OBITUARY NOTICES.

FREDERICK WILLIAM DOOTSON.

BORN AUGUST 10TH, 1863; DIED DECEMBER 12TH, 1929.

BY the untimely death of F. W. Dootson at the comparatively early age of 66 years, the University of Cambridge lost an able and devoted teacher and his friends in the Chemical Laboratory a congenial and gifted colleague.

There is little of general interest to record about Dootson's earlier years, but his connexion with Cambridge dates from 1891, when he entered Fitzwilliam Hall as an undergraduate. Shortly after graduating in the Natural Sciences Tripos, he attached himself to Trinity Hall, and for many years devoted himself to the interests of the students as a private tutor. From the time of taking his first degree up to the date of his death he was identified with the University Chemical Laboratory, where his success as a teacher, first as Demonstrator and later as University lecturer, will long be gratefully remembered.

Shortly after graduating, Dootson became interested in the chemistry of citrazinic acid, a subject on which his teacher, the late W. J. Sell, had published several memoirs. A paper published by Sell and Dootson on the action of phosphorus pentachloride on citrazinic acid in 1897 led to a systematic study of the chlorine derivatives of pyridine. The results of these investigations were published at frequent intervals in the *Journal* between 1898 and 1903. Dootson also published a paper on the " Halogen Derivatives of Acetonedicarboxylic Acid " (J., 1899, **75**, 169), and in another paper, entitled " Condensation of Methyl Acetonedicarboxylate. Constitution of Orcinoltricarboxylic Esters " (J., 1900, **77**, 1196), he demonstrated a very simple method for transforming an aliphatic into a benzenoid compound.

After 1903, Dootson's administrative duties in the laboratory increased considerably and he was of necessity drawn away from research. During the period of the War, however, he was actively occupied with experimental preparative work on various substances of national importance. His last memoir, entitled " A Note on Thermal Diffusion " (*Phil. Mag.*, 1917, **33**, 248), was published jointly with Dr. S. Chapman.

To past and present generations of Cambridge students, however, the most enduring memory of Dootson will be that of an attractive and successful teacher of the more elementary branches of chemistry. His admirable capacity for organisation made him a valuable help to his Professor and a very kindly friend to other members of the Departmental Staff. Dootson was a man of many interests: not only was he essentially a "well-read man," but he developed his appreciation of art in a more practical way as a very successful amateur oil painter.

He died, as he would have wished, in harness, after a very short illness. Among the many tributes to his memory, the writer ventures to quote from a letter written by an eminent Member of the Faculty of Medicine to Mrs. Dootson. ". . . I should like to add my appreciation of Dr. Dootson's work as a teacher. He was a friend to every student, and every student valued his kindly and unsparing help."

A. J. BERRY.

HENRY JOHN HORSTMAN FENTON.

BORN 1854; DIED JANUARY 13TH, 1929.

HENRY JOHN HORSTMAN FENTON was born at Ealing in 1854. He received his earlier education at Magdalen College School, Oxford, and afterwards went to King's College, London, where he studied chemistry under Bloxam. During the time that Fenton was at King's College the Clothworkers' Company instituted an exhibition in physical science tenable for three years by a non-collegiate student at Cambridge. Fenton applied successfully for this exhibition and, in accordance with its conditions, entered the University of Cambridge in the Lent Term, 1875. In his first year at Cambridge he gained an entrance scholarship at Christ's College, where he was admitted in May 1876. He was then 22 and thus older than the majority of undergraduates. His chemical knowledge and experience were also greatly in advance of those of men of the same university standing, and while still an undergraduate he was made an assistant demonstrator by Professor Liveing. He had a very independent spirit, and it was therefore perhaps not unnatural that he chafed at the discipline then imposed on members of the University *in statu pupillari* and not infrequently came into conflict with University and College authorities. In fact to the end he cherished a certain antagonistic attitude towards university authority. He took the Natural Sciences Tripos in 1877—it was at that time not divided into two parts—and was placed in the First Class along with, amongst others, Adam Sedgwick, the zoologist, F. O. Bowen, afterwards Professor of Botany at Glasgow, and Alex. Hill, sometime Master of Downing.

On the resignation of the then University Demonstrator of Chemistry, John Wale Hicks, of Sidney Sussex, afterwards Bishop of Bloemfontein, W. J. Sell was appointed to succeed him and an " Additional Demonstratorship of Chemistry " was instituted by the University and the post was assigned to Fenton.

The University Department of Chemistry was then accommodated in a building since removed, which stood on the southern part of the east side of the Old Botanic Garden site and afterwards served as part of the Pathological Laboratory.

Several of the Colleges had their own chemical laboratories and these were run in competition with the University laboratory. This competition continued for many years after the erection in 1887 of the new University Chemical Laboratory facing Pembroke Street, though in an ever-lessening degree as the college laboratories one by one were given up. The greater part of the teaching in the University Laboratory was carried on by Sell and Fenton and in spite of their different temperaments the two men worked together in harmony until their association was terminated by the death of Sell in 1915.

Fenton's lectures were for many years an outstanding feature in the instruction given in the University Laboratory. He took immense pains in their preparation and although in lecturing he affected an air of indifference and a somewhat indolent manner, actually he delivered them with very great care, and he was extraordinarily successful in stimulating the interest of the abler men. He scrupulously avoided dogmatism. He endeavoured, so far as possible, to present each subject as a debatable question on which there were diverse views to be discussed, to balance the evidence for and against every inference, and to induce his hearers to use their own judgment and draw their own conclusions. The value of his lectures was greatly enhanced by the informal discussions which he encouraged : at the close of every lecture a number of eager young men would come down to the lecture table and engage with him in discussion, often prolonged, of the subjects in which he had aroused their interest. Those who brought their difficulties to him found him unexpectedly sympathetic, and he would deal exceedingly gently with one who asked a thoughtless or an ill-considered question.

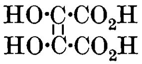
The course of experimental work in general and physical chemistry which he devised to illustrate his lectures was very carefully thought out, and during the 'eighties, and even later, the type of laboratory work being done by his class was probably unique. Although his chief interest always seemed to be in general and physical chemistry, the greater part of his original work was carried out in organic chemistry. His earlier work consisted of a series of investigations on the action of hypochlorites on urea and related compounds. A pupil of his (Mr. Street), wishing to estimate urea, happened to use, instead of sodium hypobromite, a strongly alkaline solution of sodium hypochlorite and found that only half the expected quantity of nitrogen was evolved. Fenton followed up this observation and discovered that the missing half of the nitrogen was present in the solution as sodium cyanate. He gave an explanation of the phenomenon a few years later. At the same meeting of the Chemical Society (June 20th, 1895) at which Walker and Hambly communicated their well-known experiments on the transformation of ammonium cyanate into urea Fenton read a paper giving an account of experiments he had been making on the same subject, using the action of sodium hypobromite to measure the rate of change. Finding that the transformation of the ammonium cyanate was never complete, he inferred that ammonium cyanate and urea were in tautomeric equilibrium and concluded that, whilst the more reactive hypobromite attacked both the urea and the ammonium cyanate (liberating all the nitrogen from the former and that present as ammonium from the latter), the hypochlorite attacked the ammonium cyanate only and thereby disturbed the equilibrium of the system so that the whole of the urea was finally converted into nitrogen and sodium cyanate. In other papers he showed that hypochlorites and hypobromites liberated different amounts of nitrogen from several nitrogenous compounds and in this manner he proved that ammonium carbonate in presence of water was in equilibrium with a small proportion of ammonium carbamate :

$$NH_4^{\cdot} + CO_3'' \rightleftharpoons NH_2{\cdot}CO_2' + H_2O.$$

What is probably to be regarded as his most important work is that connected with the discovery and investigation of dihydroxymaleic acid. It extended over many years, for the initial observation from which it grew was made during his first year as an undergraduate at Cambridge. The story current in the laboratory in later years was that a fellow student, amusing himself by mixing reagents at random, chanced to obtain a violet coloration, which he showed to Fenton. Fenton was keenly interested in the observation, and he found out the essential reagents which were concerned in the production of the colour, namely, tartaric acid, a ferrous salt, hydrogen peroxide, and excess of caustic alkali. He reported the discovery in a letter to the *Chemical News*, entitled " On a New Reaction of Tartaric Acid " and dated Christ's College, Cambridge, April 25th, 1876. He was at first disposed to regard the colour as being due to the production of a ferrate, but a few years later (in

1881) he published a second letter in the *Chemical News* in which he showed that the colour arose from an iron derivative of an oxidation product of tartaric acid, since the colourless solution obtained after removal of the iron gave the colour again on the addition of a ferrous or ferric salt.

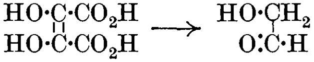
After several years he took up the problem again, and in 1894 he discovered how the new oxidation product could be isolated—it could be salted out from the reaction mixture by the addition of fuming sulphuric acid—and in a series of papers extending over the years 1894 to 1902 he described its reactions and relationships. It had the formula $C_4H_4O_6$; its formation from tartaric acid thus involved only the loss of two atomic proportions of hydrogen. It was a dibasic dihydroxy-acid; it showed no ketonic reactions; it could be reduced to racemic acid and oxidised to dihydroxytartaric acid. It was therefore either dihydroxyfumaric acid or dihydroxymaleic acid. It readily gave a diacetyl cyclic anhydride with acetyl chloride and was transformed into an isomeric acid by hydrobromic acid. Fenton therefore regarded it as dihydroxymaleic acid :



$$\begin{array}{c}\mathrm{HO{\cdot}C{\cdot}CO_2H}\\ \|\\ \mathrm{HO{\cdot}C{\cdot}CO_2H}\end{array}$$

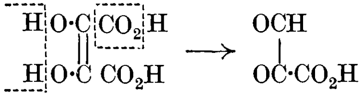
Its production from *d*-tartaric acid thus involves the *trans*-elimination of the two hydrogen atoms lost, and its reduction to racemic acid the *trans*-addition of hydrogen.

The most interesting reaction of the new acid was perhaps that brought about by heating with water. Two molecules of carbon dioxide were eliminated and glycollaldehyde was formed :



$$\begin{array}{c}\mathrm{HO{\cdot}C{\cdot}CO_2H}\\ \|\\ \mathrm{HO{\cdot}C{\cdot}CO_2H}\end{array} \longrightarrow \begin{array}{c}\mathrm{HO{\cdot}CH_2}\\ |\\ \mathrm{O{:}C{\cdot}H}\end{array}$$

On re-examining this reaction with H. Jackson, he obtained the resulting glycollaldehyde in a bimolecular crystalline form. It had a sweet taste (it could be regarded as the simplest sugar) and Fenton showed subsequently that it could be degraded by Wohl's method to formaldehyde. With Ryffel, he showed that dihydroxymaleic acid could be oxidised to mesoxalic semialdehyde, a compound of considerable interest on account of its close relationship to the hypothetical trihydroxyacrylic acid of which uric acid is the diureide.



$$\begin{array}{c}\mathrm{H{\vdots}O{\cdot}C{\vdots}\boxed{CO_2}{\vdots}H}\\ \|\\ \mathrm{H{\vdots}O{\cdot}C\;CO_2H}\end{array} \longrightarrow \begin{array}{c}\mathrm{OCH}\\ |\\ \mathrm{OC{\cdot}CO_2H}\end{array}$$

Nevertheless attempts to synthesise uric acid by condensing this compound with urea yielded only glycouril and carbon dioxide.

Further investigations showed that the new reagent—hydrogen peroxide in conjunction with ferrous salts—which acted on tartaric acid in so characteristic a manner, constituted a specific and valuable oxidant for certain classes of compounds. With H. Jackson, Fenton showed that di- or poly-hydroxy-alcohols with vicinal hydroxy-groups were smoothly and rapidly oxidised to hydroxy-aldehydes; for instance, glycol gave glycollaldehyde, glycerol glyceraldehyde, erythritol erythrose, and mannitol mannose. Monohydric alcohols, however, were not attacked. With H. O. Jones, he examined the effect of the new reagent on acids. α-Hydroxy-acids were oxidised rapidly and with evident heat-evolution to the corresponding keto-acids; acids of other classes were unaffected. Thus glycollic acid was shown to be oxidised to glyoxylic acid, lactic acid to pyruvic acid, tartronic acid to mesoxalic acid, and glyceric acid to hydroxypyruvic acid, whilst from malic acid there was formed the previously unknown free oxalacetic acid. Fenton and Jones examined the reactions of this acid in some detail and among other observations found that its phenylhydrazone, heated with water, decomposed in two ways, either losing carbon dioxide to give pyruvic acid phenylhydrazone, or undergoing dehydration to a pyrazolone derivative. The relative proportion of these products depended on the hydrogen-ion concentration of the solution, and on this fact an approximate method of comparing the strengths of acids could be based.

The observation that dihydroxymaleic acid was converted into its diethyl ester by the action of an ethereal solution of hydrogen bromide led him to examine the action of this mixture on compounds of other classes. With Miss M. M. Gostling, he found that various carbohydrates, in particular fructose, gave a purple colour when dissolved in ether and treated with hydrogen bromide, and this proved to be due to an oxonium salt of a yellow crystalline compound which could be thus obtained in considerable quantity and was shown to be ω-bromomethylfurfuraldehyde.

Among other observations of interest which he made may be mentioned the reduction of carbonic acid by magnesium to formaldehyde and the formation of a crystalline explosive compound of formaldehyde and hydrogen peroxide of the composition $C_2H_6O_4$ and the probable constitution $HO{\cdot}CH_2{\cdot}O{\cdot}O{\cdot}CH_2{\cdot}OH$.

Fenton was gifted with keen powers of observation and acuteness of interpretation and the whole of his experimental work is marked by its elegance.

Of his books, those best known are his "Notes on Qualitative Analysis," which was based originally on a small book published by Liveing, but was greatly expanded in successive editions, and his

"Outlines of Chemistry." He was elected into the Royal Society in 1899, and served on the Council of that body from 1913 until 1916. He was made an honorary fellow of his College in 1911.

He was naturally a shy man and was exceedingly sensitive to chaff or criticism; he endeavoured to conceal his shyness by assuming a certain *hauteur* which tended to repel some of those who would have sought his friendship. He had a very strong sense of fairness, but his pertinacity in defending views in which he was in a minority of one sometimes made him a difficult member of University bodies. He married in 1892, Edith, daughter of George Ferguson of Richmond. He left no children. He gave up his lectureship in 1924 and went to live at Hove, but the last years of his life were greatly clouded by illness. He died in a nursing home in London on January 13, 1929, at the age of 74.

W. H. M.

HENRY WILSON HAKE.

BORN DECEMBER 17TH, 1851; DIED JANUARY 18TH, 1930.

H. WILSON HAKE, who died in January aged 78, was the last surviving son of Dr. Thomas Gordon Hake, author of "Madeline," "Parables and Tales," and other poetic works.

He was educated privately up to 1872 and then went to the University of Giessen, where he took his Ph.D. (1875), and subsequently to Bonn for a short post-graduate course, studying under Professors Will and Kekulé. He formed a close friendship with the younger Will. After travelling for some time with his father in Italy, he returned to England and became an assistant to Thudichum, with whom the writer had for some two years previous been associated in researches chiefly concerning the chemistry of brain-matter.

For some years we were intimately acquainted and during that time we communicated a joint note to the Chemical Society on "Some New Reactions in Organic Chemistry," which was published with a supplemental note in the *Pharmaceutical Journal* of May 12th, 1877. We also contributed to the *Quarterly Journal of Science* (January, 1877) a joint critical essay on "Physiology and its Chemistry at Home and Abroad."

Hake became acquainted with my old friend Thomas Farries and upon leaving Thudichum he took charge of the laboratory of his firm (Messrs. Burgoyne, Burbidge, Cyriax, and Farries) for about one year: he was then appointed Lecturer on Chemistry at Queenswood College, Stockbridge, Hants (1879—1885). In 1885 he became Assistant Lecturer on Chemistry at

Westminster Hospital Medical School and assisted Dr. A. Dupré in his analytical and consulting practice; he also collaborated with him in the production of a "Manual of Inorganic Chemistry," published in 1886. In 1897 he succeeded Dupré as Lecturer on Chemistry and Toxicology and although the Chemistry Department was discontinued in about 1907 he continued to coach students for the D.P.H. degree and lectured on Toxicology up to June, 1929—some six months prior to his decease.

Hake was an examiner in Chemistry for the Civil Service Commission from 1894—about 1918, and for the Royal College of Physicians from 1898—1902: during the period 1901—about 1917 he was Lecturer on Toxicology at the London (Royal Free) Hospital School of Medicine for Women and from about 1922—1926 he served as Examiner on Public Health to the Conjoint Board of Physicians and Surgeons. He also served for many years as Gas Examiner to the Wandsworth Borough Council. In addition to his other activities he specialised in the analyses of mineral and ordinary waters and did a good deal of consulting work on poisons, drugs, medicines, etc. Among his publications may be mentioned a joint paper with Thudichum on "The Estimation of Hydrogen occluded by Copper, with Special Reference to Organic Analysis" (J., 1876); a joint paper with A. Dupré on "The Estimation of Organic Carbon in Air" (J., 1881); "A Preliminary Note on the Absorption of Moisture by Deliquescent Salts" (P., 1896); a note on "Further Experiments on the Absorption of Moisture by Deliquescent Substances" (P., 1897); an article entitled "Chemistry and Medicine" (*Westminster Hospital Reports*, Vol. 3, 1887); a further paper on the same subject (*ibid.*, Vol. 5); a joint paper with Dr. William Murrell on "Green, Blue, Magenta, and other coloured Urines" (*Edinburgh Med. J.*, 1906); a joint paper with Dr. S. Monckton Copeman entitled "A Study of the Variations in the Secretion of Hydrochloric Acid in the Gastric Contents of Mice and Rats as compared with the Human Subject, in Cancer" (*Proc. Roy. Soc.*, 1908, *B*, Vol. 80); "Report on Ferro-Silicon with Special Reference to the Poisonous Gases evolved" (extracted from supplement to the 38th Annual Report, Local Government Board, 1908—1909; Cd. 4958); joint Report with Dr. S. Monckton Copeman and S. R. Bennett, M.A., on the "Nature, Uses, and Manufacture of Ferrochrome and other Ferro-Alloys" (Reports, Local Government Board, New Series, No. 93, 1911); "The Action of Chlorine on the Blood" (*Lancet*, July 10th, 1915); and "Some Problems in Toxicology" (Post-graduate Lecture at the Westminster Hospital, 1924).

Hake became a Fellow of the Chemical Society in 1876, and a

Fellow of the Institute of Chemistry in 1878 and served on the Council (1901—1904). As will be obvious from what has been written above, he was specially interested in Toxicology and almost up to the time of his death he was occupied in the preparation of notes with a view to the publication of a text-book on that subject.

In 1890 Hake married Miss Mabel Mann (youngest daughter of Richard Mann of Bromley, Kent), who died in 1924, leaving as issue one son (the present Director of the National Portrait Gallery) and two daughters. Hake took the greatest possible interest in the education of his children. He was a good lecturer and teacher and had a great love of nature. Highly cultivated, of charming manners and retiring disposition, he was a lovable man and it is a matter of great regret to me as an old friend that I was able to see so little of him since our early intimate association.

CHARLES T. KINGZETT.

WILLIAM WALKER JAMES NICOL.

BORN JUNE 27TH, 1855; DIED MARCH 19TH, 1929.

WILLIAM WALKER JAMES NICOL, the only son of William Walker Nicol and Marianne Ballantyne Nicol, both belonging to old Border families, and the nephew of James Nicol, Professor of Natural History, who elucidated the nature of the rock formation of the North-west Highlands, was born in Edinburgh in 1855. He was educated first in England, and later at the Edinburgh Academy, where he was a contemporary of the late Lord Haldane; in 1872 he proceeded to the Edinburgh University, where he took the M.A. degree. Attracted by chemistry, he turned his special studies in this direction in Professor Crum Brown's laboratory, and gained the medal of the year and the Hope Prize Scholarship, taking also the B.Sc. and finally the D.Sc. degree. After working at Berlin University under Professor A. W. Hofmann, he returned for a short time to Edinburgh University as demonstrator, and in 1876 was appointed lecturer at the newly founded University College, Bristol, now the University of Bristol. In 1880, Mason College, Birmingham, now the University of Birmingham, was founded, and in 1881, with William Augustus Tilden as professor, Nicol joined the staff as lecturer in chemistry: he retained this post until his retirement in 1894, following on Tilden's removal to the Royal College of Science, South Kensington.

During this period of 18 years Nicol proved himself a very successful lecturer and teacher. As a lecturer he was clear and logical and his lectures were appreciated, not only by his students, but by wider and more popular audiences to whom he gave numerous lectures in the West of England and the Midlands, partly as University Extension Lectures and partly under the Gilchrist Trustees. As a teacher in the laboratory, he was indefatigable in his individual attention to his students, being at all times both able and willing to help them in their difficulties.

At this period, especially in newly founded Chemical Departments, the time of the members of the staff taken up in lecturing and in the daily work of the laboratory was frequently so great as to leave but little for research, and the equipment and apparatus available were often very limited. Nicol, however, always devoted as much time as could be spared from other duties to research work : he was greatly helped in this respect by the possession of an exceptionally good mechanical aptitude and an unusually skilful manipulative capacity, which enabled him to construct his own apparatus, whether of wood, metal, or glass, thus minimising the difficulties which many would have experienced owing to lack of equipment. At the outset, while in Berlin and later in Edinburgh, he carried out short investigations in organic chemistry, but the bent of his mind was much more towards inorganic and physical chemistry, and it was especially in this direction that he turned during his stay in Birmingham.

The particular problem which attracted Nicol was that of " solution," and from 1882 to 1894 he carried out a long series of investigations on the physical constants of salt solutions, and especially of their molecular volumes, these being ascertained with the high degree of accuracy characteristic of his work. In the controversies of the period, which just preceded the rapid development of physical chemistry in the 'nineties, he took a considerable part as an opponent of the " hydrate " theory of solution : he also acted as Secretary of the British Association Committee on Solution. He was a very expert photographer, and worked out the " Kallitype " printing process, in which silver nitrate and ferric salts were employed.

After his retirement from active teaching work in 1894, although he continued his chemical investigations for a time, Nicol's interests tended more and more to the fulfilment of the mechanical bent of his versatile inventive mind. One outlet of this, joined with his love of natural scenery and of the open air, was found in caravanning in the wildest parts of the Scottish Highlands, and along the narrowest and most difficult of roads in various types of caravan, first with a horse and later with the motor as tractor, the caravans, full of ingenious contrivances, being built and fitted entirely by himself.

Externally rather quiet and reserved, Nicol felt no great inclination for large meetings or social functions, but those who were regularly brought into contact with him soon learned how thin was this external layer, and beneath it soon recognised his high-minded sense of honour, his innate courtesy, and his intellectual capacity, and that these were combined with a great personal hospitality and a strong sense of dry humour. To those intimate with him he was to the end, even when opportunities of meeting became rare, a friend who continued always the same.

During most of his life Nicol enjoyed very robust health, and it was a legitimate source of pride to him that throughout the whole time he spent in Birmingham he was never for a single day absent from his work through illness. During the last year or so, however, his health failed, and he died in his 74th year on March 19th, 1929. He leaves a widow and one daughter, Dr. E. A. Traquair Nicol, who, after taking the B.A. degree at Cambridge and the Ph.D. at Edinburgh, is now carrying out zoological research in the laboratory of the latter University.

H. G. C.

SAMUEL RIDEAL.

BORN, 1863; DIED NOVEMBER 13TH, 1929.

DR. SAMUEL RIDEAL, who died on November 13th last at the age of sixty-six, had been a Fellow of the Society since 1882, and for the greater part of his life was a familiar figure at its meetings and at those of kindred societies.

Rideal was born in 1863, being the son of Mr. John Rideal of Sydenham, and was educated at Dulwich College and at the Royal School of Mines, whence he migrated to University College, London; there he completed his degree course and acted for several years as an assistant teacher, first under Professor Williamson and later under Sir William Ramsay. He took Chemical Honours in his B.Sc. Degree and only two years later was awarded the Doctorate at the very early age of twenty-three—a considerable achievement in the days when the D.Sc. was awarded, not, as later, for original work, but as the result of an examination of almost encyclopædic range demanding, not only a severe course of intense reading, but also the possession of an exceptionally retentive memory. His investigational work in chemistry, which was varied and continuous and gave him a wide reputation, came later.

In 1886, however, he contributed to the *Transactions* of our Society by a paper on the " Action of Ammonia on Chromyl Dichloride " (J., 1886, **49**, 367), and in 1889 a paper on the " Action of Ammonia on Tungsten Compounds " (J., 1889, **55**, 41). But he had already contributed some original observations on analytical methods to the *Chemical News* and a paper on " Isodimorphism " (in relation to the specific volumes of arsenic and antimony trioxides in their octahedral and prismatic forms) to the *Berichte* of the German Chemical Society (1886, **19**, 589).

In 1889, after having received the honour of election as a Fellow of his College, Rideal was appointed Lecturer on Chemistry in the Medical School of St. George's Hospital; and soon after, on his appointment as Public Analyst for Chelsea, he established himself as a chemical consultant at Westminster.

A communication from him to the German Chemical Society on " Organic Boron Compounds," dealing with the action of boron halides on ammonia and on organic bases, was published in the *Berichte* (1889, **22**, 992). He gradually, however, turned his attention mainly to problems of a technical nature, his first memorable contribution in this direction being a paper, with S. G. Rosenblum as co-author, on the " Estimation of Chromium in Chrome Iron Ore, Ferro-chromium, and Chrome Steel," in which were communicated the results of a searching investigation into the method of fusion with sodium peroxide which had been put forward by Hempel in 1893 and adapted for quantitative purposes by Dr. John Clark as described in a communication by the latter to our own Society (J., 1893, **63**, 1079): the subject was further pursued by Rideal and Rosenblum in a paper in the *Chemical News* (1896, **73**, 1), to which was appended a very complete bibliography of other work on the same process.

Rideal's attention, however, became concentrated on matters connected with sanitation, mainly those bearing upon water supplies and, more especially, upon the disposal and purification of sewage and sewage effluents; on this subject he became a generally acknowledged authority, his assistance being constantly requisitioned by engineers and by local authorities, and he was frequently called upon to give evidence before Royal Commissions, Departmental Committees, and Local Government enquiries relating to sewage disposal or public water supplies.

Rideal also gave a good deal of attention to disinfectants and his name has for many years been familiar in connexion with the Rideal–Walker method for assessing the value of disinfectants on the basis of comparison with pure phenol by ascertaining their relative effect on cultivations of *Bacillus typhosus*.

He was the author of a book entitled " An Introduction to the Study of Disinfection and Disinfectants," first published in 1895, with subsequent editions in 1898 and 1904, which work, however, was superseded by a later edition by himself and his son, Dr. Eric

K. Rideal, on " Chemical Disinfection and Sterilisation " published in 1921.

He was also the author of a book on " Sewage and the Bacterial Purification of Sewage," first published in 1900 and re-published in 1901 and 1906; and in 1914, again jointly with his son, he published what has come to be regarded as a standard work on " Water Supplies, their Purification, Filtration, and Sterilisation."

The application of electrolytic chlorine to sewage purification and deodorisation engaged Rideal's attention over several years, and he was the author of two papers on the subject (*J. Roy. Sanit. Inst.*, 1905, **26**, 378; *J. Soc. Chem. Ind.*, 1909, 215).

He was also the author of a book on " Glue and Glue Testing "; and made several communications to the Society of Public Analysts recorded from time to time in the *Analyst.* Amongst these were papers on " The Sulphuric Acid Hydrolysis of Butter-Fats " (1893, **18**, 165); on " Formalin as a Milk-Preservative " (1895, **20**, 157); on " Determination of Dissolved Oxygen in Waters in Presence of Nitrites and of Organic Matter " (1901, **26**, 141); (jointly with H. G. Harrison) on the " Polenske Method for the Detection of Cocoanut Oil in Butter " (1906, **31**, 254); (jointly with W. T. Burgess) on the " New Standards for Sewage Effluents " (1909, **34**, 193); (jointly with L. H. D. Acland) on " Examination of the Oils from Manihot Ceara and Funtumia Elastica and a Comparison of their Properties with those of Linseed and Hevea Oils " (1913, **38**, 259).

Rideal was chosen as Cantor Lecturer to the Royal Society of Arts in 1902, taking as his subject " Water Purification " (*J. Soc. Arts*, 1902, **50**, 717, 729, 741, 755).

He was President of the Association of Sewage Works Managers in 1902, and President of the Society of Public Analysts in 1918; and he served a period as Examiner in Chemistry to the Royal Colleges of Physicians and Surgeons.

During recent years Rideal's health gradually failed, compelling him to give up—it was hoped only for a time—active work, and on medical advice he sought change of scene abroad; but the hoped-for recovery did not ensue and he died with unexpected suddenness in South Africa, leaving a widow (Lilla, daughter of the late Samuel Keightley, of Bangor, Co. Down), one daughter, and three sons, including Dr. Eric K. Rideal, Owen Jones Lecturer in Physical Chemistry in the University of Cambridge, already referred to in connexion with two books of which, with his father, he was joint author.

The writer deplores the termination of an intimate personal friendship which had lasted unbroken through more than forty years.

BERNARD DYER.

SAMUEL BARNETT SCHRYVER.

BORN, 1869; DIED AUGUST 21ST, 1929.

SAMUEL BARNETT SCHRYVER was born in London in 1869 and was educated at University College School, University College, and the University of Leipzig, where he graduated Ph.D. After his return to England he was appointed in 1893 Demonstrator in Chemistry under Campbell Brown at University College, Liverpool, where he remained until 1897. Early in 1898 he joined the staff of the Wellcome Research Laboratory and retained this position until March 1901, when he was appointed Lecturer in Physiological Chemistry at University College, London. Up to this time he had been engaged in research on a variety of subjects in Organic Chemistry, but here for the first time he came into direct contact with biochemical problems and henceforward until his death he was continuously engaged in biochemical and physiological research. He left University College in 1907, on his appointment as Physiological Chemist to the Research Institute of the Cancer Hospital, and in 1913 joined the Staff of the Imperial College of Science at South Kensington as Assistant Professor, becoming full Professor of Biochemistry in 1920. Schryver was elected to the Fellowship of the Royal Society in 1928. He died on August 21st, 1929 after an illness of several months' duration.

Trained as an organic chemist, Schryver developed into a biochemist whose chief interest lay in the chemical and physical behaviour of the proteins and other colloidal constituents of the cell. Gifted with a fertile imagination, he was never lacking in ideas for new lines of research, many of which he himself began to develop. He leaves behind him a band of workers trained in his laboratory, many of whom are continuing the work commenced under his inspiration.

In 1910 Schryver married Miss E. Davies, who, with their two daughters, survives him.

Schryver's first paper (1890) was published in conjunction with Norman Collie, under whom he studied, on the effect of heat on quaternary ammonium compounds and the nature of the tertiary amine thus formed when the radicals of the quaternary compound were varied. This led to an attempt (1891) to prepare stereoisomeric compounds of the quaternary ammonium salt type (methyldiethyl-*iso*amylammonium iodide). Certain differences in crystallisation (probably due to dimorphism) were regarded as possibly due to the effect of asymmetry of the nitrogen atom.

At Liverpool he commenced the study of the oxidation of oil of turpentine, from which he obtained a new acid (terpylonic acid).

The heptolactone formed by distillation of terpenylic acid and an isomeric lactone were synthesised and their constitutions thus established. He next turned to researches on the derivatives of camphor, effecting the synthesis of an isomeride of camphoric acid and studying the oxidation products of lauronolic acid.

From the Wellcome Research Laboratories he published papers on acid phenyl salts of dibasic acids, which were obtained by acting on the anhydrides of such dibasic acids as camphoric, succinic and phthalic acids with the sodium salt of a phenol. Here too he commenced (with F. H. Lees) an investigation on morphine and published two papers on this subject, dealing with *iso*- and β-*iso*-morphine. He also devised a method for the estimation of phenols, depending on the production of ammonia from sodamide by the action of the dry phenol dissolved in anhydrous benzene.

At University College, in the course of unsuccessful attempts to effect the synthesis of proteins from peptones in presence of intestinal mucous membrane, his attention was drawn to the phenomenon of autolysis, which was investigated (partly in collaboration with Miss Lane Claypon) in some detail (1904, 1905, 1906). He finally reached the conclusion that the autolysis of the organs *in vivo* was regulated by chemical means and that the normal supply of nitrogenous food yielded by its breakdown sufficient ammonia to prevent the tissues from becoming acid and then undergoing autolysis.

Whilst at University College he also made experiments (with Hamill) on the excretion of nitrogen by normal individuals, finding that it corresponded to a daily intake of 93 g. of protein. In the course of investigations carried out for the Local Government Board he devised new and delicate methods for the detection of tin and of formaldehyde in foodstuffs. The application of the latter test enabled him to show the production of formaldehyde when chlorophyll was exposed to sunlight in the presence of moist carbon dioxide.

At the Cancer Hospital he carried out with Dr. C. Singer investigations on the gastric juice in malignant and non-malignant diseases of the stomach and duodenum (1913) in which chemical methods (*e.g.*, determination of the peptic index and of the ratio of acid combined with amino-acids to total nitrogen) were applied to diagnosis. To the last he retained an intense interest in the biochemistry of cancer. Here he also began work on the state of aggregation of matter, which led directly to the study of clot formation, the results of which formed the subject of a series of seven papers published between 1910 and 1919. These included useful studies of the relation between the viscosity and surface tension of salt solutions and the effect of these salts on clotting and gel formation and an intensive examination of the clotting of milk by rennin, in the course of which he showed that caseinogen is converted into a less soluble "metacaseinogen" by treatment with hot water but that this substance differs in properties from the casein produced by rennin. He also (1912) made a study of the unconjugated acids of ox-bile and devised a method of separation of cholalic, choleic and deoxycholeic acids, depending on the solubilities of their magnesium and barium salts.

Schryver's deep interest in gel formation was maintained in the investigations which he carried out at the Imperial College. These followed two main lines. In the first place he attacked the constituents of plant cells, preparing and studying the proteins of leaves and also studying the cell wall, from which he isolated the pectins and hemicelluloses which take a part in its structure. He came to the conclusion that pectinogen is a trimethyl ester of pectic acid combined loosely with metallic ions, such as $Ca^{\bullet\bullet}$, and that pectic acid and the hemicelluloses, a number of which were isolated from various materials, were both complexes of "uronic acids" and sugars, as suggested by Ehrlich and Ling. For such complexes he suggested the name "polyuronides." Lignification of tissue he found (1928) to be accompanied by the disappearance of pectins.

The second group of researches arose from work done under the auspices of the Adhesives Research Committee, of which he was made a member. This Committee was appointed by the Department of Scientific and Industrial Research in 1919 to take over the work of the Adhesives Committee originally appointed by the Conjoint Board of Scientific Societies in the latter part of 1917. This work, carried out largely in conjunction with his students, resulted in two series of papers, on the preparation, purification and properties of gelatin and on the separation of the products of protein hydrolysis. Many of these results are also contained in the First and Second Reports of the Adhesives Research Committee (1922, 1926): a Third Report, also containing much of his work, is in course of preparation.

The formation of gelatin from its precursors collagen and ossein was studied from the physico-chemical standpoint. Elaborate attempts were made to "purify" gelatin and obtain a material which could be regarded as a chemical entity, but without complete success. He found that a large degree of purification could be effected by electrolysis and by flocculation in an electric field. The resulting material, however, is probably always to some degree contaminated by products formed by the action of water, which produces an irreversible change, measurable in a few hours, even at 37°. Such "purified" gelatin is almost insoluble in water at 15° and is very similar in properties to the globulins, from which it differs by its power of readily forming gels when dispersed in acids, alkalis or salts.

In the course of these researches the important observation was made (Knaggs, 1923) that the composition of gelatin was not constant, but varied with the treatment to which either the gelatin itself or its precursor had been subjected. This was detected by a variation in the percentage of the total nitrogen of the hydrolysis products which were precipitated by phosphotungstic acid (diamino-nitrogen). For instance, the hydrolysis products of gelatin from a precursor which had been treated with dilute alkali yielded 29·5%, whereas those of gelatin from the same precursor treated with dilute acid gave only 26·0% of diamino-nitrogen; gelatin itself showed similar changes, but of even greater magnitude.

These results have been criticised by Daft, working in the Carlsberg Laboratory, but the criticism has been refuted by Thimann (1930), one of Schryver's students, who has explained the apparent divergence of experimental results. The investigation of this phenomenon led to the work on the separation of the products of protein hydrolysis. In this pioneering work, which must be regarded as preliminary and awaiting further extension and confirmation, Schryver developed a method of separation of the products of protein hydrolysis which depended on the use of Siegfried's barium carbamate compounds of the amino-acids. In this way he obtained from the hydrolysis products of isinglass (and of edestin, but not of caseinogen or egg-albumin) hydroxylysine, in the form of a barium carbamate soluble in 70% alcohol but insoluble in cold water, whilst from the glutelin which he isolated from oats he obtained two new aminohydroxy-acids, aminohydroxybutyric acid, which forms an insoluble copper salt, and aminohydroxyvaleric acid, which forms a soluble copper salt.

In addition to this he obtained a new eight-carbon acid, $C_8H_{15}O_3N_3$, which he termed protoctin, from the phosphotungstic acid precipitate obtained from the soluble carbamate from glutelin and the protein of castor bean. Finally, *dl*-lysine was obtained from gelatin which had been treated with acid before being hydrolysed and to this the increased percentage of diamino-nitrogen found in such gelatin was traced. No clue was, however, found to the origin of this extra lysine.

Schryver (with Chibnall) also initiated an investigation into the proteins of leaves, which has been continued with great success by Chibnall. He, moreover, isolated a crystalline substance, $C_3H_8O_4$, from cabbage leaves, which he regarded as a disaccharide derived from glycollaldehyde and formaldehyde.

From 1918 up to the time of his death he was also engaged in researches on the autolysis and nutrition of yeast in connexion with the Research Scheme of the Institute of Brewing. The interesting fact was observed that when yeast is washed it is only autolysed very slowly, and much work was expended in endeavouring to trace the presumed agent removed by washing, but without any definite result. The work on yeast nutrition had only reached a preliminary stage at the time of Schryver's death.

He was the author of two books. " An Introduction to the Study of Biological Chemistry " (1918) provided a general introduction to Organic Chemistry, followed by special chapters on the chief chemical constituents of the animal body (fats and lipoids, carbohydrates, proteins); the methods employed for the investigation of chemical changes within the animal organism (metabolism, total and intermediary); and the chemical processes taking place in plants (including enzyme actions). This was also the plan he adopted in his lectures. He also contributed in 1909 an early volume to Longman's Series of Monographs on Biochemistry on the general characteristics of the proteins. A. HARDEN.