# OBITUARY NOTICES.

## WILLIAM THOMAS BURGESS.

### 1861—1939.

WILLIAM THOMAS BURGESS, whose death took place at Bedford Park, London, on June 22nd, was born at Brighton on January 8th, 1861. Receiving a preliminary scientific education at Brighton, including chemistry under W. Jago, F.I.C., he proceeded to the Royal College of Science in 1882. In his first year at the College, he took the first prize, the Tyndall Prize, for Physics, and his sound knowledge of chemistry and physics, coupled with his resourcefulness and dexterity in experimental manipulation, so impressed Prof. Percy Frankland that he was offered, and accepted, the vacant position of assistant to Sir Edward Frankland in his private laboratory for consultative work. At that time, Sir Edward was, among other things, the leading authority on water supplies and water analysis, and Burgess, who remained with him as friend and assistant until the death of Sir Edward in 1899, gained an experience in matters relating to water supplies which was unequalled in the country.

The part of Sir Edward's work pertaining to his official position as " Water Analyst to the Local Government Board " consisted mainly in the regular analysis of the supplies of water to London by the eight separate water companies of that time, and, on his death, it was soon transferred to the Government Laboratory, but Dr. (later Sir) Edward Thorpe stipulated that Burgess should continue to do the work on the lines adopted by Sir Edward Frankland. Burgess's employment, part time, on this work continued until it was taken over by the Metropolitan Water Board in 1908, after which he was able to devote all his time to a private practice which devolved on him from the unofficial consultative work of Sir Edward Frankland. This work as a water consultant was kept up until his death, and he was consulted by local authorities or by water engineers in most of the new schemes for water supply as they arose.

Burgess devised a simple instrument for measuring the colour of water, equating the colour of a definite depth of water with colours on the Lovibond scale. Apart from his extensive knowledge of the geology of this country, he had a keen interest in all developments in chemistry and physics, and was an authority on the composition of glass and porcelain used for laboratory ware. In this connection he did much work for the Glass Research Committee set up by the Institute of Chemistry during the last war. He was at one time a Member of Council and later a Vice-President of the Institute of Chemistry and acted temporarily as Honorary President in 1918. He had also been a Member of Council and Vice-President of the Society of Public Analysts, was a Member of the Society of Chemical Industry, and was elected a Fellow of the Chemical Society on June 19th, 1884.

Burgess endeared himself to all his acquaintances by his interest in their work, and his ready help and advice, based on a wide experience. A. MORE.

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## WALLACE HUME CAROTHERS.

### 1896—1937.

THE death of Wallace Carothers on April 29th, 1937, at the age of 41 years, cut short the brilliant career of one of America's ablest workers in the field of chemistry. Although the period of his scientific activity extended over scarcely more than ten years, Carothers' work had gained wide recognition and placed him in the front rank of organic chemists.

Wallace Carothers was born on April 27th, 1896, at Burlington, Iowa, the eldest son of Ira Hume Carothers and Mary Elvina McMullin. His father's family was of Scottish origin and had settled in Pennsylvania in the 18th century, moving westward to Illinois many years later. His maternal ancestors were of Scotch-Irish lineage. His early education was obtained in the schools of Des Moines, Iowa, and in 1915 he entered Tarkio College,

Tarkio, Missouri, where he began his scientific studies. During this period and later, he earned a large portion of his educational expenses by acting as a teaching assistant.

In 1920 he received the B.Sc. degree from Tarkio College and began graduate study in chemistry at the University of Illinois. He was awarded the Master's degree at Illinois the following year and then accepted a teaching appointment at the University of South Dakota, which he held for one year. Returning to the University of Illinois in the fall of 1922, he became a candidate for the doctorate, choosing organic chemistry as his major field with physical chemistry and mathematics as minor subjects. His doctoral thesis was prepared under the direction of Professor Roger Adams and dealt with the catalytic hydrogenation of aldehydes with platinum-oxide-platinum-black and the effect of promoters and poisons on the reduction of various organic compounds with this catalyst (*J. Amer. Chem. Soc.*, 1923, **45**, 1071; 1924, **46**, 1675; 1925, **47**, 1047). He was a gifted experimenter and a brilliant theorist. His work even at this early stage showed a great breadth of knowledge and a keen, discerning judgment. In 1923 he was granted the Robert F. Carr Fellowship and in 1924 received the Ph.D. degree. At that time he was regarded by the chemistry faculty at the University of Illinois as one of the most brilliant men ever to have studied there.

Carothers remained at Illinois for two years as an instructor in organic chemistry and then spent three semesters in a similar post at Harvard University. At this time E. I. du Pont de Nemours and Company had completed plans for a new laboratory to be devoted to broad fundamental research in organic chemistry at their central laboratory, the Experimental Station at Wilmington, Delaware. Wallace Carothers was selected to direct and develop the research programme and in February, 1928, he embarked upon this new and exceedingly productive phase of his scientific work. A small group of excellently trained chemists was brought together and placed under his direction to take up the study of problems of his own selection. Work progressed rapidly under the stimulus of his keen intellect and friendly encouragement. In the brief period of nine years this small group made outstanding contributions to theoretical organic chemistry and also laid the foundations for commercial developments of great significance.

Carothers showed a remarkable independence of thought early in his scientific training. He could at once grasp the essence of a new idea, see its broad ramifications, and apply the new concepts to problems that interested him. He had the ability to express his own views concisely with precision and clarity. He was greatly impressed by the early papers of Lewis and of Langmuir on the electronic theory of valence and was eager to extend these ideas into organic chemistry. In 1923 he published his first independent paper, on the isosterism of phenyl *iso*cyanate and diazobenzeneimide. The following year he published a theoretical memoir entitled " The Double Bond " (*J. Amer. Chem. Soc.*, 1924, **46**, 2226) in which he interpreted a variety of organic reactions from the standpoint of electronic theory, presenting a number of ideas that clearly foreshadowed many of the subsequent theoretical developments in this field. He stated the view that reactivity of the double bond is not chiefly due to the electrical charges (polarity) of the active centres but to an unstable electronic configuration, particularly a deficit of electrons (to be termed later, an open sextet). He decried " the tendency to regard reactivity as exclusively the attribute of polarity and polarity as in some nebulous manner the ultimate cause of typically organic reactions." Later he studied the thermal decomposition of sodium ethide and of sodium and potassium methides (*ibid.*, 1929, **51**, 588; **52**, 1254) to obtain data concerning the stability and reactions of the simplest definite alkyl anions.

Soon after he went to the du Pont Experimental Station vinylacetylene and divinylacetylene became available for his researches. He undertook an extensive study of the reactions of these compounds and of a large number of related acetylenic hydrocarbons that were synthesised in his laboratory. The results of this detailed and comprehensive study were the subject of more than twenty scientific papers and formed the basis for several important patents. Carothers discovered that hydrogen chloride adds to vinylacetylene in the 1 : 4-positions to give a reactive allene derivative ($CH_2Cl{\cdot}CH{:}C{:}CH_2$) which is easily isomerised to 2-chloro-$\Delta^{1:3}$-butadiene (chloroprene). The latter undergoes polymerisation readily and yields a rubber-like polymer having very desirable properties

as a substitute for natural rubber. This synthetic rubber is now produced commercially in the United States and marketed under the name neoprene. In the course of his investigations in this field a thorough study was made of the relations between the chemical constitution of substituted 1 : 3-dienes and their rate of polymerisation and the physical properties of the polymers.

Even before his association with the du Pont Company Carothers had become interested in the interaction of polyfunctional molecules to form high molecular polymers. Before leaving the University of Illinois he had started an investigation of the reaction of ethylene glycol with succinic acid. In 1928 he began a comprehensive study of the action of substances x-A-x on y-B-y where A and B are bivalent radicals and x and y are functional groups capable of reacting with each other. His published investigations in this field, comprising more than thirty papers, covered a wide variety of compounds and resulted in a number of significant contributions to theoretical and applied chemistry. He did much to systematise and clarify the chaotic field of condensation polymerisation and enunciated a broad general theory of polyfunctional reactions.

Carothers investigated methods of synthesising substances of high molecular weight and known constitution from simple polyfunctional molecules such as glycols, diamines, dibasic acids, etc. This led him to prepare a large series of polyesters, polyamides, polyalcohols, etc., and resulted in the production of the first completely synthetic fibres comparable in degree of molecular orientation, tensile strength, pliability, and other physical properties with natural fibres such as silk, wool, and cotton. The results of Carothers' work on linear polymers have served as the basis of several exceedingly important commercial developments by the chemists and chemical engineers of the du Pont Company. A large plant costing upwards of ten millions of dollars is now under construction at Seaford, Delaware, for producing new, purely synthetic polymers for a variety of uses, particularly a new silk-like fibre marketed under the name nylon. This material consists of a polyamide of peptide-like structure obtained from an aliphatic diamine and dibasic acid. Preliminary tests extending over several years have shown that fibres, bristles, and sheets of these synthetic polyamides have great strength, elasticity and toughness, and that they will find numerous practical applications.

The significance of Carothers' work rapidly established his reputation but he was always modest and unassuming in manner. He took an active part in affairs of the American Chemical Society and for a number of years served as an Associate Editor of the Journal. He also served as an editor of *Organic Syntheses*. He visited England on several occasions and in 1935 presented a paper on " Polymers and Polyfunctionality " before the Faraday Society. He was elected a Fellow of the Chemical Society on May 2nd, 1935. In 1936 he was elected a member of the National Academy of Sciences of the United States—a signal honour in that he was the first organic chemist outside of academic circles to be elected to that society.

He was married in 1936 to Helen Everett Sweetman of Wilmington, who survives him with their daughter Jane.

In the preparation of this notice I have been aided by the biographical memoir of Wallace Carothers written by Roger Adams (National Academy of Sciences, U.S.A., Biographical Memoirs, 1939, XX, 293). JOHN R. JOHNSON.

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## REGINALD CRAVEN.

### 1896—1939.

UNTIL last summer there were few better known figures in Aberdeen than that of Reginald Craven, the local representative of the Chemical Society and Lecturer in Chemistry at Robert Gordon's Technical College. Powerfully built, thick set, and slow in his movements, he would be seen moving along deep in thought, often but half conscious of his immediate surroundings, moving his head, which was prominent, slowly from side to side as he walked. There was a touch of oddity in his appearance; and yet one turned again

to regard him. For his was the face of a personality; a man who had many friends, a man of sympathetic understanding, a man whom one trusted instinctively, a man of learning. Of few whom the Society mourns would it be more true to write that as a chemist the man was greater than his output of published original work would have indicated, for the latter was limited to two communications on quinones, whereas Craven's influence on the development of chemistry in Aberdeen was considerable. For in co-operation with Alexander Findlay, James Hendrick, R. H. Plimmer and a few other enthusiasts, he helped to found the Aberdeen Chemical Club in 1920 and became its first Secretary. After a useful life the Club became merged in the newly formed local sections of the Chemical Society and of the Institute of Chemistry and—as was fitting—Craven was appointed Local Representative of the former and Local Secretary of the latter, which appointments he held until his death.

Students of Robert Gordon's College had reason to know him as a sympathetic friend with a keen sense of humour, and as a first-rate teacher of chemistry. He must have been an accurate observer; for he could identify by sight nearly all the commoner chemicals found on the reagent shelves, and his memory even in trivial things—people's addresses and the like—was unusually retentive.

His interests were many-sided. Philately, foreign travel and languages, pictorial photography, music, swimming, walks over the moors and hills, and the company of friends—these were the recreations of his choice, to which may be added chess, mathematical conundrums, and golf, which he played left-handed with more zest than precision. More illuminating as an index of his character was his behaviour during 1916. Breaking his student career at the Royal College of Science in South Kensington, whither he had gone as 1851 Scholar in the previous year, and failing to be accepted for service in the Army, he worked in a war gas factory near London. One day, a supply pipe failed, and realising the danger—for no gas masks were available then—he cleared the shed of workers and himself shut down the plant. A long period in hospital followed, after which he returned to College and completed his studies for the A.R.C.S. and B.Sc. examinations. Research into poisonous arsenicals likely to be of service in chemical warfare followed; but he became so badly affected that another long period of illness resulted, and indeed he was not entirely free from the effects of arsenical poisoning for ten years. Only a few intimate friends knew of these incidents. But it is fitting that they should be recalled now. For bravery and a sense of duty are never out of fashion; and we honour him greatly for them.

Reginald Craven, born on March 25th, 1896, at Halifax, Yorks, was the son of Charles Edward and Elizabeth Ann Craven, née Linfoot. He began his education there at the Secondary School and Technical College and proceeded to the Royal College of Science, South Kensington, in 1915. He was elected an Associate of the Institute of Chemistry in 1919, a Fellow of the Institute in 1935, and a Fellow of the Chemical Society in 1920. Robert Gordon's Technical College, Aberdeen, appointed him to a Lectureship in chemistry in 1920. On December 27th, 1930, he married Margaret Lilian Overell at Wimbledon and had a very happy married life. On July 27th, 1939, he died near Aberdeen and was buried at Springfield Cemetery.

To his widow and his sister the Fellows of the Chemical Society express both their sympathy and their sense of their indebtedness to him for the part he played in the advancement of chemistry in Aberdeen.

T. H. READE.

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## WILLIAM RISDEN CRIPER.

### 1855—1939.

W. R. CRIPER was born on December 9th, 1855, and died on January 13th, 1939.

He received his chemical training under Professor Edward Frankland and Dr. Percy at the Royal School of Mines and obtained his Diploma of A.R.S.M. in the metallurgical division in 1875. He continued working with Dr. Percy for a period and then took up the post of assayer to an extraction works for silver and copper in Cornwall. Somewhere about the year 1880, he took up prospecting work in Burma and from there went to India about 1882, where he joined the staff of Carew and Co., Distillers and Sugar Refiners. In 1884,

he joined the late Dr. David Waldie in his chemical works at Cossipore, near Calcutta, subsequently becoming his partner and thus one of the founders of the heavy chemical industry in India; for a time David Waldie and Company was the only heavy chemical works of note in that country. It is interesting to recall that Dr. Waldie (of Linlithgow) was the originator of the use of chloroform as an anæsthetic, having suggested its employment to Dr. Simpson and having provided him with his first samples of that chemical.

On the death of Dr. Waldie, Criper continued to carry on the business of D. Waldie & Co., as proprietor, and moved the works to its present large site at Konnagar, 10 miles north of Calcutta on the banks of the Hooghly, where his sulphuric acid works were enlarged. He also floated the Bengal Distilleries Co., Ltd., about the year 1906 for the manufacture of potable spirits and pure alcohol for medicinal and other purposes. In 1909 he admitted his nephew, Mr. Eric Hayward, into partnership and the business gradually extended as the years went by to include large-scale manufacture of a number of products, including red lead, sulphate of alumina and other heavy chemicals, and the firm became interested in various other undertakings in the Empire.

Criper's interest in the laboratory work was constantly maintained and he and Dr. Waldie elaborated an analytical method for the estimation of rosin in shellac which for many years was the standard method.

Criper was elected a Fellow of the Institute of Chemistry in 1880 and was recipient of the Frankland Medal awarded by the Institute on the occasion of its Charter Jubilee in 1935. He was highly regarded by Indians of all classes, who were sure of sympathy, interest and help in the various problems which they took to him from time to time, and his passing was much lamented in the district. He was elected a Fellow of the Chemical Society on June 20th, 1878. E. HAYWARD.

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## PERCIVAL GEORGE LLOYD.

### 1871—1939.

PERCIVAL GEORGE LLOYD was born at Dalston on July 28th, 1871, the son of John Irvin Lloyd. He received his early training at the Aylesbury Grammar School but when he joined the Native Guano Company in 1887 he entered the field of sewage treatment and disposal, with which he was connected during the whole of his subsequent career. This Company put into practice the " A.B.C." (Alum, Blood and Charcoal) process of sewage treatment, in the commercial application of which Lloyd played a considerable part. The process was employed at Kingston-on-Thames and when these works were taken over by the Corporation in 1908 Lloyd remained as their officer in charge of the plant and was holding that position at the time of his death.

Lloyd was keenly interested in the scientific aspects of sewage treatment and was an ardent supporter and Member of Council of the Association of Sewage Works Managers (now incorporated as the Institute of Sewage Purification), of which he was an early member. He regularly attended the meetings and made many contributions to their journal.

It is largely due to his initiative that the Kingston Sewage Works are likely to be abandoned in the near future in favour of a more suitable site in the Hogsmill Valley, thus freeing a valuable river frontage for other purposes.

Lloyd was elected to the Chemical Society in 1907. He died on April 28th, 1939, and is survived by a widow and one son. J. T. CALVERT.

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## GEORGE JAMES ROBERTSON.

### 1898—1939.

DR. GEORGE JAMES ROBERTSON, senior lecturer in chemistry in the United College, University of St. Andrews, died suddenly on September 5th, 1939, at the age of forty-one years. Born on June 18th, 1898, he was a son of the late Mr. James Robertson, head-

master of Colinsburgh School, Fife. He entered the University of St. Andrews from the Madras College, St. Andrews, in October, 1916. He undertook military duties soon afterwards, and held a commission in the Gordon Highlanders, 51st Highland Division. He was on active service in France from September, 1917, and in March, 1918, he was taken prisoner at Cambrai and interned in Germany until the end of the war.

Returning to the University of St. Andrews in 1919, Robertson graduated M.A. (1921) and B.Sc. with first class honours in chemistry (1922). He held in succession a Carnegie Research scholarship, fellowship, and teaching fellowship in the Chemistry Department at St. Andrews. In 1924 he was awarded the degree of Ph.D. for a thesis entitled "Investigations on Cellulose." Since 1927 he had been senior lecturer in the Department, and in this capacity he carried out and directed a considerable amount of research work in carbohydrate chemistry. In 1936 he was awarded the degree of D.Sc. for a thesis entitled "Walden Inversions in the Sugar Group"; this thesis also gained him the Sykes Medal for outstanding merit. His investigations, most of which were published in the *Journal of the Chemical Society*, dealt largely with the interconversion of simple sugars through anhydro-derivatives and the problem of the natural formation of lactose, glucosamine and allied substances.

Courteous and considerate to his colleagues and students, Robertson has been described as "an excellent teacher endowed with unusually fine powers of expression and easy fluency." His military training enabled him to render valuable services to the University O.T.C. throughout his period as a member of the University staff. He leaves a widow and two sons of school age.

J. READ.

## JOHN TROTTER.

1864—1939.

THE death of John Trotter, M.A., D.Sc., F.I.C., on March 4th, 1939, marked the end of a remarkable career. Born at Kelso, he attended Caddonfoot school near Clovenfords, where he came under the sway of a typical Scottish dominie by the name of Litster and attracted the attention of the parish minister, the Rev. Robert Small. Although he showed great promise at school, especially in mathematics, he was obliged at about the age of thirteen to leave and take up farm work at Fairnalee farm on Tweedside, where he had been brought up. After five years he went to Blainslie near Lauder as a ploughman.

We next hear of him at Greenlaw in Berwickshire, where he attended an evening class on agricultural science. He was so keen to learn and such a prodigious worker that he was sent to South Kensington for a course of training and returned to take charge of the evening class for a year or two.

Trotter was determined to make a name for himself, however, and he left the country at the age of 25 for Edinburgh. At this time he worked during the day at various employments and was able to attend evening classes at the Heriot Watt College. The subjects taken here were mathematics, bookkeeping and shorthand. Between 1892 and 1896 he took the College diploma in science and also the first class certificate of the Department of Science and Arts, London, in physiology, geology, and inorganic chemistry.

In 1895 he secured a post with the Edinburgh Corporation. Working at night, and attending classes at the University of Edinburgh during the day, he covered himself with distinction. In 1898 he was awarded the diploma in agriculture of the Highland Agricultural Society. In the session 1899—1900 he obtained an honours certificate and senior medal in agriculture and rural economy and an honours certificate and prize in colonial and Indian agriculture. Graduating B.Sc. in pure science in 1905 and B.Sc. in agriculture in 1908, he received the degree of M.A. in 1915, and was admitted a Fellow of the Institute of Chemistry in 1918.

Trotter, after graduating B.Sc., however, had commenced a research in organic chemistry under Professor Boon. The title of the thesis for which he was awarded the degree of D.Sc. in 1910 by his alma mater was "Bis-*p*-methoxybenzylidenedimethylpyrone and some of its derivatives." This had the unique distinction of attracting the attention of

" Punch " (April 13th, 1910, p. 257), who remarked " Lucky that the ' bis ' didn't come at the end of the word, or he might have had to say it all over again."

This work was embodied in a publication by Boon, McKenzie, and Trotter (*Proc. Chem. Soc.*, 1914, 205).

Trotter spent several years abroad as an adviser on agricultural problems. His appointments included two years with the Sudan Plantation Syndicate, three years on a large estate in the Gold Coast Colony and with the Jewish Territorial Organisation in Cyrenaica. During the Great War he worked from 1915—1918 in the T.N.T. Department of Messrs. Chance and Hunt, Ltd., at Oldbury.

From 1918 until his death he carried on a very successful business in Edinburgh as a gold refiner and assayer. During this period of comparative leisure he returned to his old boyhood hobby of angling and became a well-known Tweedside trout fisher. He was a great admirer of our national ploughman poet and was responsible for the founding of the Clarinda Burns Club.

His independent mind and kind heart gained for Trotter the respect of a large circle of friends and to one of these, Mr. J. C. Henderson, Ph.C., I am greatly indebted for much information on his career.

Trotter was an outstanding example of the maxim that you can never keep a good man down and a typical example of the hardworking Scottish student of days gone by. He was elected a Fellow of the Society in 1918. W. G. R. MURRAY.