OBITUARY NOTICES.

SIR WILLIAM CROOKES, O.M.*

BORN JUNE 17TH, 1832; DIED APRIL 4TH, 1919.

THE author of a succession of papers published by the Royal Society and other scientific bodies extending over sixty-seven years (from 1851 to 1918), to say nothing of a number of technical treatises in the form of large volumes, must have been a man of remarkable industry as well as intellectual qualities, and those who believe in the influence of heredity will therefore be disposed to look for some indication of the ancestral origin of these qualities in the famous man who has so recently passed away.

His father, Joseph Crookes, born in 1792, the son of a small tailor in the north of England, came to London a poor boy. He was evidently a man of brain and energy, for the tailor's business he established proved so prosperous that when he died in 1884, at the age of ninety-two, he was a rich man. Joseph Crookes married on February 24th, 1831, at Aynhoe, Northamptonshire, as his second wife, Mary Scott, and from this lady he had a second family of several sons and daughters. William was her firstborn, and resembling her in feature and in disposition, it may be surmised that he derived some of his characteristics from her.

There is but little to say concerning William Crookes's early years. Improbable as it may appear, he always maintained that he remembered learning to stand and to walk. Such regular education as he received was obtained at a grammar school at Chippenham. His father wished to make him an architect, but in the end he satisfied his inclination for experimental work, already indicated at home, by entering the Royal College of Chemistry under Hofmann, the first professor, in 1848. He must have made extraordinary progress, as in 1851 his first paper appeared in three

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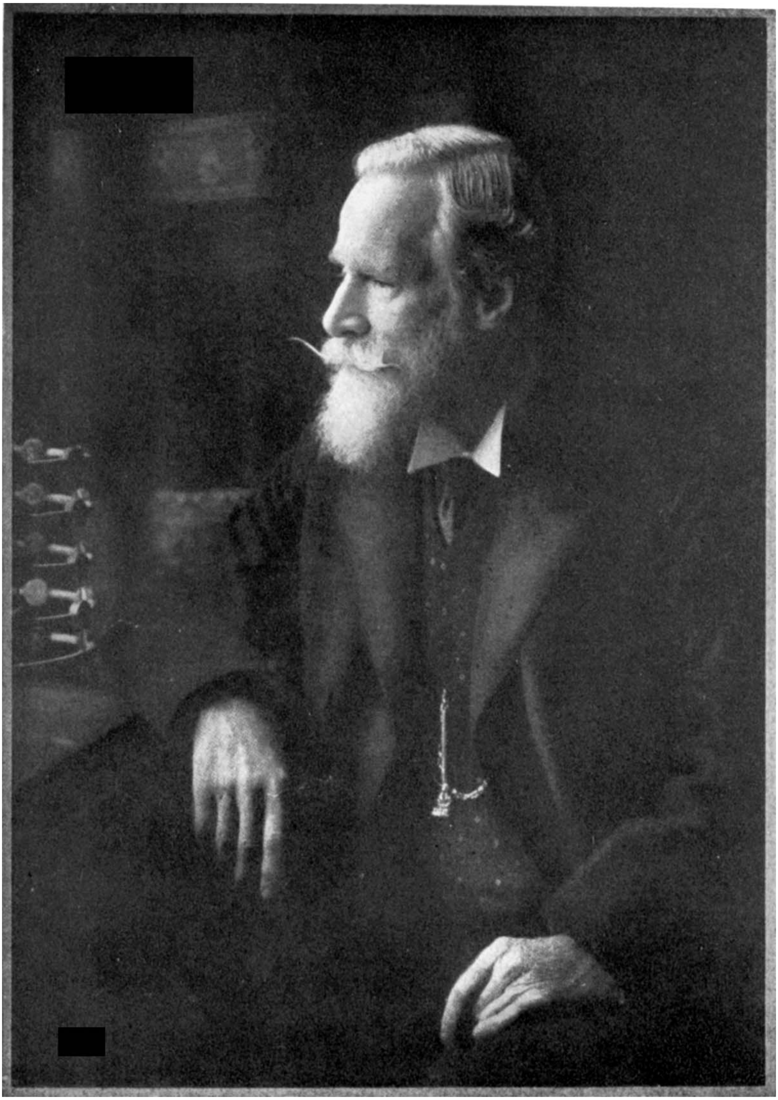

William Crookes.

[*To face Trans.*, p. 444.

German chemical journals to which it was communicated, doubtless by Hofmann. The English version was printed in the *Quarterly Journal of the Chemical Society* (1852, **4**, 12), "On the Selenocyanides, by William Crookes, Esq., Assistant in the Royal College of Chemistry." This position as assistant he retained from 1850 to 1854. He then went to Oxford for a short time as Superintendent of the Meteorological Department at the Radcliffe Observatory, and in 1855 he became Lecturer on Chemistry at the Chester Training College.

In 1856 he married Miss Ellen Humphrey, a native of Darlington, whose acquaintance he had made some years earlier as a school friend of his cousin. They were married on April 10th, 1856, at the Parish Church of St. Pancras, Middlesex, and began housekeeping at Brompton. They removed to 20, Mornington Road, N.W., and afterwards to 7, Kensington Park Gardens in 1880, and this was their home to the end of their lives. In 1859 he brought out the first number of the *Chemical News*, of which he remained sole editor until 1906.

In the meantime he seems to have been much occupied with the study of phenomena connected with the nature and effects of light, for several papers relating to photography were published between 1853 and 1857. Soon after this, the employment of the prism in recognising and distinguishing volatile substances in flame was introduced by Bunsen and Kirchhoff, and the discovery of rubidium and cæsium in the water of the Dürkheim spring was announced by Bunsen in 1860. On applying the spectroscope to the seleniferous material from the vitriol works at Tilkerode (Harz), which had been given to him by Hofmann some years previously, and which he had used as the source of selenium in his work on the selenocyanides, Crookes observed a new green line which led him to the discovery of thallium. The first announcement of the existence of a new element appeared in the *Chemical News*, March 30th, 1861. It was originally supposed to be related to sulphur, but the discoverer soon saw fit to alter his opinion, and the specimens exhibited in the International Exhibition, 1862, and to which a medal was awarded, were labelled Thallium, *a new metallic element*. The discovery was interesting from several points of view. The use of the spectroscope was novel and the properties of the new metal were strange, exhibiting as it does the appearance and approximately the density of lead, some of its salts resembling those of lead and mercury, whilst others are perfectly similar in solubility and crystalline relations to the salts of the alkali metals. The discovery of thallium at once secured for William Crookes a recognised position in the scientific world, and in 1863 he was elected F.R.S. Obviously the first task which lay before him was the investigation of the chemical and physical properties of the new element and its sources in nature. Among the most important of the physical constants to be determined was the atomic weight, and the remarks on the subject contained in Prof. F. W. Clarke's "Constants of Nature" (Smithsonian Institution, 1882) may properly be quoted here. "In 1873, Crookes, the discoverer of thallium, published his final determination of its atomic weight. His method was to effect the synthesis of thallium nitrate from weighed quantities of absolutely pure thallium. No precaution necessary to ensure purity of materials was neglected; the balances were constructed specially for the research; the weights were accurately tested and all their errors ascertained; weighings were made partly in air and partly *in vacuo*, but all were reduced to *absolute* standards, and unusually large quantities of thallium were employed in each experiment. . . . Suffice it to say that the research is a model which other chemists will do well to copy. . . . Hence, using the atomic weights and probable errors previously found for N and O, Tl=203·715±·0365. If O=16, Tl=204·183. . . . Crookes himself, using 61·889 as the molecular weight of the group NO_3, gets the value Tl=203·642; the lowest value in the series being 203·628 and the highest 203·666, an extreme variation of 0·038. This is extraordinary accuracy for so high an atomic weight, at least as far as Crookes's work is concerned."

This passage illustrates the spirit which animated Crookes's work throughout. Nothing short of the highest attainable accuracy ever satisfied him.

The use of the vacuum balance, however, was attended by unexpected phenomena, which occupied his attention for many years afterwards and led to the discovery of the *radiometer* in 1875. This was described in a paper entitled "On Attraction and Repulsion resulting from Radiation," communicated to the Royal Society on March 20th, 1875. A Royal Medal was awarded to Crookes at the Anniversary Meeting in the same year. The President in presenting the medal referred to the instrument in the form in which it has been since familiar, namely, with the four-armed fly mounted on a sharp point and having the vertical disks at the ends of the arms blackened on one side. He also remarked, "it is the mystery attending this phenomenon that gives it its great importance." Great interest was manifested by many experimenters in the phenomena observed, and there were many attempts at explanation. In the end, the hypothesis put forward by Dr. G. Johnstone-Stoney, according to which the repulsion is due to the movements of the molecules of the residual gas acting differentially on the two surfaces of the movable disk, was accepted.

In a footnote to one of his papers (*Proc. Roy. Soc.*, 1876, **25**, 308), Crookes drew attention to the properties of highly attenuated gas, and expressed the view that the phenomena indicate the existence of a fourth state of matter as far removed from the condition of gas as gas is from liquid.

In all the numerous experiments connected with this investigation, Crookes was assisted by Mr. C. H. Gimingham, whose mechanical dexterity and skill as a glass-blower were quite remarkable. Gimingham joined the Swan Electric Light Company in 1881, but unhappily died a few years later.

The phenomena exhibited by the electric discharge in rarefied gas had long been familiar, and had been studied by Plücker, by Hittorf, and other physicists. It was natural that in the examination of the properties of highly attenuated gas the phenomena exhibited by electric discharge through such media should receive Crookes's attention, and in the paper in which his first experiments in this direction were described (*Proc. Roy. Soc.*, 1879, **28**, 110), he was led to theoretical speculations on the ultra-gaseous state of matter. In this paper, the dark space which appears round the negative pole was the subject of experiment, and was found to enlarge as the exhaustion proceeds, whilst the phosphorescence excited on the glass walls of the tube diminishes and ultimately disappears. The dark region round the electrode has since been known as the *Crookes*, or *cathode dark space*. The rays from the cathode may be made to converge by the use of an aluminium cup, and the result is the production of a green phosphorescent spot on the glass; the rays, travelling in straight lines, cast a strong shadow from any object placed in their path. The rays when concentrated also develop great heat, which may rise to the melting point of platinum.

In 1880 the French Académie des Sciences awarded Crookes an extraordinary prize of 3000 francs and a gold medal in recognition of his discoveries in molecular physics and radiant matter. In the years following 1880 he continued the active investigation of the phenomena exhibited by gases in a highly attenuated state, and among other properties he studied the heat conduction and viscosities of gases in this condition. He also examined the phosphorescence exhibited by many substances when exposed to the discharge from the negative pole in a highly exhausted tube; and in the Bakerian Lecture for 1883, speaking of this discharge as "radiant matter," he considered that the particles flying from the cathode were of the dimensions of molecules.

For some years he was occupied in tracing by the spectroscope the changes noted, and he was led to attempt the separation of some of the earths, notably yttria, into the components of which they were supposed to consist, by means of a very elaborate system of chemical fractionation. The result of all this work led him to speculations as to the characters of the elements and the existence of a class of bodies which he called "meta-elements." These meta-elements he regarded as composed of atoms "almost infinitely more like each other than they are to the atoms of any other approximating element. It does not necessarily follow that the atoms shall all be absolutely alike among themselves. The atomic weight which we ascribe to yttrium therefore merely represents a mean value around which the actual weights of the individual atoms of the 'element' range within certain limits. But if my conjecture is tenable, could we separate atom from atom we should find them varying within narrow limits on each side of the mean." This view was put forward in the Presidential Address to the Chemical Society, 1888, the whole of which even now, after thirty years, would repay perusal. The possibility of the evolution of the elements from a primal elementary protyl or urstoff is a proposition which has been discussed from the most ancient times, but the chemist had little positive information as to the inter-relations among the recognised elements before the conception of the periodic law. Taking an idea from Prof. Emerson Reynolds for the diagrammatic display of the periodic relation of properties to atomic weight, Crookes produced a figure of eight curve, on which the symbols of the elements are placed at intervals so that the members of natural families fall into position vertically over one another.

On this curve the meta-elements would be ranged in groups or clusters close together. Radioactivity had not been discovered when this address was composed, but something approaching Crookes's idea has been realised in more recent times by the discovery of isotopes among the products of the disintegration of radioactive elements. For his researches on the behaviour of substances under the influence of the electric discharge in a high vacuum, with special reference to their spectroscopic behaviour, the Davy Medal was awarded to Crookes by the Royal Society in 1889.

The discovery of argon by Rayleigh and Ramsay in 1894, and of helium by Ramsay in 1895, opened a new field, and Crookes being recognised as the most experienced observer of spectra and the highest English authority in this direction, the new gases were at once submitted to him, and the identity of terrestrial with solar helium was established finally by his examination.

Soon after this time the brilliant researches of J. J. Thomson threw an entirely new light on all the difficult spectroscopic questions which had been so patiently and so successfully examined by Crookes. It became clear that the particles projected from the cathode were much smaller than any known atoms or molecules of ordinary matter, and were, in fact, the minute bodies called electrons. On this point, Crookes in a paper on the "Stratifications of Hydrogen" (*Proc. Roy. Soc.*, 1902, **69**, 411), expressed himself in the following terms: "In twenty-five years one's theories may change, although the facts on which they are based remain immovable. What I then called 'Radiant Matter' now passes as 'Electrons,' a term coined by Dr. Johnstone-Stoney to represent the separate units of electricity which is as atomic as matter. What was puzzling and unexplained on the 'Radiant Matter' theory is now precise and luminous on the 'Electron' theory." And by application of this theory the stratifications of hydrogen were explained.

The discovery of radioactivity by Henri Becquerel and of radium by Madame Curie towards the end of the century naturally attracted Crookes's interest and attention. On examination of uranium salts, some specimens were found to be much more radioactive than others. It was soon found that the radioactive constituent is precipitated from a solution by ammonia, and on adding excess of the reagent, a small, insoluble, light brown precipitate is left which exhibits strong radioactive properties, whilst the uranium salt remaining is almost inactive. A year later the uranium had regained its activity. To the active substance the name uranium-X was given. Whatever be its nature, it is evident that uranium owes its usual activity to the presence of this substance which is generated from it, and the separation of which depends on the readiness with which it attaches itself to precipitates, especially ferric hydroxide, when iron is present as an impurity in the uranium compound employed as material. The year following, Crookes, continuing his observations on the emanations of radium, discovered the effects produced by the α-rays on a surface of hexagonal blende (zinc sulphide), and invented the little instrument, which he called the spinthariscope, by which the number of scintillations can be counted, each spark being produced by one α-particle.

The researches on the spectra and other characters of the rare earths occupied more than twenty years, and one result was a very extensive study of scandium and its salts, which places it in the position of being now better known than almost any other of these difficult elements from which scandium is separated by its low atomic weight.

In 1908 Crookes drew attention to the remarkable resistance to the attack of all kinds of reagents by the metals iridium and rhodium, and in 1912 he recorded a useful series of observations on the relative volatility of metals of the platinum group. In the case of platinum at 1300°, the metal seems to volatilise *per se*, whereas the loss of weight of iridium is probably due to the formation of a volatile oxide. The spectra of elementary boron and silicon were the subjects of papers communicated to the Royal Society in 1912 and 1914.

A very valuable investigation undertaken in connexion with the Glass Workers' Cataract Committee of the Royal Society was begun in 1909. The main object was to prepare a glass which will cut off those rays from highly heated molten glass which damage the eyes of workpeople. This involved a study of the effects of the addition of a large number of metallic oxides to a colourless glass, specially prepared for the purpose by Mr. H. Powell, of the Whitefriars Glass Works. The problem was to prepare a glass which would cut off as much as possible of the heat radiation, and at the same time be opaque to the ultra-violet rays, whilst the colour would be scarcely noticeable when used in spectacles. In the result, a series of eighteen different recipes were provided which meet, more or less fully, the three requirements contemplated. These have been found to be, in practice, very beneficial to the workers.

We may now recall some of the subjects which at various times were studied by this untiring worker, outside the course of research which may be supposed to have represented his predilection.

It should not be forgotten that when quite a young man he was appointed by the Government to report on disinfectants and their application to the arrest of the cattle plague in 1866, and that he was responsible for the recognition of the antiseptic value of phenol or carbolic acid.

The diamond has been ever a subject of interest, not merely to the jeweller, but to the mineralogist and chemist, owing to the mystery in which, up to recent times, its origin and formation were involved. In a visit to Kimberley in 1896, Crookes spent nearly a month in the mines studying the question of the origin of the mineral, and again in 1905, on the occasion of the visit of the British Association, he pursued the same inquiry. In 1893 the late Prof. Moissan demonstrated the production of diamonds by crystallisation of carbon from molten iron under pressure, and

Crookes showed that the residue of cordite exploded in a closed steel cylinder contains crystalline particles possessing the form of the diamond. He published an interesting little book on diamonds in 1909.

Another subject in connexion with which he did good service was the importance of producing and applying to the land much larger quantities of nitrogen in the form of nitrate in order to increase the supply of wheat. "The Wheat Problem" was one theme of his Presidential Address to the British Association at the meeting at Bristol in 1898, and his views on the subject were embodied in a volume published a year later, in which he was able to reply to the various critics who in the meantime had questioned some of his conclusions. Though, doubtless, some of his most startling statements admit of modification, the problem still remains a topic of supreme interest to the agriculturist and to the world at large.

It would be almost impossible to enumerate all the various directions in which Sir William Crookes (he received the honour of knighthood in 1897) occupied himself in connexion with problems of public interest or as expert adviser to the Government, but, in passing, may be mentioned his work on the disposal of town sewage, his reports on the composition and quality of daily samples of the water supplied to London from 1880 to 1906, and his services as Consulting Expert on the Ordnance Board from 1907 onwards during the period of the war. Nor should it be forgotten that the office of President is in many learned societies no sinecure. In presiding over the Chemical Society (1887–1889), the Institution of Electrical Engineers (1890–1894), the British Association (1898), the Society of Chemical Industry (1913), and, finally, the Royal Society (1913–14–15), Sir William paid close attention to all the multifarious details of the business of each society. He also served as Honorary Secretary to the Royal Institution from 1900 to 1913, and as Foreign Secretary to the Royal Society from 1908 to 1912. Every man of science among his contemporaries will be ready to affirm, therefore, that the numerous honours which were showered on Crookes by the most distinguished academies and universities in the world were well earned and very fittingly conferred. He received from the Royal Society the Royal, the Davy, and the Copley Medals, and from the Royal Society of Arts the Albert Medal, and finally, in 1910, the Order of Merit was conferred on him by the King.

Crookes's whole scientific career is interesting, apart from the value of his discoveries, as illustrating the fact that to a man of genius the character of his early education has but little influence on his achievements. As mentioned already, he left school at the early age of fifteen, and at once specialised in a single branch of science under a teacher eminent in his own line, but from whom the young student seems to have derived little but the advantage of example, for the subjects to which Hofmann devoted his energies appear to have had but little attraction for Crookes. Unlike W. H. Perkin, who also entered the college at about the age of fifteen with equally imperfect general education, he never seems to have been attracted by organic chemistry, and to the end of his life remained practically ignorant of this branch of science. The genius displayed by Crookes was, however, accompanied by unusual independence of character, which was displayed in a variety of ways, not only in the course taken by his own researches, but by his attitude toward the statements and pretensions of others. Nothing seemed too improbable to escape his attention, and of this the time and trouble he was tempted to expend on the pretended transmutation of silver into gold some twenty years ago is a sufficient illustration. The same liberality of spirit made him very tolerant, and perhaps not always sufficiently critical, in regard to articles in his paper, the *Chemical News*.

Here we must add that no account of William Crookes's life as a scientific man would be complete, and less than justice would be done to his personal character and independence of spirit, if all reference were omitted to the investigations in which, early in his career, he became involved concerning the phenomena of so-called "Spiritualism." The *Quarterly Journal of Science* for July, 1870, contains an article under the title, "Experimental Investigation of a New Force," in which Crookes describes experiments undertaken with Mr. D. D. Home, a "medium" well known to the public at that time. At one of the earlier *séances* the experiments were made in the presence of Dr. Huggins (afterwards Sir William Huggins, President of the Royal Society), Serjeant Cox, proprietor and conductor of the *Law Times* and *Recorder of Portsmouth*, one of Crookes's brothers, and his chemical assistant. Later, in January, 1874, the same journal published "Notes of an Enquiry into the Phenomena called Spiritual during the years 1870–73," with the signature William Crookes.

Anyone who has read these articles can realise the shock which was experienced by the scientific world on learning the character of the statements contained in them. Here was a well-known man of science, a Fellow of the Royal Society, the discoverer of thallium, with which and with its salts chemists had had time to become perfectly familiar, asserting in the most formal manner that in his presence things had been seen and done which everyone would regard as contrary to well-established natural law and to all ordinary experience.

It is perhaps not surprising that Crookes was publicly attacked in a violent manner, but he was able to show that many misrepresentations and misstatements were made which everyone must now perceive were wholly unjustifiable. The story of his experiences as told by him is supported by evidence which would be accepted as conclusive if these statements related to any scientific work or to any ordinary occurrence. Crookes himself never withdrew or altered his statements concerning the phenomena he had witnessed, and in his Presidential Address to the meeting of the British Association at Bristol, so late as 1898, he reiterated his conviction as to their reality. This conviction he retained to the end of his life. He was President of the Society for Psychical Research in 1897. His view, if he really had a settled opinion, as to the explanation of these strange phenomena cannot be given in his own words, but the view of Mr. Serjeant Cox on the theory of what he called psychic force is given very clearly at the end of these "Notes," and it appears probable from the prominence given to this exposition that it represents very nearly the opinion of Crookes himself. Perhaps the last few lines are sufficient to quote in this place, as probably views may have changed during the forty-five years since they were written. The passage is as follows: "The difference between the advocates of psychic force and the Spiritualists consists in this—that we contend that there is as yet insufficient proof of any other directing agent than the Intelligence of the Medium, and no proof whatever of the agency of the Spirits of the Dead; while the Spiritualists hold it as a faith, not demanding further proof, that the Spirits of the Dead are the sole agents in the production of all the phenomena. Thus the controversy resolves itself into a pure question of *fact*, only to be determined by a laborious and long-continued series of experiments and an extensive collection of psychological facts."

It is unnecessary to pursue the subject further, but as Crookes made no secret of his views, and his credibility in regard to all other questions, scientific or otherwise, has never been impugned, his biographer would not be justified in doing more or less than to place on record such statements as appear to represent fairly the position he had assumed, and certainly no biographer would be expected to pronounce any opinion other than that which he believes to have been entertained by the subject of his notice.

By the death of Sir William Crookes on April 4th, 1919, the world lost a great scientific pioneer. His age was far advanced, and the loss of his wife some three years earlier had been a severe blow, from which he never completely recovered, so that when in January last year his friends learned of his increasing weakness, it was with the sad conviction that the end was not far off. The touching dedication prefixed to his little book on Diamonds was an indication of the domestic happiness which throughout accompanied his long and active career.

W. A. T.

THOMAS FAIRLEY.

BORN 1843; DIED FEBRUARY 21ST, 1919.

THOMAS FAIRLEY, who died on February 21st, 1919, at the age of seventy-six, had been a Fellow of the Society since 1865.

He was born in Glasgow, and received his school education in the Free Church Training College of Edinburgh, where, as is indicated by still extant evidence, he distinguished himself in classical study as well as in mathematics and physical science. He had begun to amuse himself with chemical experiments in early childhood, and his early acquired chemical taste led him, on leaving school, to become first a student with, and subsequently an assistant to, Lyon Playfair at Edinburgh University. After some time spent thus he migrated to Leeds to become a teacher in the Grammar School there and lecturer in chemistry in the local School of Medicine. At the same time he began to practice as a chemical consultant, and when the Sale of Food and Drugs Act of 1873 came into operation, he was appointed Public Analyst for Leeds and the North Riding of Yorkshire. At a later date he became official Agricultural Analyst under the Fertilisers and Feedings Stuffs Act for both the North and West Riding, having for many years previously acted as consulting chemist to the Yorkshire Agricultural Society.

He had acted both as Treasurer and as Chairman of the Yorkshire section of the Society of Chemical Industry, of which society he also became Vice-President; also as President of the Leeds Naturalists' Field Association, and as Chairman of the Leeds Institute of Science, Art, and Literature, and while holding this office he was elected Chairman of the Council of the Association of Technical Institutions of Great Britain and Ireland in 1908.

He served a full term as examiner during the earlier days of the Institute of Chemistry, and became a Vice-President of that body, in the welfare of which he always took an active and cordial interest, and he was President of the Society of Public Analysts in 1903 and 1904.

Fairley's earliest contribution to chemical literature was a paper on "The Action of Hydrogen on Organic Polycyanides" (*Journ. Chem. Soc.*, 1864, **17**, 362). This paper incidentally records the first successful attempt at the synthesis of cyanoform, which the author prepared by heating together chloroform, potassium cyanide, and alcohol at 100° under pressure. Fairley's experiment appears to have been successfully repeated seven years later by Pfankuch (*J. pr. Chem.*, 1871, [ii], **4**, 38). Further contributions to the *Journal* were: "Analysis of Water from the 'Old Crescent Well,' Harrogate" (1875), "A New Oxide and Acid of Uranium" (1876), and "Study of Hydrogen Dioxide and of Certain Peroxides, including Experiments to determine the Heat of Formation of the Oxygen Molecule" (1877).

To the *Transactions* of the British Association he contributed papers on: "Organic Cyanides" (1865 and 1868), "The Use of Platinum Black in the Preparation of Ethylene Diamine" (1868), "Preparation of Olefiant Gas" (1868), "Preparation of Cyanogen and Hydriodate of Cyanogen" (1870), "Use of Platinised Charcoal in the Hydrogenation of Cyanogen" (1870), and "The Distillation of Sulphuric Acid" (1870).

To the *Journal of the Society of Chemical Industry* he contributed: "Note on the Detection of Certain Adulterations in Dyestuffs" (1886), "On the Estimation of Sulphur and Impurities in Coal Gas" (1886), "On the Various Forms of Filter-pumps or Water-jet Aspirators" (1887), "On the Impurities of Coal Gas" (1892), "Note on the Durabilities of Platinum–Iridium Vessels in Laboratory Use" (1896), and "The Manufacture of Ammonium Nitrate by Double Decomposition" (1897).

Published in the *Analyst* were the following papers: "Note on the Estimation of Chlorine in Water" (1893), "Arsenic Estimation relating to Malt-kilns" (1901), "Notes on the History of Distilled Spirits, especially Whisky and Brandy" (1905), and "On the Phosphates in Certain Vinegars, and the Materials used in their Manufacture" (1909). The paper on the distillation of spirits was one recording the results of interesting antiquarian research into the early antecedents of an industry which at about that time was the subject of much legal contention and of a monumental official investigation.

A paper on "The Water Supplies of Yorkshire" was contributed in 1898 to the *Journal of the Federated Institute of Brewing*.

Various other notes from Fairley's pen appeared at various times in the *Chemical News* and *Pharmaceutical Journal*, and he was one of the contributors on subjects connected with laboratory apparatus to Thorpe's "Dictionary of Applied Chemistry."

As gas examiner to the City of Leeds, he became interested in questions relating to the manufacture and purification of coal-gas, to which he devoted a good deal of practical attention.

His health and activity were well maintained until 1911, when he had an illness from the effects of which he never completely recovered.

B. DYER.

WALTER WILLIAM FISHER.

BORN 1842; DIED FEBRUARY 7TH, 1920.

WALTER WILLIAM FISHER, Aldrichian Demonstrator in the University, Oxford, who died on February 7th, in his seventy-eighth year, had been a member of the Society since 1872.

He was educated at Worcester and Merton Colleges, Oxford, where he took a first class in chemistry in the School of Natural Science in 1870, and in the following year also succeeded in taking a class in "Greats," and he was shortly afterwards elected a Fellow of Corpus Christi College. He became chemical assistant to the late Vernon Harcourt, and in January, 1872, was appointed by the late Sir Benjamin Brodie as University Aldrichian Demonstrator in Chemistry, a post which he continued to hold until his death. For six years, from 1874, he was also lecturer in chemistry at Balliol, and he served from time to time as a public examiner for the University. He also acted as examiner to the Institute of Chemistry from 1903 to 1907, and served for several periods as a Member of Council of that body.

To the *Transactions* of the Chemical Society Fisher contributed papers on "Manganese Tetrachloride" (1878) and "Lead Tetrachloride" (1878), and to the *Proceedings* in 1892 a paper on "Anhydrous Oxalic Acid." He was a keen field botanist and a good geologist, and took a large interest in the subject of the composition of well waters from various water-bearing strata, several papers from him on this subject having appeared from time to time in the *Analyst*, notably one on "Alkaline Waters from the Chalk" (*Analyst*, 1901) and one on "Alkaline Waters from the Lower Greensand" (*Analyst*, 1902).

He had an extensive professional practice as a water analyst and as Public Analyst under the Sale of Food and Drugs Act, having been for nearly forty years Public Analyst for the counties of Oxford, Berks, and Bucks, and also for the City of Oxford and for boroughs within the area of the aforesaid counties.

He was a man of fine physique, and in his early days was distinguished as a college oarsman, as well as on the running path; whilst during eleven years' volunteer service in the 1st Surrey Rifles in his early days he won numerous shooting prizes.

His life was lived mainly within his university, and he was less well known in the general chemical circle than were many of his contemporaries. But by those who came within the range of his genial personal friendship he was much loved and will be sadly missed.

B. DYER.

ANTOINE PAUL NICOLAS FRANCHIMONT.

BORN MAY 10TH, 1844; DIED JULY 2ND, 1919.

ANTOINE PAUL NICOLAS FRANCHIMONT, Professor of Organic Chemistry in the University of Leiden and an Honorary Foreign Member of the Chemical Society, was born at Leiden on May 10th, 1844. He came of an old French refugee family, who after 1687 migrated to Holland from the neighbourhood of Spa, where the ruins of their ancestral castle, "The Franchimont," still exist. His father was the minister of the French Church at Leiden, and had married the daughter of a Dutch pastor. The young Antoine was a weak, fragile child, too frail to be sent to school in his early years, and hence owed his primary education mainly to his father. In his later boyhood he attended the Lyceum, the principal public school of Leiden. It was intended that he should become an apothecary, and he gained his diploma in 1864, but after a few years' service he relinquished that occupation and entered the University of Leiden as a student of chemistry, obtaining his doctorate in 1871 for a thesis on "Contributions to the Knowledge of the Origin and Chemical Constitution of the so-called Turpentine Resins." His first teacher was Van der Boon Mesch, a chemist of the old school, whose contributions to experimental chemistry were almost wholly concerned with mineralogical or geochemical subjects. Organic chemistry was scarcely studied at Leiden in those days.

Accordingly, Franchimont proceeded to Bonn, where his zeal and ability were quickly recognised by Kekulé, to whom he became private assistant. He remained at Bonn about eighteen months, and thence went to Paris to work under Wurtz. Here he gained the friendship of Friedel and Le Bel. In 1873 he returned to Holland, and was attached, as teacher of chemistry, to the school of agriculture at Wageningen, but in the following year was called to Leiden to fill the newly-created chair of organic chemistry, established on the retirement of Van der Boon Mesch, a position which he continued to occupy until his retirement on reaching the age-limit in May, 1914.

Franchimont's association with Kekulé may be said to have influenced his whole career. It had a no less marked effect on the status and development of organic chemistry in Holland. He entered on his professorship at a momentous epoch in the history of chemistry, and he was not insensible to the opportunity which the times had brought him. He came to be regarded as a missionary in the new movement which Kekulé initiated, and he made Leiden the most progressive school of modern chemistry in the Netherlands. His success may be judged from the number and variety of his published contributions to its chemical literature, and from the character of the men who were attracted by his teaching—among them may be named Lobry de Bruyn, van Romburgh, Holleman, Klobbie, van Erp, Backer, and others who have occupied teaching positions in Holland or who have associated themselves with its industrial development.

Franchimont was an excellent teacher and an admirable lecturer, enthusiastic and inspiring. His lectures were always carefully prepared according to a well-considered scheme, and he spared no effort to make them interesting and profitable. Advanced students could always learn something from his methods, from the originality of his views and the wide range of his knowledge; whilst beginners, although they might at times be perplexed by the rapidity of his utterance, and his quick-change blackboard practice, chalk in one hand and sponge in the other, could not fail to be impressed by his evident mastery of his subject.

It was, however, in the laboratory that his influence was mainly felt. He seemed to take a special interest in the work of each pupil, and regularly went his rounds twice a day. Like Kekulé, for whose methods he always expressed great admiration, he attached much importance to cleanliness and neatness of manipulation, qualities which characterised his own work. The Leiden laboratory, when he retired in 1914, showed few signs of wear, although some hundreds of students had passed through it since its opening in 1901.

His activities were, however, affected in the outset by various adverse circumstances, and it says much for his energy, perseverance, and patience that he should have been able to accomplish so much. During the greater part of his career at Leiden he was hampered by the conditions under which he had to work: the old laboratory was small and poorly furnished and lacked the structural fittings and appliances of modern methods of research. Holland at that period had relatively few openings for a career in chemistry, and the number of those who occupied themselves in the pursuit of that science as a profession was consequently small. Hence there was little public pressure on the Government to build and equip chemical laboratories of a type demanded by the times. As regards Leiden, the State seemed content for years to allow it to live on the traditions of Boerhaave. Franchimont must frequently have sighed for some of the arrangements he had learned to know and to appreciate in the spacious temple, which, under the inspiration and guidance of Hofmann, had been erected in the Poppelsdorfer Alleé in Bonn. But everything comes to him who waits. After many and long delays his hopes and wishes were gratified, and, thanks to his industry and zeal, Leiden now possesses an admirably arranged laboratory for the study of organic chemistry. In its planning and equipment Franchimont took the keenest interest, sparing no trouble to make himself acquainted with every detail that would contribute to its utility and convenience. The writer recalls the lively pleasure with which he inspected the buildings of the then recently erected Government laboratories in Clement's Inn Passage, and the quick appreciation with which he noted any contrivance that would facilitate the operations of analytical chemistry.

When the new Leiden laboratory was opened Franchimont had occupied his chair for twenty-seven years, and much of his intellectual vigour and creative power were spent. He used to lament that for him it had come too late, but to the last he continued to regard it with pride and affection. He could have desired no more appropriate monument by which to perpetuate the memory of his long and fruitful association with the famous old University.

On the twenty-fifth anniversary of his election to his professorship his friends presented him with his portrait, painted by the distinguished Dutch artist, Therese Schwartze, which is ultimately to pass into the possession of the University. On the occasion of the fortieth anniversary, a week before his seventieth birthday, a relief portrait in bronze by Toon Dupuis was offered to the new laboratory to be affixed to the wall of the entrance vestibule.

Franchimont, on his retirement, mainly occupied himself with his duties as one of the editors of the *Recueil des Travaux Chimiques des Pays-Bas et de la Belgique*, with which he had been connected since 1882, and in which his own contributions to science for the most part appeared.

Although towards the end of his days his physical strength was greatly impaired, and he suffered acutely at times from the effects of the painful malady to which he ultimately succumbed, his mind continued active and alert to the last, and he read and corrected proof-sheets to within a week of his death on July 2nd, 1919.

A man of simple tastes and habits, happy in his relations with his colleagues and pupils, and in his home life—he had married Miss Cornelia van Batenburg, a member of an old Gelderland family, in 1880—his interests were wholly centred in the duties and responsibilities of his office. He lived the serene, contemplative existence of the philosophic student, devoting his life to the elucidation of a special class of phenomena. The character of his studies was, of course, mainly determined by the requirements of his professorship, but his knowledge as a chemist was by no means limited to his own department. He was an omnivorous reader, and followed the development of every section with equal interest. He had a sound judgment, a strong logical faculty, and keen intuitive power—qualities which made him an admirable editor and a capable and judicious critic. He was blessed with a happy temperament and a genial manner, and had the saving grace of humour. Although absorbed in his work, and apt to resent interruptions to it by the routine calls of academic trivialities, he was in no sense a recluse, but when the occasion demanded took his full share in the management of university affairs.

Franchimont's first published paper on "Turpentine Resins" appeared in the *Archives Néerlandaises* for 1871, and was quickly followed by communications on heptylic acid and heptyl alcohol. With Kekulé he discovered triphenylamine, and he detected the formation of anthraquinone in the preparation of benzophenone. These, it is believed, were the only papers on aromatic chemistry with which he was directly concerned. During his stay in Bonn he also worked with Zincke on the aliphatic derivatives from Heracleum oil—a subject which had already engaged his attention before his visit to Germany. Indeed, he seemed almost exclusively attracted to the chemistry of aliphatic compounds, and practically the greater part of his memoirs, as well as those he published in collaboration with his pupils, deal with this class of substances. During the forty years of his activity at Leiden upwards of one hundred contributions to the periodical literature of chemistry emanated from his laboratory, apart from the many graduation theses which he may have inspired. Considerations of space prevent any detailed examination of this mass of work, but certain papers of special significance require notice. Among them is the memoir on the "Acetylisation of Glucose" (1879), leading to the isolation of the penta-acetate, which subsequently played so important a part in Emil Fischer's researches on the isomeric derivatives of glucose. Next is the paper on the "Acetylisation of Cellulose" (1879–1881), when he prepared three acetates, one of which was afterwards identified by Skraup and König, in 1901, as the octa-acetate of cellobiose. From these researches originated the methods of acetylation now in common use, thereby laying the foundations of an important technical industry.

Franchimont's name is, however, principally associated with the study of the nitroamino-compounds—a class of substances with which the Leiden laboratory is identified. In collaboration with van Romburgh he investigated the action of nitric acid on dimethylaniline, which resulted in the discovery of trinitrophenylmethylnitroamine—the "tetryl" of these later days. Franchimont also prepared dinitrodimethyloxamide and dimethylnitroamine.

With Klobbie (1888) he obtained methylnitroamine, an acid substance isomeric with Frankland's dinitromethylic acid, by the action of ammonia on methyl nitrourethane.

With his pupil, van Erp, he found (1894) that alkylation of the monoalkylnitroamines gives not only the dialkylnitroamines, but also isomeric forms, which may be regarded as oxygen esters—one of the first of the illustrations of isomerism to be studied by Hantzsch with his theory of pseudo-acids.

A complete list of Franchimont's papers, together with the titles of the various graduation theses which originated in his laboratory, has been compiled by his pupil, Professor Backer, and is published in the *Chemisch Weekblad*, 1914, No. 18.

Franchimont was also the author of several text-books on organic chemistry which had a considerable measure of popularity in their day, but have now been largely superseded by more modern works. Compilation of literature of this kind was not a congenial task to a mind of his originality.

Franchimont was an Officer of the Order of the Dutch Lion, and of the Legion of Honour, and a member of the Dutch Academy of Sciences of Amsterdam. He was elected an Honorary Foreign Member of the Chemical Society in January, 1898.

My acknowledgments and thanks are due to Miss J. J. P. Brants, a niece of the late Professor Franchimont, and also to Professor Backer, of the University of Groningen, for the information and assistance they have afforded me in the preparation of this notice.

T. E. THORPE.

HAROLD CECIL GREENWOOD.

BORN MAY 3RD, 1887; DIED NOVEMBER 4TH, 1919.

HAROLD CECIL GREENWOOD, O.B.E., D.Sc., F.I.C., was born at Edenfield, near Manchester, on May 3rd, 1887, and was educated at the Grammar School, Bury. He entered for his Science Course at Manchester University at an early age, and graduated as B.Sc. with first-class honours in chemistry in 1907. He obtained in succession the Mercer Scholarship, the Beyer Fellowship, and an 1851 Exhibition Scholarship. During this period the Electrochemical Department of the University was constituted under Dr. R. S. Hutton, and Greenwood became one of his most enthusiastic students. He carried out a series of important researches on the production of ferro-alloys, the reduction of refractory oxides, and on the boiling points of metals, first at atmospheric pressure, afterwards studying the effect of reduction of pressure on the boiling point. Later he employed some of the pressure furnaces designed by Dr. J. E. Petavel for further study under increased pressure. His researches in this field furnish the accepted data for most of the substances he studied. On obtaining the 1851 Scholarship, Greenwood proceeded to Karlsruhe, where he worked for a period with Professor Haber. Following up the earlier work of Haber and Le Rossignol, Greenwood's research on the synthetic production of ammonia by means of the uranium carbide catalyst, and his study of the details of this reaction under varying conditions of flow rate, temperature, pressure, etc., probably marked the stage at which it was first realised that a successful technical process might be founded on it. The Badische Company had already begun to take an interest in the developments at Karlsruhe and to help to finance the expenses of the research; therefore when, after six months' work, the time arrived for a report of progress to be furnished by Greenwood to the Commissioners of the 1851 Exhibition, he was obliged to go before some of the Badische directors to be catechised as to what use would be made in England of the report. Would it fall into the hands of Sir William Ramsay? The publication of this research, and of a number of others carried out by Haber's co-workers at Karlsruhe about the same period, was held over until after the outbreak of war, by which time the technical success of the synthetic ammonia process had been assured.

Greenwood returned to England in the year 1910, and worked for some time in the Heat Division of the National Physical

Laboratory on the specific heat of metals at high temperatures, elaborating the method formerly employed by Harker in his determination of the specific heat of iron. He obtained the D.Sc. from Manchester University in 1912, and became a Fellow of the Chemical Society in the same year. He was subsequently appointed Research Chemist to the firm of William Hutton and Sons, Ltd., of Sheffield, where he investigated problems cognate to the electroplating industry.

Early in 1916, when the submarine campaign had begun to cause anxiety as to the country's supplies of sodium nitrate from Chile, the Faraday Society appointed a small committee to prepare a memorandum on the question of nitrogen fixation for submission to the Ministry of Munitions. Of this committee Greenwood subsequently became a member. After a number of preliminary conferences, the Nitrogen Products Committee of the Ministry was constituted, and among its other activities it was decided to commence experimental work on certain problems relating to fixation. Although at that time it was not anticipated that there would be any shortage of supplies of ammonia, yet it was deemed desirable, in view of the suitability of the synthetic ammonia process for the needs of the country, that an experimental study of it should be made forthwith, so that the required information should be available if necessary. Greenwood at the time was serving as a technical officer in the R.N.V.R., but in view of his previous experience his services were requisitioned at the writer's suggestion, and he became the head of the Synthetic Ammonia Section of the Research Laboratory established by the Munitions Inventions Department. This was located in premises placed at the disposal of the Government in the new Ramsay building at University College, chiefly through the instrumentality of the Provost and Professor Donnan. In the early stages of the work there were many difficulties with which to contend, but in his section a considerable measure of success was quickly achieved by Greenwood and his collaborators. After a year's experimentation, it was decided by the committee to establish a technical plant on a moderate scale, since by means of this plant it was hoped that a study of the chemical engineering problems could follow on that already made of the pure chemistry of the reactions involved.

Early in 1918, however, the engineers of the Explosives Department decided that the progress made justified them in proceeding with a scheme for the erection of a large works for the manufacture of synthetic ammonium nitrate, and a site on the River Tees was ultimately chosen, and building operations were begun. At the time of the Armistice, however, the factory was far from complete, and since then arrangements have been made for its transfer from Government ownership to private enterprise. In the following autumn Greenwood was taken over into the service of the Syndicate which was to assume control of the new development. He had been engaged only a few weeks on his new duties as their chief research chemist when he was suddenly taken ill. After a few days' illness he died from blood poisoning at Winnington Hall, Northwich, on November 4th, 1919, at the early age of thirty-two years.

Dr. Greenwood married, in 1913, Miss M. G. Horsfall, who, herself a graduate in science, was able to render her husband valuable assistance in his work. He leaves no family.

Just before his death he had completed for press an important work on "Industrial Gases" for Dr. Samuel Rideal's series, which has since been published.

Although of a rather shy and retiring disposition, the reverse of dogmatic, and not excelling as an expositor, Greenwood possessed the true research instinct, and had a genial and attractive personality. He won the esteem of all who worked with him. His output of research was one of which many a much older man would have been proud; by his death, experimental applied chemistry suffers a severe loss.

J. A. HARKER.

CHARLES EDWARD GROVES.

BORN MARCH 4TH, 1841; DIED FEBRUARY 1ST, 1920.

THOUGH during the last twenty years of his life the figure of C. E. Groves was less familiar than formerly to the Fellows of the Chemical Society, no one was better known and esteemed during the long period in which he held office as Editor of the *Journal*.

Groves was born at Highgate on March 4th, 1841, but while still a young child his parents removed to Kennington, and in that neighbourhood he remained until the end of his life. He was educated at Brixton College School, and subsequently entered the Royal College of Chemistry under Hofmann, the first professor. In October, 1862, he became chief private assistant to Dr. John Stenhouse, F.R.S., who had a laboratory for research in Rodney Street, Pentonville. This was an almost unique establishment. Stenhouse had been for some years lecturer on chemistry at St. Bartholomew's Medical School, but about the year 1856 he had been disabled by a paralytic stroke, from which he partly, but never wholly, recovered. His interest in chemical investigation prompted him, notwithstanding his crippled condition, to resume his researches into the nature of the crystalline constituents of lichens and other vegetable materials, and he found premises to suit his purpose in an old house to which was attached the outbuildings of an abandoned artificial flower factory. Here early in 1860 he established himself with E. J. Mills (afterwards professor in Glasgow) as his scientific assistant. Mills was succeeded in Stenhouse's laboratory by C. E. Groves, together with W. A. Tilden as junior. When the latter left, for a post at the Pharmaceutical Society, he was succeeded by R. Meldola (afterwards President of the Chemical Society) and T. Bolas. The little laboratory was always busy, and Groves remained in command until the death of Stenhouse in 1880. During the later years of this association the papers resulting from the work done were published in the joint names of Stenhouse and Groves. Both were men of earnest religious convictions, and "the Doctor," who could only sit and watch operations, was much disposed to talk during work, which was not unfrequently interrupted by controversy on subjects connected with their respective religious views, Stenhouse being a Presbyterian and great admirer of the famous preacher Charles Spurgeon, while Groves, as a high churchman, stood up for the episcopal establishment.

In 1865 Stenhouse succeeded Hofmann as one of the external Assayers to the Royal Mint, and held the office until it was abolished by Mr. Robert Lowe in 1870. Stenhouse, of course, was incapable of any sort of manipulation, and the work was done by Groves with the aid of a technical assistant.

In 1877, when the Institute of Chemistry was founded, Groves took an active part in the movement and was appointed Secretary; from 1887 to 1892 he was also Registrar. He was connected with the *Journal of the Chemical Society* from 1878, first as Sub-Editor and in 1884 as Editor, in succession to Mr. Henry Watts. This office he resigned in 1899. Soon after Dr. Stenhouse's death in 1880 Groves was appointed Lecturer on Chemistry and Dental Metallurgy in the Medical School at Guy's Hospital, retiring in 1901. For more than twenty years he was also consulting chemist to the Thames Conservancy Board, and gave up this work in 1909. For only a few years later he was able to sustain his interest in scientific work, but failing health compelled him to retire from active life or study, and he died at his house on Kennington Green, February 1st, 1920.

Groves became a Fellow of the Royal Society in 1883.

Groves was a good manipulator and skilful analyst. His familiarity with several languages and his extensive knowledge of physical and chemical science were valuable qualifications for the post of Editor, though he may perhaps be remembered for certain peculiarities of phraseology in English on which he insisted and which sometimes brought him into conflict with less scrupulous contributors to the pages of the *Journal*.

In early life he was a great walker, and though in frame very spare he was both muscular and active. Though not addicted to games, he found his recreation in mountaineering, and for many years his summer vacations were spent in Switzerland. He will be remembered by many among the older members of the Alpine Club.

W. A. T.

JOHN HOLMES.

BORN JANUARY 15TH, 1871; DIED OCTOBER 1ST, 1919.

JOHN HOLMES, who died on October 1st, 1919, after a short illness, at the age of forty-eight, received his early education at Giggleswick School. Entering the Royal College of Science as a revenue student in 1894, he passed with much credit through the prescribed course of studies, and was afterwards employed in the Government Laboratory—first as a chemical assistant, and subsequently as a member of the permanent analytical staff. During the early part of this period he carried out several investigations in collaboration with Sir Edward Thorpe, including one on the occurrence of paraffins in the leaf of tobacco (T., 1901, **79**, 982), and one on the constitution of the fat present in the yolk of eggs. Later, he worked out the now well-known "Thorpe and Holmes" method for the quantitative estimation of methyl alcohol in mixture with ethyl alcohol by oxidation of the former to carbon dioxide. Much of his work at this period was concerned with questions relating to alcohol, and in the laborious task of compiling a series of revised alcoholometric tables, published officially in 1912, Holmes had a prominent part. A process for the accurate determination of ethyl alcohol in commercial fusel oil is also due to him.

Problems in physical chemistry, especially those concerned with the theory of solutions and the intermiscibility of liquids, had always a great interest for Holmes. A series of papers by him on these subjects has appeared in the Society's *Transactions* (1907, 1908, 1909, 1913, 1915, and 1918). Although lucid exposition was not the author's *forte*, the experimental results disclosed in some of these papers are quite noteworthy; and it might, perhaps, well repay some physical chemist, who is not too much trammelled by accepted theories, to look carefully into these researches, even if it should turn out that he is not in agreement with the author's theoretical explanations of the results obtained.

Holmes was a man of equable temper and kindly disposition. In his younger days he was an excellent all-round man at sports, and could point with pardonable pride to a goodly collection of trophies carried off in athletic contests. Scientifically, his bent was distinctly that of the investigator. He was never so happy as when, the day's work done, he could devote his spare hours to following up in the laboratory some new clue revealed by previous experiments, or some fresh line of thought which his reading had suggested. In his modest way he was veritably of those "who seek knowledge simply because they crave for it"; and to a Fellow of the Chemical Society no better tribute than this can be paid.

C. SIMMONDS.

SIR BOVERTON REDWOOD, BART.

BORN APRIL 26TH, 1846; DIED JUNE 4TH, 1919.

SIR BOVERTON REDWOOD, who died on June 4th, 1919, after a brief illness, was the eldest son of Dr. Theophilus Redwood, of Boverton, Glamorganshire, who was for forty years Professor of Pharmacy in the Pharmaceutical Society at Bloomsbury Square. It was quite natural, therefore, that Boverton Redwood chose the study of chemistry as a profession.

Boverton Redwood was born near to the scene of his father's activities at 19 Montague Street, Russell Square, on April 26th, 1846. He studied at University College School, where he showed his inclination for the pursuit of science. On leaving University College he entered his father's laboratory, where he received his early instructions in practical chemistry. In 1866, at the age of twenty, he was elected a Fellow of the Chemical Society and twice served on the Council.

In 1869 he was appointed Secretary and Chemist to the Petroleum Association, and this caused him to turn his attention to the study of mineral oils, a subject at that time quite in its infancy, the chemical side of which had scarcely been touched. In fact, the American oil had only recently been struck, and at that time the chief source of mineral oil was the distillation of shale by Young's process. In a short time he became the leading expert on the subject of mineral oils, and kept pace with its rapid developments until the day of his death.

His earliest recorded work in connexion with mineral oils had to deal with the testing of the flash point. In 1872 he gave evidence before a select committee of the House of Lords on the subject, and in 1877, in conjunction with Sir Frederick Abel, he carried out researches which resulted in standardising the methods of testing for flash points and the establishment of the Abel apparatus as the legal basis for testing flash points of low flash oils. In the same year he visited the United States to carry out further investigations on the subject.

In 1881 he studied the effect of barometric pressure on the gaseous constituents dissolved in oils. These tests were carried out at various heights in the Alps and in a pressure chamber at Berlin. Following up this line of investigation he visited India and carried out further tests as to the influence of climate. As a result of this work he—jointly with Sir Frederick Abel and Dr. Kellner—advised the Government of India in amending the Petroleum Act.

He travelled considerably and examined petroleum wells in all parts of the world, and by this means obtained a first-hand knowledge of the oil industry and followed its developments.

In 1886 he turned his attention to the viscosity of lubricating oils, and designed the Redwood viscosimeter, which has become the standard instrument in the British oil industry. Recently he devised a modified form for use with heavy fuel oils, and this is now known as the Admiralty standard.

In 1892 Redwood visited Egypt in reference to the transport of oil in bulk through the Suez Canal. In 1894 the Institution of Civil Engineers awarded him the Telford premium for his work in reference to the accumulation of petroleum vapour in tanks and difficultly accessible parts of ships carrying petroleum. He designed a special apparatus for testing for the presence of such vapours. About the same time, in conjunction with his brother, Robert Redwood, and Mr. H. Barringer, he invented the Redwood water-finder, an instrument for determining the amount of water which has collected beneath the oil in tanks.

Redwood was one of the first to attempt the cracking of oils for the production of lighter oils from heavy residues. In this connexion he and Sir James Dewar patented a process in 1889 for distilling and condensing oils under high pressure. This resulted in the heavier grades of oil yielding lighter oils and spirit. At this time, however, there was not much call for light oils, and the process was not worked on a large scale.

As might be expected from his interest in oils for fuel and other purposes, he early took an interest in motor-cars, and more than twenty years ago the first four-cylinder Daimler car was constructed to his order and was exhibited to King Edward VII. (then Prince of Wales).

Besides his interest in his life-work, Redwood took very active interest in international exhibitions, and acted as chairman to the chemical section of the Royal Commissions for the Exhibitions of Brussels and Turin. He also served on the Committees of the Rome and St. Louis Exhibitions. He was a man of great activity and extreme conscientiousness, and beside looking after his business and advising his clients, served on committees of scientific societies, from which, when a member, he was rarely absent. It was, in fact, difficult to realise how he concentrated so much work within the working day.

During the war he served as Assistant Controller in the Trench Warfare Research. He was also Director of the Petroleum Research Department, and in this connexion supervised a large number of tests on the carbonisation of coals and other bituminous materials with the object of obtaining oils, so that this country might be self-contained and not require to procure the oils from abroad. Later he was appointed Director of Technical Investigations to the Petroleum Executive.

In 1913, at his instigation, the Institute of Petroleum Technologists was founded, and he was elected its first President.

Redwood was knighted in 1905 and received a baronetcy in 1911. The title passes to his grandson, Thomas Boverton Redwood.

Sir Boverton was adviser on petroleum to the Admiralty and Home Office, the India Office and the Colonial Office. He also acted as consulting adviser to the Corporation of London under the Petroleum Acts, and adviser to the Thames Conservancy. His treatise on petroleum, first published in 1896, is the standard English work on the subject. He wrote another work on petroleum in 1901 in conjunction with Captain J. H. Thomson, and published a number of papers on the subject before different industrial scientific societies.

As a man, Redwood had a most charming manner with an old-world courtesy. He was always willing to help the younger generation, and would take an infinite amount of trouble to help young men commencing their career. He was a staunch friend, and never spoke unkindly even of those with whom he did not agree. He had a habit when he met his friends of putting his hands on their shoulders and saying, "Well, friend, and how are you to-day?" Those who knew Sir Boverton Redwood felt a very personal loss of a kind friend and counsellor. He died in harness, and only a few days before his death was enthusiastically examining the first oil struck in this country.

F. MOLLWO PERKIN.

JOHN CHARLES UMNEY.

BORN MARCH 13TH, 1868; DIED OCTOBER 9TH, 1919.

J. C. UMNEY was a pharmacist of a type that is none too common. He declared that he loved pharmacy, and was proud of being a pharmacist.

His father, Charles Umney, was a Fellow of the Chemical Society from 1865 until the time of his death in 1916, and an original Fellow of the Institute of Chemistry. He did pioneer work in bringing trained technical knowledge into the wholesale drug trade, and became one of the most prominent wholesale druggists of his day.

John Umney may thus be said to have been born into the drug trade. He was educated at Dulwich College, where he gained a scholarship, and at the Pharmaceutical Society's School of Pharmacy, where he was a medallist. After passing his examinations he worked in the Pharmaceutical Society's research laboratory under Professor Dunstan, with whom he was joint author of a paper on aconitine, which was published in the *Transactions* in 1892. He was elected a Fellow of the Society in the following year.

His first publication, made in 1889, was a note on the analytical characters of oil of anise. Thus did he early identify himself with essential oils, in connexion with which he is so well remembered. The literature of many essential oils has been enriched through his work, which consisted largely in the examination of new oils, of known oils from new sources, and occasionally of exposures of new and scientific methods of adulteration. Among others, he worked on the oils of anise, bergamot, cajuput, cloves, cinnamon, citronella, dill, eucalyptus, fennel, juniper, lavender, lemon, lemongrass, neroli, peppermint, pine, and rose, and his papers on the essential oils alone number upwards of fifty.

In 1912 the Fairchild Memorial Lectures delivered before the Pharmaceutical Society took the form of a short course of lectures on the terpenes and essential oils. The first of these, on "The History and Chemical Relations of the Terpenes," was delivered by Sir William Tilden; the second, on "The Synthesis of the Terpenes," by Professor W. H. Perkin. J. C. Umney was selected to give the third and fourth lectures, the title of which was "Essential Oils, their Constitution and Commerce."

Umney was a member of the Committee of Reference in Pharmacy concerned in the preparation of the 1914 edition of the British Pharmacopœia, and was part-author of the paper on "The Essential Oils of the British Pharmacopœia," which was read before the Pharmaceutical Society and formed the basis of the monographs now official in that book. He also contributed the article on "Essential Oils" in Thorpe's Dictionary of Applied Chemistry.

Umney published papers on fixed oils also, particularly almond, olive, cod liver, and fish liver oils, and many dealing with crude vegetable drugs, making valuable suggestions as to standards for these and other medicines.

His original contributions to pharmaceutical literature during a quarter of a century cover a wide range of subjects. In addition to scientific papers, and articles of a technical and commercial nature, he made valuable communications on subjects usually comprehended in the term "Pharmaceutical Politics." His publications were made chiefly in the *Pharmaceutical Journal*, and at the annual meetings of the British Pharmaceutical Conference. Latterly his communications appeared in *The Perfumery and Essential Oil Record*, which journal he himself founded and edited with conspicuous success.

At an unusually early age, in fact while still a student, John Umney began to exhibit signs of remarkable business capacity, and perhaps the most striking characteristic in his outstanding personality was his great executive ability.

Upon leaving the Pharmaceutical Society's research laboratory he entered his father's firm of wholesale druggists, and remained a director up to the time of his death. Sacrificing to some extent original work on the scientific side for the organising and more purely commercial aspects of pharmacy, John Umney rapidly reached a prominent position in the drug trade, and while still comparatively young was possibly the best known man in the world of pharmacy.

During the course of his business career he filled many offices, and in particular was President of the British Pharmaceutical Conference (1912–1913), President of the Drug Club (1908–1911), and chairman of the Chemical Trade Section of the London Chamber of Commerce (1902–1916).

Prolific though he was as a contributor on pharmaceutical subjects, prominent and successful as he was as a business man, Umney was seen to greatest advantage in his public work, where his alert brain found full play. Possessed of keen and sound judgment, with a quick perception of the main issue to the exclusion of minor details, he was an invaluable man on the countless committees on which he was called to serve. A facile speaker, possessed of rare tact and great persuasive powers, Umney was at his best when acting as chairman of a meeting, a position he was called upon to fill on innumerable occasions.

Readily receptive of new ideas, innocent of obstinacy, possessing to a remarkable degree the gift of seeing the other man's point of view, Umney was an ideal colleague to work with, whether as joint-author, as fellow-councillor, or in commerce. As a business rival he was broadminded and generous. Indeed, those who knew him really well, and they have been many, will remember him most for his personal charm. Many since his death have testified to the valuable advice and kindly help which they have ungrudgingly received from him in cases of difficulty. Few pharmacists can have made so many strong personal friendships as John Umney.

The strain of his too-busy life weakened his constitution, and some five years ago ill-health, promoted by overwork, assailed him so seriously that he who had never spared himself willingly was now obliged to yield.

Notwithstanding his partial retirement from regular work, and despite the efforts of medical science, his health steadily grew worse, so that with accumulated infirmities he died at the comparatively early age of fifty-one. Thus did Pharmacy lose a leader, and many pharmacists a friend.

C. A. H.