resignation of the writer, he was appointed Professor of Chemistry. He was interested in the economic and medicinal plants of Ceylon and when on leave in 1928 he visited Europe and worked for nearly a year in Germany with Staudinger and Schmidt. He had completed, but had not yet published, a book on the

medicinal plants of Ceylon. As a chemist he was painstaking and thorough, more interested in the work he was doing than in the publication of results, although he had several papers to his credit in the *Journal of the Chemical Society* and the *Biochemical Journal*. He was an excellent teacher and was always able to interest his students in investigation. As a colleague and friend he was admirable. A man of simple tastes, he was a Buddhist who lived up to the high tenets of his faith. He was interested in social work and did much to help the unfortunate classes. By his untimely death Ceylon loses one of the best men it has produced. He leaves a widow, a son, and a daughter, to whom will be extended the sympathy of all who knew him.

N. RAE.

ROBERT ENGLISH.

1870—1934.

ROBERT ENGLISH acquired the elementary principles of gas manufacture at the Beckton Works of the Gas Light and Coke Co., where he was employed for about 10 years, doing a considerable amount of experimental testing on the Dibden and Harcourt pentane standards under the direction of Mr. W. Grafton. Subsequently he gave evidence before the Select Committee on the Standard of Light and Sulphur Clauses.

In 1901 he obtained the position of assistant to Mr. Shoubridge, the then engineer to the Crystal Palace (now the South Suburban) Gas Co., and in association with the late Prof. V. B. Lewes conducted experiments on the admission of water-gas to inclined retorts. In 1902 he went to New Zealand as chief engineer and manager to the Christchurch Gas Co., retaining this position for some years. In 1933 he came to England in company with Mr. H. R. Young in the interests of Coal Distillation and By-Products (N.Z.) Ltd., with a view to preparing a scheme for the manufacture of free-burning coke and by-products from the Westport coals (0.2% ash), which scheme was well advanced at the time of his death. He was an Associate Member of the Institute of Mechanical Engineers, and a prominent Freemason in the Dominion, being a past Master of the St. Albans Lodge, Christchurch, and a past District Grand Warden of the District Grand Lodge, Canterbury.

He passed away at the Masonic Hospital, Fulham, on 29th May, 1934, aged 64.

J. R.
A. V. H.

MORRIS BROAD FOWLER.

1870—1934.

MORRIS BROAD FOWLER was born on July 19th, 1870. He was the elder son of George Cupit Fowler, a wax-refiner and night-light manufacturer whose business entailed several changes of residence with consequent changes of school for his children. After leaving school, Morris Fowler matriculated at London University, studying chemistry and attending classes at the Royal School of Mines, South Kensington.

For some years he assisted his father in work on a patented process for making night-lights. During this period, in 1898, he married Miss Geertruida Eduarda Verkade, daughter of Ericus Gerhardus Verkade, an oil refiner of Amsterdam. Their three daughters survive him.

In 1900 Fowler joined the firm of Capper Pass & Son, Tin and Lead Smelters of Bristol, with whom and their successors, Capper Pass & Son, Ltd., he remained for the rest of his life. His powers of organisation and his appreciation of the possibilities of new developments in engineering and metallurgy proved of great value to his firm, of which he became Works Manager in 1906 and a Director in 1917.

Fowler's temperament and training were such as to fit him eminently for the position he filled. Not only was he himself a master of experimental technique, but he was always ready to encourage and help others, whether engaged in the investigation of scientific

problems or in the application of scientific discoveries and principles to industrial processes. Fairness, sympathy and devotion to duty endeared him to his co-directors, staff and work people alike, and he will also be remembered with respect and gratitude by many members of the printing trade for his dissemination of metallurgical knowledge in relation to the alloys used as type-metals. His lectures and booklets for printers did much to abolish mystery and rule-of-thumb methods from the type-casting shops of the world.

The exigencies of a strenuous business life did not leave much time for social activities or such public work as brings fame, though in early life he achieved great success as an amateur racing cyclist. In 1892 he was the first man in England to beat Zimmerman, the famous American champion, and among other records, in 1894 he created a world's record by doing 180 miles in under 12 hours. In later life he kept himself fit by strenuous work in his garden and woods, which were to him a continual source of pleasure, while a love of music and the hobbies of photography and radio-reception gave him recreations well suited to his somewhat retiring disposition. He could not claim a large circle of acquaintances, but his was the happier lot of making lasting and devoted friendships. Those of us who had the privilege of knowing him intimately and working with him are all poorer for his loss, but far richer for the long years of our happy association together. He died on February 8th, 1934.

P. G. J. GUETERBOCK.

GEORGE FRY.

1843—1934.

GEORGE FRY—who died at his home at Berwick-on-Tweed on June 29th at the age of 92—though known to comparatively few, was in several respects a remarkable man. He was born at Arundel (Sussex) in 1843, the son of a timber merchant there, the first to take up the importing of wood in sailing ships which came up the river Arun.

Fry himself passed to London, becoming agent for Swedish and Russian owners of forests, and was at one time the delegate of the London Timber Trade to the London Chamber of Commerce. As a business man he was very successful, and he was also a good linguist. But his real interest was in science and, though he had had no regular training in chemistry and was neither a College nor a University man, he showed a decided leaning to research in chemical, botanical, and other directions. Although purely self-taught, he became a well-read man, able to speak on a wide range of scientific subjects and carry out experimental enquiry in his own somewhat isolated sphere. In his business he introduced the Ekman-Fry process, one of the earliest processes for the treatment of wood-pulp for paper-making.

Taking up farming, largely as a recreation, at Chobham (Surrey), he became known, about 1882, as the introducer of the system of "sweet silage," in contradistinction to the "sour silage" produced by the rapid filling of silos with fresh grass, etc., and the immediate application of pressure to the mass. Fry drew attention to the fact that, if the green food was inserted in smaller lots and allowed to heat to 125—150° F. before pressure was applied, it passed through a different fermentation which produced a silage almost free from acidity and possessing a sweet aromatic flavour. The late Dr. Voelcker, in writing of Fry's work (*Journal of the Royal Agricultural Society of England*, 1884), describes his experiments as "being the first accurate observations of the changes which grass and similar green produce undergo under the influence of temperature."

Leaving the south shortly afterwards, Fry became Managing Director of the firm of Allan Bros., Ltd., the well-known timber merchants of Berwick-on-Tweed. Here his zeal for investigation asserted itself and he applied it to the building and ventilation—on his own principles—of his house, attached to which, on the sloping banks of the Tweed, was a rock garden of more than ordinary horticultural interest.

Being attached to music, and himself a good violinist, Fry devoted much enquiry to the composition of the varnishes used for the instruments of Stradivari and other famous makers. The account of his researches on this subject, in which he dealt extensively with the chemical composition and properties of varnishes, old and new, and with their influence on tone, is

embraced in his book entitled "Italian Varnishes" (Stevens & Sons, Ltd., London, 1904). All this work was carried out in the laboratory in his own house, where he worked unaided and, indeed, but little noticed by those around him. Fry was, however, to those who knew him, a most interesting man to meet and his conversation showed the thorough grip he had obtained of the principles underlying several different branches of science. After retiring from business, he lived a very secluded life, but was interested in scientific enquiry until quite near the close of his days, he suffering only from deafness.

He became a Fellow of the Chemical Society in 1904.

J. A. VOELCKER.

GEORGE GRAY.

1848—1934.

GEORGE GRAY, for 32 years lecturer on Agricultural Chemistry at Canterbury Agricultural College, Lincoln, New Zealand, died on February 23rd, 1934, at his New Zealand home, in his 85th year.

Gray was born in 1848 near Southampton, where he afterwards became teacher of chemistry at the Hartley Institution (now Hartley College). He held this position until 1874 and was then selected as assistant to Professor Bickerton, who was about to leave England to become first Professor of Chemistry and Physics at Canterbury College, Christchurch, New Zealand. At this College Gray stayed from 1874 to 1883, when he was appointed to his position at Lincoln, which he held until his retirement in 1915. From that date until his death he lived quietly in the village of Lincoln (N.Z.)

Gray took little part in public life, but was secretary of the Canterbury (N.Z.) Philosophical Institute from 1881 to 1883. His scientific writings were chiefly concerned with the analyses of rain water, carried on for a number of years. He also wrote on the analyses of stock foods and manures and especially on the reactions between superphosphate and lime.

He was of a quiet and retiring disposition, an exceedingly conscientious worker, and a loyal and disinterested friend.

H. G. DENHAM.

JOHN HAWORTH.

1869—1934.

JOHN HAWORTH was born at Mirfield, Yorkshire, in 1869, and died suddenly at his home, Grove Road, Sheffield, on 20th January, 1934. Haworth received his early education at Mirfield Grammar School, and at the age of sixteen he became a junior assistant to Mr. Frank Scudder, who was at that time Chemist and Works Manager to the Whitwood Chemical Company, Normanton. Towards the end of 1887, Scudder returned to Manchester as a consulting chemist, taking Haworth with him as his private assistant. While at Manchester, Haworth availed himself of opportunities of studying chemistry at Owen's College under the late Sir Henry Roscoe, but it was the training and experience obtained in Scudder's laboratory which developed in Haworth that keen interest in the chemistry and biology of the purification of sewage, water and trades waste which he put to such good service in later years.

In 1892, Haworth went to Tiverton as science master at Blundell's School, and the following year he was appointed public analyst to the Borough of Tiverton.

In 1899 he was appointed chemist at the Sheffield sewage works, when the Corporation were considering the adoption of Dibdin's contact-bed system of sewage purification. He was responsible, with the then City Engineer, for the design and construction of the necessary works. In 1914, Haworth was made directly responsible for the sewage purification of the city, being appointed general manager of the department and chemist to the Corporation. In the latter respect he was Water Examiner, while his training as a public analyst enabled him to undertake the testing of a great variety of materials used by other departments of the Corporation.

Faced with the necessity for improving the Sheffield main sewage works, owing to the

greatly increased volume of sewage and the more exacting requirements of the rivers authority, Haworth turned his whole attention to evolving a more intensified process of biological oxidation. The war years were spent in patient study and experiments in several directions. His first efforts were directed towards increasing the efficiency of contact beds and percolating filters by forced aeration, but, although he met with considerable success, he was led to commence investigations on quite different lines. In this decision, Haworth was no doubt influenced by the work of Fowler and his collaborators at Manchester, on the purification of sewage by aeration without the use of biological filters. He conceived the idea that it ought to be possible in sewage purification to reproduce conditions similar to those natural or self-purification processes which occur in streams not polluted beyond their power of recovery. His main contention was that, as streams derive the oxygen necessary for their self-purification from the atmosphere by solution at a continually changing interface, it should be possible to construct a kind of artificial stream with mechanical means for ensuring a sufficiently lengthy and turbulent flow to enable enough atmospheric oxygen to be dissolved for effecting the biological purification of a continuous and controlled flow of sewage liquid through the system. How this pioneer work proceeded from small-scale experiments to the complete reconstruction of the Sheffield sewage works, now dealing successfully with a dry-weather flow of twenty million gallons of sewage daily, has been faithfully and modestly described by him in papers published in various scientific and technical journals. Haworth's process, to which he gave the name "bio-aeration," has since been adopted at a number of towns in this country, and in some places abroad.

It is typical of Haworth that he refused to consider patent rights in connexion with his bio-aeration process. He took the view that, as a municipal servant, the benefits of any discovery he made during the course of his duties should be available for the community generally without restriction.

Side by side with the reconstruction of the Sheffield main sewage works, Haworth's energies were directed towards bringing all the seven works under his control into the highest state of efficiency. With the official opening of the last of these works reconstructed, in July, 1933, his great effort was brought to a successful issue. He died leaving his department in excellent condition, creditable both to himself and to the City of Sheffield, which he served so faithfully and well.

Haworth's valuable work for the community and his eminence in an important department of the public service were recognised in 1929, when he was awarded the M.B.E.

In the particular branch of science in which he was engaged Haworth's reputation was international; he was a recognised authority on all matters relating to sewage disposal and rivers pollution prevention. He gave valuable evidence on these matters before the last Royal Commission on Sewage Disposal. Frequently he had given evidence before Parliamentary Committees and he had served upon an Advisory Committee of the Ministry of Health. He was one of the representatives of the Institution of Municipal and County Engineers on the British Standards Institution Committee on bitumen, asphalts, tar and building materials, and also attended several meetings of the Sub-Committee engaged in the preparation of standard methods of testing aggregates for road construction.

For three years Haworth was President of the Association of Managers of Sewage Disposal Works, and took a leading part in the incorporation of this Association as the Institute of Sewage Purification, in 1932. He was President of that Institute at the time of his death.

Of John Haworth it may be said that, as a public servant, he possessed an idealistic conception of his duties towards the community he loved to serve. He was modest in the extreme; always ready to listen to appeals and willing to render what help he could to his fellow men; and generous in his appreciation of the work of others. He possessed a shrewd insight into human nature and a quiet sense of humour. He displayed almost a fatherly interest towards those who worked under his supervision, which won for him their great loyalty, respect and esteem. Haworth's quiet nature and lovable character will not be forgotten by those whose good fortune it is to have known him.

J. H. GARNER.

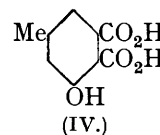
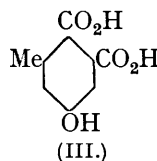
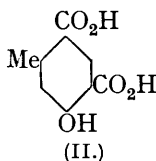
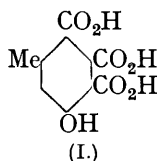
ANDREW NORMAN MELDRUM.

1876—1934.

ANDREW NORMAN MELDRUM was born at Alloa on 19th March, 1876, received his early education at Gordon's College, Aberdeen, proceeded to the Royal College of Science, London, in 1893, and gained the associateship three years later. He then entered the University of Aberdeen, graduated B.Sc. with first class honours (chemistry) and the Neill Arnott prize for experimental physics in 1899, served as research assistant to Professor Japp until 1902, and then became a demonstrator at Liverpool with Professor Campbell Brown. In 1904 he rejoined the staff at Aberdeen University, and in that year, while chief demonstrator, graduated D.Sc., his thesis being a first-rate monograph entitled "Avogadro and Dalton: the Standing in Chemistry of their Hypotheses" (published by James Thin, 1906). From this emerges evidence of a profound interest in the historical aspect of chemistry, coupled with an alert faculty for criticism; these influences remaining through life predominant in his outlook on science and rendering his contributions to chemical history notably luminous and exact. In the doctorate year he joined the staff of Professor Wynne, Sheffield University; in 1907 became Carnegie Research Fellow at Manchester, and finally entered the Indian Education Service, 1912. His first appointment therein was the chair of chemistry at the Madhavlal Ranchodal Science Institute, Ahmedabad, whence he proceeded in 1918 to Bombay as professor of chemistry at the new Royal Institute of Science (University of Bombay), where he was also principal from 1925 until his retirement to Edinburgh in 1931.

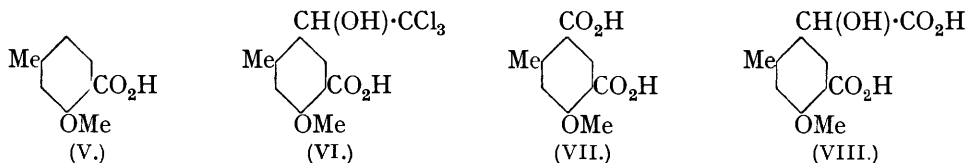
A survey of Professor Meldrum's published work reveals an unusual pursuit of two parallel paths in chemistry, organic and historical. These held his attention permanently, and were complementary while distinct, each serving as an intellectual refreshment to the claims of the other. Viewing them in that order, it appears that his introduction to organic chemistry was made by Japp, whose earlier work on the ammoniacal condensation of ketones he continued in Aberdeen, describing the results in three collaborative papers. On joining W. H. Perkin in 1907, Meldrum found the Manchester laboratories actively occupied with synthetic work on terpenes, to which he contributed usefully by careful standardisation of 2-hydroxy-*p*-toluic acid production as a step in preparing the 1-methylcyclohexan-2-ol-4-carboxylic acid required for 1-methyl- Δ^1 -cyclohexene-4-carboxylic acid (Meldrum and Perkin, J., 1908, **93**, 1416; 1909, **95**, 1896). Concurrently he studied the β -lactone arising from acetone and malonic acid when condensed by acetic anhydride, reporting thereon in his first independent paper (J., 1908, **93**, 598).

Before he left Manchester, Meldrum's experimental work led him to the class of substances that retained his interest whenever facilities for their study became available. Liebermann and Voswinckel (*Ber.*, 1897, **30**, 688, 1733) had shown that heated cochenillic acid (I) yields three acids; 5-hydroxy-*m*-toluic, *m*-hydroxyuvitic (α -coccinic, II), and hydroxymethylphthalic (β -coccinic, III) acids. The isomeride (IV) of (II) and (III)



was designated γ -coccinic acid by Meldrum, and applying to 5-methoxy-*m*-toluic acid the Fritsch method of synthesis (*Annalen*, 1897, **296**, 358; 1898, **301**, 360), in which the relevant aromatic acid is condensed with chloral, he produced a mixture of (III) and (IV) as methyl ethers, the preparation of 5-hydroxy-*m*-toluic acid itself having been previously studied in conjunction with his work on 2-hydroxy-*p*-toluic acid mentioned above. Owing to disruption of a carboxyl group, the methyl ether of (III) could not be converted into the parent acid; but its derivation from β -coccinic acid was established by identification with the methylated product of (III) from cochenillic acid (J., 1911, **99**, 1712).

The foregoing substantial work was marked by that careful procedure which characterised Meldrum's activities elsewhere, and the interruption it suffered in 1912 was due to his recognising the prior claim of administration following appointment to the new post at Ahmedabad, where also the laboratory facilities were then inferior to those of Bombay. In the latter city, however, he was able to resume its thread, assisted by some excellent collaborators, including R. L. Alimchandani, with whom he applied the chloral condensation to a varied range of aromatic acids, and thus arrived at a new synthesis of *m*-hydroxyuvitic (α -coccinic) acid (II). The product (VI) obtained by the combination of *m*-cresotinic acid methyl ether (V) with chloral was found to yield *m*-hydroxyuvitic acid methyl ether (VII) by (a) oxidation with potassium permanganate, or (b) conversion into the dibasic



acid (VIII) with baryta, followed by (1) oxidation to the keto-acid, (2) disruption of the carboxyl group, and (3) oxidation of the resultant aldehyde. The methyl ether (VII) obtained by routes *a* and *b*, when demethylated by hydrogen iodide, gave *m*-hydroxyuvitic acid (II), the α -coccinic acid found by Liebermann and Voswinkel among the products of heating cochenillic acid (*J. Indian Chem. Soc.*, 1925, **2**, 1; 1929, **6**, 253). Several other communications issued from the Bombay laboratory in conjunction with R. L. Alimchandani, R. C. Shah, N. W. Hervé, M. M. Patel, and Miss B. N. Katrak, supplementing the main line of Meldrum's research by observations on the bromination of aromatic sulphonic acids and the nitration of salicylic derivatives. The considerable volume of work remaining unpublished at his death, but available in thesis-form at the Bombay University library, included a new synthesis of cochenillic acid.

Meldrum had opened his doctorate thesis (1904) by the following quotation from J. S. Mill: "Truth on these subjects is militant and can only establish itself by means of conflict." So closely did the author embrace this principle that in the guise of a chemical David he attacked several contemporary Goliaths. For the fate of these monsters the monograph should be consulted, when it will be found that news from the front makes pungent reading even thirty years after the encounter. Controversial aspects disregarded, the essay submits to rigid and always interesting scrutiny (1) the relation of Avogadro's hypothesis to Gay-Lussac's law, (2) molecules and atoms, (3) Dalton's attitude thereto, (4) the atomic weight systems of Berzelius and of Gmelin, (5) the systems of Gerhardt and Laurent, and of Cannizzaro, concluding with (6) the relative standing of Dalton's atomic theory and Avogadro's hypothesis. Absorbing also is a pamphlet entitled "The Development of the Atomic Theory" printed (1920) in India, condensing matter presented to the Literary and Philosophical Society of Manchester during 1909—11, and criticising a Chemical Society presidential address: the argument is directed to showing that the work of Priestley and Lavoisier, preceded by that of many earlier users of the balance, was the logical forerunner of Dalton's theory; and although it is not suggested that Dalton was already aware of William Higgins, nevertheless the doctrine of chemical combination in multiple proportions was actually embodied in the atomic theory published by the last-named in 1789.

Smoother ground was covered by Meldrum in his later works, of which "The Eighteenth Century Revolution in Science—The First Phase" (1930) treats of Lavoisier's work during 1772—75 and is based on an intensive study of his memoirs and journals along with publications of Bayen and of Priestley. Still happier was his contribution to the bicentenary commemoration of Joseph Priestley (J., 1933, 902), exhibiting Priestley's unique addition to chemical knowledge and including a brief survey of the earlier pneumatists. His latest publications (*Isis*, 1933, **19**, 330; 1934, **20**, 396) dealt with Lavoisier's early work, and it is known that he was then comprehensively re-examining the discoveries of Black.

An estimation of Professor Meldrum's very high character would be diminished in

accuracy by ignoring his interpretation of the above-quoted introduction to his doctorate thesis. So truth-conscious was he that a fanciful imagination might envisage him congenially occupied confronting Saladin, in twelfth-century Palestine: and this temperamental quality was an obstacle to friendship in its more conventional forms. Nevertheless, it gave a misleading impression of his nature. My own slender association with Meldrum began with a few months' companionship in 1896, and thereafter we met so seldom that by 1922 I had overlooked his passage to India having been pre-War: consequently, his unaffected welcome on the morning I landed in Bombay was a happy surprise, and remains a cherished recollection. Even during the nine years we shared in that country our meetings were rare, but they sufficed to establish my profound respect for his tenacious and conscientious adherence to principle, and single-minded attachment to duty; linked with a sensitive loyalty. In the Manchester days he had begun to assemble material for a comprehensive history of chemistry, and it cannot be doubted that, if circumstances had freed him to exercise untrammelled the scholarly propensity disclosed so soon, an extraordinarily sound and critical history would have been written. He mistrusted other histories until he had checked their conclusions by reference to original sources.

The smiles of Destiny are often sardonic, but it seems an exaggeration of mockery, grim and impish, to detach a heaven-directed historian five thousand miles from the requisite archives during nineteen years of his mature judgment. Had Meldrum been less loyal, less conscientious, this mockery would have reflected itself in the conduct of his duties; but the testimony of his Indian students and colleagues establishes the contrary beyond question, and led to the Meldrum Memorial Prize being founded at his retirement. He was a valued member of the Bombay University senate and syndicate, becoming dean of the faculty of science in 1930. The Government of India nominated him a trustee of the Prince of Wales Museum of Western India, and a member of the provincial council for agricultural research. For a time he edited the *Journal of the Indian Chemical Society*, and in 1923 he was president of the chemistry section, Indian Science Congress, meeting at Lucknow. His teaching methods were most thorough, and attractive to beginners, who were not subjected to the terror of complicated formulæ, and were consistently treated with disciplined sympathy. More mature students also benefited by his logical procedure in the conduct of research, which is regarded by his Indian associates as having laid the foundation of advanced scientific study in the Bombay Presidency. During the last two years of his principalship he was much occupied with the work of a committee appointed to organise a department of chemical technology within the university.

Tragedy overwhelmed the last year of Meldrum's life. The untimely death of his only son in 1933 was a calamity which could not be withstood, and he died on 12th March, 1934. His widow survives him, with two daughters.

M. O. FORSTER.

WILLIAM F. SANDROCK.

1909—1933.

WILLIAM F. SANDROCK, in whom is lost a young organic chemist of high promise, was born in London on 25th September, 1909. After completing his general education at the Central Foundation School, London, he spent a year at Birkbeck College, and then entered East London College in 1927 as an Honours student in Chemistry, where, after a distinguished undergraduate career, he graduated B.Sc., London, with 1st Class Honours in 1930. Sandrock then embarked on research work in the Division of Biochemistry of the London School of Hygiene and Tropical Medicine, and from the beginning displayed a rare aptitude for original work. His first problem dealt with the synthesis of hydroxy-carbonyl compounds, and was the subject of two communications to the *Journal* (1931, 2426; 1932, 1180); then, utilising the experience gained in this work, he proceeded to a synthetical investigation of the constituents of the important anthelmintic drug, *Felix-mas*, on which he was actively engaged at the onset of the illness to which he succumbed on 8th May, 1933. The results

of his preliminary work on the constituents of this drug have been recorded in two papers (J., 1933, 819, 1617).

Although fully alive to the risk of falling a victim to the heart lesion which developed during his early school days, Sandrock maintained a cheerful outlook and took an active part in the sport and social life of his College. In addition to being a first class cricketer, he played association football and golf. His enthusiasm and gaiety which remained to support him during a long and insidious illness endeared him alike to his teachers and fellow students and won him many friends.

A. ROBERTSON.

B. D. STEELE.

THE death occurred at Brisbane on 12th April, 1934, of Professor B. D. Steele, F.R.S. He was forced through ill health to relinquish active teaching in 1928 and retired from the Chair of Chemistry in the University of Queensland with the title of Emeritus Professor in 1930.

Professor Steele was brought up in England, but came to Australia with his family in early youth. First qualifying as a pharmacist, he later took his Science Degree in the University of Melbourne. He returned to Europe in 1899 with an 1851 Exhibition Scholarship. Following this, he held posts in McGill University, Montreal, and Heriot-Watt College, Edinburgh. He returned to the University of Melbourne as Lecturer in Chemistry in 1905. In 1910 he was appointed as first holder of the Chair of Chemistry, University of Queensland. His scientific work in connexion with the determination of transport numbers of electrolytes and the electrochemistry of non-aqueous solutions was carried out before his return to Australia. After his return to Melbourne, he designed in conjunction with Kerr Grant the very sensitive micro-balance later used by Ramsay and Gray for determining the density of radon. The duties associated with a Chair in a New University left him little time for scientific work in his later life. He acted as first President of the Board of Faculties of the University, which was largely responsible for the organisation of the Institution.

Perhaps his most valuable contribution to public welfare in Queensland was his association as Chairman with Government Commissions for the control of prickly pear. As a result of the activities of a Royal Commission, the pear which was formerly encroaching on hundreds of thousands of acres of good land annually is now actually being driven backwards.

During the War Professor Steele proceeded to England on leave from his University and entered the service of the Ministry of Munitions. He was responsible, among other activities, for the design and successful running of a Synthetic Phenol Factory at Ellesmere Port.

L. S. BAGSTER.

BERTRAM VINCENT STORR.

1878—1934.

BERTRAM VINCENT STORR, who died on 5th April, 1934, the third son of Rev. T. Storr, was born at Scunthorpe in Lincolnshire in 1878. He received his preparatory education at schools in Tetney, Tadcaster and Malton. Winning a scholarship, he attended the Leeds Higher Grade School until 1895, when he entered the Yorkshire College of Victoria University at Leeds. He chose chemistry as his main subject and worked under Professor A. Smithells. At the University he became noted for conscientious hard work and his passion for accuracy. Graduating with the degree of Master of Science in 1898, he was awarded a Priestley Research Scholarship at Mason College, Birmingham, where he worked for a year under Professor P. F. Frankland. His bent was towards industrial chemistry and in 1899 he joined Mr. F. F. Renwick in the Research Laboratory of Ilford Ltd., Manufacturers

of Photographic Materials. The remainder of his life was spent with the same Company and in 1922 he became Chief Chemist in their plate factory at Ilford, a position which he held until 1930; he then took charge of much of the Company's business relating to patents and inventions, being responsible also for scientific publications. In 1924 he was made a director of the Company's Film Factory at Warley. From 1918 until 1930 he was a member of the Council of the British Photographic Research Association.

It is only comparatively recently that much work on photographic research has been published. When Storr entered the industry, the results of research were for the most part kept secret; thus it is that he published very little.

In 1918 he was associated with F. F. Renwick and H. J. Channon in a paper on the "Behaviour of scattering media in fully diffused light" (*Proc. Roy. Soc.*, 1918, *A*, **94**, 222). Two further papers on "White light development" and "The photographic uses of the Osglim lamp" respectively were published in his own name (*Phot. J.*, 1921, **61**, 126; 1922, **62**, 271). He patented several inventions, of which the most notable covered a very successful method for the recovery of silver from photographic waste.

His contribution to photographic science was not, however, confined to the laboratory. In 1916 he wrote the first of the Annual Reports on Photographic Materials published by the Society of Chemical Industry and continued this work for two more years. These admirable reports paved the way to what was, perhaps, his greatest labour in this field. In 1921 the Royal Photographic Society, through its Scientific and Technical Group, published the first number of *Photographic Abstracts*. This was issued quarterly, and Storr, for the first ten years of publication, acted as its Honorary Editor. The editorial work was extremely onerous and he carried it out with the same meticulous care that marked his other work. He once said that it absorbed about two-thirds of his leisure. On his retirement from the editorship in 1930 he was awarded the somewhat rare distinction of Honorary Fellow of the Royal Photographic Society; surely few honours have been more thoroughly earned.

Outside his work he was distinguished by his friendly personality and his eagerness to assist any who needed help. His interest in social problems was keen and for many years he was secretary and treasurer of a large Allotment Association. During the War he acted for some years as honorary radiographer in the Ilford Hospital.

Although his early years were beset with all the difficulties caused by limited means and the frequent uprootings experienced by the family of a Methodist minister, yet some great compensating influence must have been at work within him, for in spite of these difficulties, he arrived at the University "with a good schooling," possessing "sterling personal characteristics which were very evident, enduring and endearing in him." Such is the description given by one of the University staff. Throughout his life the same characteristics persisted. To his widow and his two sons, to his friends and colleagues he leaves the memory of a gallant and high-hearted man.

S. O. RAWLING.

GEORGE TATE.

1858—1933.

THE death of Dr. George Tate, F.I.C., in his seventy-sixth year at Prenton, Birkenhead, on 24th November last year, removed a noble figure from the scientific life of Merseyside. Tate was a Southerner, and the son of Thomas Tate, a well-known educationist of his day and mathematics master at the National Society's Training College, Battersea. Leaving his native Hastings, Tate proceeded to the City of London School, where he met W. H. Perkin, jun., who was a year or so younger, and then went to Germany, where he studied chemistry under Will at Giessen and Wislicenus at Würzburg, graduating at the latter university, the subject of his thesis being "Non-symmetrical Dimethylsuccinic Acids, and Propyl- and *iso*Propyl-malonic Acids." This represents only the moiety of his reading as an undergraduate, for he spread his net wide and became almost as well equipped in geology, mineralogy, botany and zoology, which knowledge stood him in good stead in later life.

On his return to England in 1881 he set up in practice in Liverpool as a consultant and, at the same time, devoted his leisure to conducting evening classes in chemistry in the then "College of Chemistry" in Duke Street, which had originally been established by the late Dr. Sheridan-Muspratt, one of the founders of the Alkali industry on Merseyside. The college had recently been taken over by the Committee of Science, Art and Technology of the City Council, and so successful was Tate as a teacher that the School was moved to more commodious premises in Colquitt Street and ultimately established in Byrom Street in 1890, the Chemical Laboratories of which were conceived and designed by Tate himself and are a lasting memorial to him. As a result of Tate's dual capacity as a teacher and a practising consultant, his students were brought into live contact with the chemical actualities of the day and district; special alloys were being introduced into the chemical industry for the first time, and his classes were thus fortunate in participating in elaborating special methods for the determination of chromium and the rarer elements such as tantalum, vanadium and niobium in steels and in the ore. He must have been one of the first teachers in this country to introduce the application of physical methods in attacking chemical problems generally, for the polariscope, microscope, refractometer, etc., were in daily common use in his laboratories. As a teacher, his wide knowledge of subjects outside chemistry was extraordinarily stimulating to his classes; he was a brilliant lecturer, clear and concise in style and very pleasant to listen to, so that his lectures and experiments were a delight to his audience. It is no exaggeration to state that what Roscoe achieved for chemistry in the Manchester district, Tate amply seconded on Merseyside. His later academical career may be summarised as follows: Head of the Chemistry Department of the Liverpool Technical School, 1890—1915, and of the like department in the Holt Technical College, Birkenhead, from 1893 until September, 1933, when he was retired owing to failing health. He has thus been active as a practitioner and a teacher of chemistry for over fifty years; it is, therefore, not surprising that these busy fifty years left little time or opportunity for scientific communications, but the three standing in his name reflect the breadth of his interests: "Estimation of minute quantities of gold" (*Chem. News*, 1890, **61**, 43, 54, 67); "Fermentation of dextrose, rhamnose, and mannitol by a lævoflactic ferment" (*J.*, 1893, **63**, 1263); "Estimation of silicon in ferrochromium and of silica in chrome ore" (*Chem. News*, 1899, **80**, 235).

Tate was a progressive member of society in aspects other than the scientific, inasmuch as he was an early Fellow of the Institute of Chemistry, served on the Council of that body from 1922 until 1925, and was active for several years on its Benevolent Fund Committee. These associations did not prevent him, however, from throwing himself, body and soul, into a newer movement in the profession of chemistry, for he was one of the founders of the British Association of Chemists, a valued member of the Nominations Committee of the latter, and one of its trustees until his death.

His chief interests outside science were cycling and gardening, and he was justly proud of having covered the whole of Wales, the Midlands, and the Northern counties a wheel, at a time when cycle touring was in its infancy; but even in this recreation he always had one eye cocked on the roadside for anything of a botanical or biological interest, for his one great passion in life was the study of fungoid growths. His most notable horticultural achievement was the breeding of a private strain of disease-free potatoes which, in less altruistic hands, would have been exploited commercially on a large scale, but, as in everything else, it was the chase and not the quarry that fascinated Tate.

He left a widow and a married daughter, the former of whom survived him by only a few months.

F. W. KAY.

HENRY WHITE.

1867—1934.

HENRY WHITE's interests were in industry rather than in the pursuit of pure chemistry, but from the time of his apprenticeship in a South Yorkshire steel works, through the forty-three years during which he was a Fellow of the Society, to his death he took a keen

interest in the development of pure chemistry and was exceedingly well informed of the developments that had an application to the industries in which his interests lay.

He was born in Rotherham 67 years ago and was educated at the Dr. Cox School there. He served his apprenticeship at the Park Gate Iron and Steel Works under the late Colonel Stoddart and later joined the staff of Messrs Newham & Co., manufacturing chemists, of King Street, Sheffield. From there he went to Carlisle, but returned to Sheffield to undertake the management of Messrs W. Pickard & Co. in 1894. He developed this business, and when it was formed into a limited company he became its first chairman and managing director. This position he retained until December, 1933. When the methylated spirit trade of the country was brought under one management in what is now the Methylating Co. Ltd., Henry White became the first managing director of the new company and he remained a director until ill-health caused him to resign this position, also in December, 1933. The cause of his ill-health was more serious than those who were associated with him in business realised and he died on 30th January, 1934.

Those who worked with him will always remember him by two of his finest attributes—his capacity for business organisation and his unfailing charity. His capacity for organisation showed itself first in the development of W. Pickard & Co. Ltd., and later in the part he played in the formation of the Methylating Co. Ltd., and of his charity it can be said that no cause which it was in his power to help appealed to him in vain and that much of his charity was given so quietly and so thoughtfully that few but the recipients of his aid knew of the help that was given.

He is survived by a widow and two daughters.

W. G. P.

W. FRANK J. WOOD.

1877—1934.

ON 26th June there passed away, at the age of 57, W. F. J. Wood, Governing Director of Wood Bros. Glass Co. Ltd., of Barnsley and Wombwell.

In his youth Wood was not merely a pupil in my laboratories, but for some time a much-beloved member of my household; and I can testify to the high estimate of his character given by the vicar of Ardsley Parish Church at the funeral.

A special course in glass analysis was destined to be of great service to his firm and to the country at large—Wood at a later date wrote expressing his appreciation of the value of the knowledge which he had thus acquired. The Great War soon revealed a shortage of chemical glass-ware, of which Germany had been the chief source of supply. Aided by his special training, Wood was soon able to supply our urgent need not merely of chemical glass-ware but also of optical glass. His advice was much valued at Sheffield University, where he became Chairman of the Glass Technology Department and a member of the Board of the Council of Glass Research.

Subsequently he was the first President of the Glass Research Association of Great Britain, a body largely originating from his own initiative. As a tribute to his services to the Glass Industry he was made a C.B.E. At a much earlier period he obtained the B.Sc. degree (London).

Wood did not allow his business to absorb all his energies. He was of great help to the sporting organisations of his district. Mr. and Mrs. Wood were the founders of the Ardsley Nursing Association, and were large benefactors to many local causes.

The funeral at Ardsley was one of the largest ever known and hundreds of friends and workpeople were unable to gain admittance. The *Barnsley Chronicle* says, "As the long funeral procession wound its way through Stairfoot and up Ardsley Hill, the blinds of every house were drawn in a silent tribute to a man they had loved and respected." It has been a great source of sorrow to many that ill-health and finally death should overwhelm in his prime so estimable and lovable a character.

Wood leaves a widow, two sons, and two daughters.

F. W. RICHARDSON