OBITUARY NOTICES.

HENRY BURGESS.

Dr. Henry Burgess, whose death occurred on the 2nd October, 1931, was born at Wrenbury Frith on the 24th January, 1897, his parents being farmers near Whitchurch in Shropshire. He began his education in the village school at Calverhall and went from there with a scholarship to the Whitchurch Grammar School in 1909. In 1914 he qualified for a leaving exhibition of the Shropshire County Council and was awarded the Whitchurch Grammar School leaving exhibition. He then proceeded to Birmingham University and after one session of undergraduate study he took up war work under the supervision of Professor P. F. Frankland, F.R.S. This task involved analyses of coal tar and the testing of high explosives, including trinitrotoluene (T.N.T.).

At the end of the war he resumed his academic studies and qualified for his pass B.Sc. in the first division, with the award of a University scholarship. In 1920 he graduated with first-class honours in Chemistry, gaining a Priestley Research Scholarship. During the session 1920–21 he was initiated by me into chemical research, the subject of study being non-aromatic diazonium salts. Our immediate objective was 4-amino-3 : 5-dimethyl*iso*oxazole in order to ascertain whether the salts of this non-aromatic base were diazotisable. Reduction of the intermediate product, 4-nitro-3 : 5-dimethyl*iso*oxazole, presented unusual difficulties, which were finally overcome by the employment of amalgamated aluminium and moist ether. At this task Burgess worked so assiduously that within the session two papers were communicated to the Chemical Society on new diazo-derivatives of the *iso*oxazole series. A thesis embodying these results gained him the M.Sc. degree and at the same time he was elected to an 1851 Research Exhibition. With this assistance he was enabled to study for two years in the University of Cambridge, at the end of which period (1921–23) he obtained the Ph.D. degree.

During these years he worked with Professor T. M. Lowry, F.R.S., who writes as follows of Burgess's collaboration : " His preparative work was remarkable for the fact that he never let anything go down the sink, but always tried to account for the whole of the material used in the preparation; and when the reaction proceeded in unexpected ways and failed to give the desired product, this procedure proved quite fertile in disclosing new products."

Burgess was both an accurate and a rapid worker, and no less than eleven papers were published as a result of his short stay at Cambridge. He isolated the sulphonates of β-bromocamphor and also β-bromocamphorquinone from very uninviting materials. An outstanding discovery was the mutarotation of beryllium benzoylcamphor, a phenomenon not before observed among metallic derivatives of this type.

On leaving Cambridge in 1924 Burgess was appointed Demonstrator in the Chemistry Department of Guy's Hospital Medical School, where he proved a very successful teacher. Professor C. S. Gibson, F.R.S., remarks that " his efforts were untiring and the students soon realised his excellent qualities; and apart from his teaching duties, the amount of investigative work which he accomplished in one year is striking testimony to his industry. He was extremely thorough, a most careful and accurate worker, with an unusual capacity for taking pains." As a practical outcome of their collaboration, optically pure *l*-camphor-10-sulphonic acid (Reychler) is now available in quantity for stereochemical investigations.

In January, 1926, Dr. Burgess joined the scientific staff of the Chemical Research Laboratory, Teddington, and we resumed a collaboration which had been interrupted since 1921. He was allotted the difficult task of studying organic derivatives of tellurium with special reference to their possible utilisation in chemotherapy. As regards this application the results were disheartening; our preparations had no beneficial effect on trypanosomiasis in mice and these animals when treated with such organic tellurium compounds were stated by our biological collaborators to acquire a penetrating disagreeable odour, probably due either to tellurium dimethyl or to some analogous telluriferous substance. The chemical results were, however, of greater interest. The interactions of aluminium telluride and αε-pentamethylene dihalides gave rise to a new series of organic telluronium halides, of which *cyclo*telluripentane di-iodide was isolated in two well-defined coloured forms.

The reduction of this di-iodide and its analogues led to *cyclo*telluropentane containing a ring system of five carbon atoms in which for the first time tellurium had been implicated. As this tellurohydrocarbon is a very oxidisable oil with a repulsive and nauseating odour, the experimental difficulties attending its investigation were very great.

In 1928 Dr. Burgess was promoted to the grade of Assistant I in the Research Department, Woolwich Arsenal, where he undertook work of a confidential and dangerous character, on the heats of formation of a series of high explosives and on the relationship of chemical constitution to explosive properties. Of this last phase in Burgess's life his Chief Superintendent, Dr. G. Rotter, writes: "He was a good all-round chemist and a very pleasant man to deal with."

With this tribute to Burgess's professional aptitude and good personal qualities all who ever worked with him are in cordial agreement.

Burgess's career as an investigator lasted only for the brief span of ten years, but within that restricted period he had contributed to chemical literature some seventeen papers of definite value in extending chemical knowledge. Such a record would be highly meritorious even for a young man enjoying good health and possessed of a sound constitution; but these blessings had not been bestowed on Burgess. From birth he had been partly paralysed down the right side and in childhood had undergone surgical operations on hand and foot, made with the object of diminishing his disability. Quite naturally Burgess was very sensitive in regard to this infirmity and he greatly disliked any sympathy. But it seems quite fitting now to mention this sad circumstance in order to emphasise the supreme triumph which an indomitable will coupled with intellectual gifts of a high order achieved over an ailing body. His life was one long battle against physical pain and debility, but he hid this suffering with a Spartan bravery. In a tragically literal sense his experimental work was mainly single-handed, a fact which made his scrupulous neatness and quantitative accuracy all the more marvellous. In sport as in his work he schooled himself to emulate those who were physically fitter than he; he was fond of walking and played tennis.

In 1930 he married Miss Enid Cottam of Eltham, who survives him.

G. T. Morgan.

ALFRED CHASTON CHAPMAN.

It is sad to have to record the death, on October 17th, at the early age of less than sixty-three, of our valued Fellow, Alfred Chaston Chapman. Professor Armstrong, in a short appreciation in *The Times*, so well expressed what many of us are thinking that the writer feels it fitting to repeat here Professor Armstrong's opening sentences. He wrote: "By the death of Chaston Chapman, the body chemical suffers a loss that is truly irreparable; there is no one to put into the niche into which he had most perfectly fitted himself by constant and conscientious endeavour. In him we lose no mere chemist—what is far more serious a social star of the first magnitude in our world. He was one of our few liaison officers—one of the very few who serve as intermediaries between the laboratory worker and the world outside. With age he developed a charm and courtesy of manner, old-fashioned in its perfection, which added greatly to his popularity and influence."

Chaston Chapman was the son of the late A. W. Chapman, formerly of Pool-in-Wharfedale, and received his early education at the Leeds Grammar School, whence he proceeded to University College, London, where he took chemistry and physics under Williamson, Charles Graham, and Carey Foster. While Williamson was Professor of general chemistry, Graham was Professor of applied or technical chemistry; and, while still a boy, Chapman found himself promoted from the students' bench to the post of "demonstrator of chemical technology" in Graham's laboratory.

It is a little difficult now to think of "applied chemistry" as coming in its entirety within the purview of one professor, but, even then, the province was a wide one. Graham was, in practice, somewhat of a specialist, and the corner of his province that he loved best to till was that of brewing chemistry. This proved to have a fascination for the young demonstrator, who, before very long, acquired sufficient knowledge to lead him, encouraged by his teacher, to the bold venture of embarking in consulting practice on his own account; and to aid him over the probable period of waiting for work he established in his newly-formed laboratory a private school of brewing long before brewing had attained the status, as it later did, of recognition as a department of even university study. A few large brewers had already long had chemists of their own, among the names of whom are remembered with homage those of O'Sullivan, of Adrian and Horace Brown, of Heron, and of Briant, who shone among minor stars; but the majority of brewers scattered over the country had no localised scientific direction and relied upon consultants, to whom many of them were glad to send their sons to learn something of the why and wherefore of their operations. At the time of Chapman's *début* there were already several well-known chemical brewing consultants in London whose laboratories afforded facilities for such instruction, but not on quite the scholastic lines instituted by Chapman: he not only set his pupils to bench work, but regularly delivered to them formal lectures. His efforts as a teacher were successful, and the pupils who went back to the country to put in practice the principles he had taught them generally leant on him later for advice and sent others to increase the steadily lengthening list of his clients.

In due course Chapman played a prominent part in the Institute of Brewing—the large and vigorous organisation that gradually developed from the "Laboratory Club"—a pleasant little *coterie* of brewing chemists that some of our elders may perhaps still remember. Of the fully developed Institute he was President in 1911–13.

But his tastes in chemistry were catholic—as we shall presently see—and his power of directing his acumen, even at short notice, into other channels led later to his advice and help being enlisted in various other branches of chemical enterprise.

His first contribution to the *Transactions* of the Chemical Society was a description (J., 1889, **55**, 576) of a definite compound of dextrose and zinc oxide which he called "zinc dextrosate," which was followed (J., 1891, **59**, 323) by the description of similar compounds of the oxides of nickel, chromium, and iron. Later (P., 1903, 66) he obtained some, but less definite, evidence of a similar compound with alumina. His first really notable paper, however, was in the *Transactions* of 1895, p. 54, on the Essential Oil of Hops. Operating on the oil distilled from large quantities of hops, of both English and Continental growth, he showed the principal constituent to be a sesquiterpene which he called "humulene," from which he prepared a nitrosochloride and a nitrolpiperidide. In the same year (J., 1895, **67**, 780) he described the preparation of a hydrochloride of the last-named derivative and other derivatives, *viz.*, humulene nitrolbenzylamine, humulene nitrosate, and nitrosite. A further paper (J., 1903, **83**, 505) dealt with constituents of hop oil other than humulene, the principal of which he identified with myrcene previously prepared by Power from bay oil. Whilst humulene and myrcene were found to be the main constituents, minor ones were linalool and linalyl *iso*nonoate, with small quantities of a diterpene and probably traces of some ester of geraniol.

Later (J., 1928, 785) humulene again formed the subject of a paper in which Chapman defended the individuality of humulene in an account of a critical repetition of the work of Deussen, who had claimed to identify humulene with a substance, obtained from clove oil, which he had described as inactive caryophyllene. Chapman was unable to obtain satisfactory evidence of the existence of any such inactive form of caryophyllene as Deussen had conjectured, but concluded that what Deussen had indeed found was humulene itself, which Chapman, by his own work, now identified as a minor constituent of clove oil. Deussen published a reply which seemed to imply misunderstanding of the evidence adduced by Chapman, who, however, in a supplementary paper next year, reaffirmed his conclusion.

Yet another paper on the essential oil of hops (J., 1928, 1304) dealt with its constituents of higher boiling point, in which were described three thitherto unrecognised substances, *viz.*, a ketone (luparone), an unsaturated alcohol (luparenol), and a phenolic ether (luparol). The presence of *iso*valeric acid was also noticed.

Prior to this (J., 1914, **105**, 1895) the "Nitrogenous Constituents of Hops" had engaged the author's attention. Until then, apart from the mere percentage of total nitrogen, knowledge appears to have been confined to the detection by Bungener and Fries of the presence of asparagine and by Griess and Harrow of choline. Chapman's investigation, whilst confirming those findings, indicated the presence also of betaine, *l*-asparagine, aspartic acid, adenine, hypoxanthine, and traces of a volatile base that may possibly have been coniine, the presence of which had been suggested but not proved by Griessmayer as far back as 1874.

In 1896 a short paper on "Santalal and some of its derivatives," written in conjunction with H. E. Burgess, is recorded in the *Proceedings* (p. 140), establishing chemical and physical distinction between cedrene and the hydrocarbon derived by treatment of santalal with phosphorus pentoxide, thitherto supposed to be identical, and this was followed by a paper (J., 1901, **79**, 134) on santalenic acid prepared by the permanganate oxidation of sandalwood oil, a series of salts and substitution derivatives being described.

An interesting paper (J., 1913, **103**, 775) on a less organic subject was an account of an investigation into the action of tartaric acid on tin in the presence of oxygen. The indifference of tin to tartaric acid as noticed by previous observers was confirmed; but Chapman found that with access of oxygen stannous tartrate was formed which gradually dissociated into tartaric acid and stannous hydroxide, the latter compound gradually forming stannic oxide or, more probably, a hydrated sesquioxide, in a strongly coloured colloidal form separable by dialysis from the concomitant acid.

A memorable and at the time startling contribution at one of our meetings was that on "Spinacene" (J., 1917, **111**, 56), this being a new hydrocarbon obtained from certain fish-liver oils, the original paper being followed (J., 1923, **123**, 769) by another in which the study of this remarkable substance was continued. The author, in the ordinary course of analytical practice, had come across a sample of reputed cod-liver oil which was found to contain nearly 90% of a hydrocarbon oil. Inquiry showed that, although obviously not cod-liver oil, it was undoubtedly the genuine product of fish livers, namely, those of two Mediterranean fish of the shark family, *Centrophorus granulosis* and *Scymnus lichia*. The hydrocarbon appeared to be an optically inactive chain compound of a composition corresponding to $C_{30}H_{50}$, yielding on hydrogenation the saturated compound $C_{30}H_{62}$. Several derivatives throwing light on its constitution were described in the first paper. Chapman christened this new hydrocarbon "Spinacene." It transpired that, unknown to Chapman until after the presentation of his original paper to the Society, the same or a similar compound had been discovered independently by M. Tsujimoto in the livers of two Japanese fish of the same family, to which the discoverer had also assigned the formula $C_{30}H_{50}$, and to which he had given the name "Squalene." Chapman in his later paper recorded a closer study of the physical constants of the hydrocarbon and described various further derivatives, concluding that its composition was more correctly expressed by the formula $C_{29}H_{48}$, that it was closely related to the terpenes and apparently to cholesterol, also occurring in fish-liver oils, having the same number of carbon atoms and being in itself a complex terpene compound.

Chapman's lecture to the Society in March, 1917 (J., 1917, **111**, 203) on "Some Main Lines of Advance in the Domain of Modern Analytical Chemistry" will be well remembered by all who were present at its delivery. He pleaded eloquently for a better scientific recognition of this branch of chemistry, presenting his thesis in a masterly and comprehensive digest of modern progress in analytical work in inorganic, physical, organic, and biological chemistry. He deprecated the too prevalent tendency to regard analytical chemistry as merely a useful art, claiming that "so far from being the exhausted and lethargic handmaiden" of our science it was "in fact, as alive, as progressive, and as originative of research as any other branch of our science." And he made a strong plea for the establishment in our universities and colleges of professorial chairs to be specially devoted to analytical chemistry.

Chapman was also the contributor of a long list of useful papers in the *Analyst*, having early in his career closely identified himself with the work of the Society of Public Analysts, of which he was one of the honorary secretaries for many years, and President in 1915 and 1916. His contributions to the *Analyst* dealt with, among other matters, the quantitative separation of *iso*valeric and acetic acids; a method for distinguishing between the bitters of hops and quassia; apparatus for use in the analysis of essential oils; distinction by colour reaction between isomeric allyl and propenyl phenols; palladium–hydrogen as a reducing agent; the reducing action of hydrogen under a great variety of conditions; estimation of tartaric acid, of creatinine, and of hydrogen cyanide; standards for malt vinegar; adsorption as applied to the detection and separation of dyes; the examination of Chinese and Japanese wood oil; fish-liver oils; the analytical examination of nucleic acid; and the testing of foodstuffs for sulphites and other preservatives.

Amongst his many contributions to the *Analyst*, however, some call for more special mention. One was the detection and estimation of glycerol in tobacco—a problem long recognised as one attended by difficulty (*Analyst*, 1926, **51**, 382)—the method adopted by Chapman being based on final conversion of the extracted and partly purified glycerol into *iso*propyl iodide and the estimation thereof by " Zeisel."

The epidemic of arsenical beer poisoning in 1900, due to the accidental use of contaminated glucose, and the inquiry to which it gave rise, directed attention to the occurrence of thitherto unsuspected arsenical contamination in other brewing ingredients, including malt and hops. Chapman was one of the many who, for some considerable time thereafter, devoted attention to improving the delicacy of the methods for estimating small quantities of arsenic, and it is to him that analysts generally owe lasting gratitude for having finally overcome the constantly recurring troubles due to insensitive zinc in the Marsh–Berzelius process by the discovery—the fruit of much patient work by himself and his then assistant, Dr. H. D. Law (*Analyst*, 1906, **31**, 3)—that such insensitiveness could be easily corrected by coating the granulated zinc used in the hydrogen evolution flask with cadmium deposited by preliminary immersion in acidified solution of cadmium sulphate.

Another memorable paper in the *Analyst* (1926, **51**, 548) was on the " Presence of Compounds of Arsenic in Marine Crustaceans and Shell Fish." Following on earlier investigations by a Government commission in Sweden, and by H. E. Cox in this country, on the presence of arsenic in fish generally, and also on an investigation at our own Government Laboratory on oysters carried out for the Ministry of Agriculture and Fisheries, Chapman investigated a large range of crustaceans and other " shell fish " with startling results. In English oysters he found arsenic (calculated as arsenious oxide) to run up to 10 parts per million of the wet flesh, whilst in Portuguese oysters he found as much as 36 parts per million. In escallops it reached 85 p.p.m., in mussels 100 p.p.m., in lobsters from 35 to 100 p.p.m., in crabs 36 to 70 p.p.m., in prawns 40 to 174 p.p.m., in shrimps 17 to 40 p.p.m., and smaller quantities in crawfish, cockles, and periwinkles, the quantities being calculated in all cases for one million parts of the moist edible portions, the arsenic being obviously in some form of organic combination and derived from sea-water. Crustacea (crayfish) and molluscs from fresh water were found to be practically free from arsenic.

The volumes of the *Journal of the Institute of Brewing* over a period of nearly 40 years contain a long series of communications from him dealing with the composition, properties, and analysis of brewing materials, and with the various problems incidental to brewing, including changes undergone by hops during storage, and the determination of their preservative effects by biological methods in supersession of earlier methods of appraisement. He devoted much attention to the fermentative functions of yeast and allied organisms under divers conditions, and in 1920 he delivered the Cantor Lectures (Royal Society of Arts) on "Micro-organisms and some of their Industrial Uses." In these lectures and elsewhere he stressed the desirability of the foundation of a National Institute for Industrial Micro-biology, which, however, still remains in the future; and he was the author (jointly with his then assistant Mr. F. G. S. Baker) of an atlas of the *Saccharomycetes* (published by the *Brewing Trade Review*, 1905) containing more than 100 beautifully executed photomicrographs with descriptive notes, possessors of which will cherish it as an artistic memorial of the thoroughness of any work to which he put his hand.

Chapman served on the Council of our Society in 1908–10 and in 1916–19; he was President of the Institute of Chemistry from 1921–24; and President of the Royal Microscopical Society from 1924–26. He was a member of the Royal Commission on Awards to Inventors, of the Scientific Panel of the Board of Trade under the Safeguarding of Industries Act, of the Forest Products Research Board of the Department of Scientific and Industrial Research, and of the Advisory Committee on Plant and Animal Products of the Imperial Institute; and he acted as British delegate at various conferences abroad, at which his linguistic skill was an asset.

His services to science were recognised in this country by his election, in 1920, to the Fellowship of the Royal Society, and abroad by the honorary membership of the Société de Zymologie of Belgium and by an honorary Professorship of the École Supérieur de Brasserie of Ghent.

He was during most of his life constant in his attendance at the meetings of the societies in which he was interested, and his contributions to discussion of the work of others rarely failed to add to the value of the communications discussed. He had a large circle of personal friends and was constant in his friendships and always ready to give wise counsel to those who turned to him in difficulty.

He married, in 1906, Margaret, the daughter of his old friend, Mr. John Astleford of Woodview, Bournemouth, who, in her loss, has the sympathy of a wide circle of chemical friends abroad as well as at home.

BERNARD DYER.

HOLLAND CROMPTON.

HOLLAND CROMPTON, who died on December 22nd, 1931, was elected a Fellow of the Society on May 20th, 1886. He was the son of William Crompton, cotton-spinner, of Preston, and his mother was Mary, daughter of David Irvin, timber merchant of Glasgow. The greater part of Crompton's boyhood was spent in Germany; he attended the Realschule at Ziegen, Westphalia, but returned to England in 1884. Wishing to study chemistry and chemical engineering, he entered the Central Technical College, where he, one of its earliest students, studied among other things chemistry under Armstrong and electricity under Ayrton and Perry. Even at this date signs of the disease which eventually terminated his life became apparent. In 1888 he was appointed by the Council of Bedford College to take charge of the teaching of chemistry at that College, in succession to Dr. S. U. Pickering. He carried out the duties of his post single-handed until 1906, when his first assistant was appointed. During this period he designed and equipped a small laboratory, which was added to the College buildings, then situated in Baker Street. Later he designed the new laboratories in Regent's Park, which until 1930 supplied the needs of the whole of the chemistry studied at this college and now house the Department of Organic Chemistry. During the war Crompton undertook and supervised work on the preparation of β-eucaine and other materials for the Royal Society War Committee. He took this work so seriously and the assistance available was so scanty that at times he remained at his bench for 36 hours continuously. He was appointed Reader of Chemistry in 1915, and in 1919, when the department was subdivided, he became Head of the Department of Organic Chemistry and Director of the Chemical Laboratories, offices which he held until his health irretrievably failed in 1927. During the whole of the 40 years Crompton served his College his health was always poor and at times so bad that he had to cease work for long periods.

Crompton was gifted with an intellect much above the average and his interests were by no means restricted to chemistry. He was very interested in chamber music and was no mean performer on the 'cello: he was skilled with his pen, and many of his pen and ink sketches deserve a recognition which has never been publicly given to them. He was a voluminous reader and possessed an exceedingly good memory; his knowledge of English literature and particularly of the history of chemistry was both wide and profound.

Crompton was an idealist: he was a member of the Fabian Society, probably an original member, but he left the Society when its aims diverged from his ideals. He was a man of equable temperament who never showed the slightest signs of hasty judgment. As a lecturer he was clear and fluent and he was always ready to take any amount of trouble to help his students. He possessed a caustic wit and this frequently accomplished what hours of patient explanation had failed to do. With Crompton the interests of his students always came first, he was respected by all who had dealings with him, and it needed only a short acquaintance to turn respect into affection.

Despite his poor health Crompton was always engaged in research. In his earlier years he was particularly interested in the problems of physical chemistry, but later he changed over to organic chemistry. In the field of physical chemistry he published several papers in the *Journal* of the Society on latent heats of fusion and evaporation, the specific heats of gases and liquids, association of liquids, molecular rotation of optically active salts, heat of neutralisation and melting points of mixtures. There was also a long paper (J., 1897, **71**, 925) on " The Theory of Osmotic Pressure and the Hypothesis of Electrolytic Dissociation," in which he considers critically the van 't Hoff and the Arrhenius theory in relation to one another. His organic work was mainly on the halogeno- and amino-acenaphthenes and the halogen-substituted vinyl ethers. Crompton was also keenly interested in what, for want of a better name, may be termed " Astro-Chemistry." This is well shown in two privately printed pamphlets, entitled, respectively, " Nebular Zones and the Formation of Planets " (1921) and " Nebulium " (1925). The pamphlets reproduce the material of lectures given as Presidential Addresses to the Bedford College Chemical Society and both will repay re-reading, the latter particularly so. It consists of a closely reasoned survey of the evidence for and against the existence of an element of atomic weight 3, nebulium.

The nature of Crompton's published work, his encyclopædic knowledge and a familiarity with the working of his mind, gained by more than 20 years' close association, have led the writer to the opinion that, had he been in the possession of even ordinary health, work of the very first importance would have resulted from his labours. He leaves a widow and three children; two sons and a daughter, his eldest son, Mr. Geoffrey Crompton, M.A., being Science Master at Winchester.

By his passing at the comparatively early age of 65, those who knew him were deprived of a sage and willing counsellor and a loyal and steadfast friend.

JAMES F. SPENCER.

THOMAS GRAY.

THOMAS GRAY, Professor of Technical Chemistry in the Royal Technical College, Glasgow, died at Elie in Fife in his sixty-third year. For the last three years his health had not been satisfactory.

Born at Mid-Calder, Midlothian, in 1869, Thomas Gray, son of William Gray and Helen Irons Hunter, was educated at George Watson's College, Edinburgh, and in 1885 became a student in Anderson's College, now the Royal Technical College, Glasgow. It was largely due to the influence of Mr. (later Sir) George Beilby, then manager of the Oakbank Shale Works, that Gray decided to adopt chemistry as a profession. He studied chemistry under Professor Dittmar, for whom he had a great admiration both as a man and as a teacher. After the completion of his course of study, he proceeded in 1888 to the University of Jena, from which he returned in the following year to become assistant to Professor Dittmar and, later, to Professor Henderson, who succeeded Dittmar in 1892. In 1890 Gray graduated B.Sc. of London University and three years later was appointed lecturer in chemistry in evening classes under Professor Henderson at the College and also University lecturer in Chemistry in Queen Margaret College, a post which he held for ten years. During the succeeding years, he spent several periods of study at the Universities of Jena and Heidelberg and at the Zürich Polytechnic under Lunge, obtaining the Ph.D. degree of Jena, and in 1901 graduating D.Sc. of Glasgow University.

Dr. Gray had kept in close touch with chemical industries, and in 1903, after the retirement of Professor E. J. Mills, was appointed to the "Young" Chair of Technical Chemistry in the Royal Technical College, a Chair founded in 1870 by James Young ("Paraffin Young") of Kelly and Durris, the first occupant of which was Sir W. H. Perkin. Professor Gray at once commenced to develop this branch of chemistry in various directions; he installed semi-large scale chemical plant, gave instruction in fuels, on which subject he was an authority, and instituted courses on gas manufacture and gas supply and on dyeing and bleaching and on other subjects, including sugar manufacture. In his teaching of technical chemistry he always stressed the importance of a sound preliminary training in pure chemistry. On the reorganisation of the Chemistry Department in 1919, Professor Gray became Director of the School of Chemistry.

During the war Gray carried out work of national importance. He supervised the extraction of benzene and toluene at gas works in Scotland for the Department of Explosive Supplies and conducted an extensive survey of the coking and furnace coals of Scotland for the Ministry of Munitions; the latter investigation was published by the Fuel Research Board in 1930 under the title "A Survey of Scottish Coking and Furnace Coals" (T. Gray, T. H. P. Heriot, and W. J. Skilling).

For many years Sir George Beilby had been impressed with the desirability of establishing a national institution for fuel research. On the inception of the Fuel Research Board, he was appointed Director. Having been closely associated with Gray and his work, Beilby in 1918 invited him to assist in the design of the Fuel Research Station at East Greenwich. Holding the post of Superintendent of the Laboratories, Gray supervised the design and erection of the station laboratories, collected the nucleus of chemists from which the staff could be formed, and initiated the experimental work of the station, including the large-scale experimental work on the high temperature and the low temperature carbonisation of coal. In the autumn of 1920, Gray, owing to the pressure of academic duties, relinquished the post as Superintendent and was appointed consultant to the Board, a position which he held for three years; in 1930 he became a member of the Board. He was also Chairman of the Committee on Sampling and Analysis of Coal appointed by the Board. On the formation of the Scottish Coal Survey Committee he became Chemical Adviser; he was also a member of the Scottish Coke Research Committee.

For many years Gray had sought to interest the shale oil companies in chemical research in connexion with their problems and the Scottish Shale Oil Scientific and Industrial Research Association was ultimately established in 1921. As Director of Research, Gray supervised extensive investigations carried out for some years in the Royal Technical College on problems connected with this industry, such as a study of retorting conditions and temperature, an investigation of the substances causing the characteristic odour of certain shale products, and the cracking of shale oils.

In addition to his other work Gray served on a number of technical committees and was on the examination board of a number of institutions. For ten years (1896–1906) he was secretary and then chairman of the Scottish section of the Society of Chemical Industry; he was a Fellow of the Institute of Chemistry and had served on the Council. He had been a life Fellow of our Society since 1892. The many and important services rendered by Gray were recognised by the conferment of the honorary degree of LL.D. by the University of Glasgow in 1924.

Much of Gray's work was never published; his interest lay in solving a problem rather than in publishing the results. His publications appeared in the *Journals* of our Society, the Society of Chemical Industry, and the German Chemical Society, *Gas Lighting and Gas World*, in the *Transactions of the Institution of Mining Engineers*, and the *Transactions of the Institution of Engineers and Shipbuilders in Scotland.* His earlier research work in organic chemistry was influenced by his association with Knorr, and a little later in conjunction with Professor Henderson he carried out investigations in the terpene group. Subsequently his publications were of a more technical character, dealing chiefly with the composition of air in mines, fire-damp, combustion, fuels, the distillation of coal, and the composition of shale oil. In a paper in the *Journal of Gas Lighting* in 1916 he pointed out, as a warning to gas producers, the possibility of a glut of synthetic ammonia after the war. His last three publications, in conjunction with Dr. J. R. Campbell, appeared in the *Journal of the Society of Chemical Industry* in 1930 and dealt with the combustion of methane by copper oxide and the influence of various catalysts on the combustion and also the combustion of various gases by copper oxide and other oxidising agents. The three last-named investigations, carried out with careful control of temperature and rate of gas flow, are of valuable practical importance.

Trained in the painstaking analytical school of Dittmar, Gray was an extremely neat and accurate worker and viewed with disgust anything slipshod in method, apparatus, or acceptance of results. An expert in the art of glass-blowing, he showed great ingenuity in designing apparatus, generally from the simplest materials, for the particular purpose he had in view; as examples might be mentioned an automatic gas-sampling apparatus (*J. Soc. Chem. Ind.*, 1913, **32**, 1092), an apparatus for delivering gas at constant pressure (*ibid.*, 1928, **47**, 187T) and, in conjunction with Dr. J. G. King, the " Gray–King " apparatus, as used at the Fuel Research Station for the laboratory assay of coal. An excellent teacher and a very clear lecturer, he was much esteemed by staff and students; it was characteristic of him that he never spared himself in anything he undertook.

Professor Gray married Violet Irene, daughter of Mr. R. A. Warren, of Liverpool, and is survived by her and two daughters. Both he and Mrs. Gray took their full share in the social and other activities of the College. One of his brothers was the late James Hunter Gray, K.C., the well-known authority on patent law.

Owing to his scientific knowledge, the possession of a very acute and logical mind, and an equable temperament, Professor Gray was much in request as an expert in legal cases. As an intimate friend of his has put it, " He was cool in judgment, honest as the day, charitable in his views, very practical in his scientific outlook, and hated shams of any kind."

In his younger days Gray was a keen walker and swimmer, but throughout his life his chief recreation was golf; he was a well-known figure at matches between staff and students and on the links of his beloved Elie, a pretty seaside resort where he had spent his vacations for many years. For some time he was captain of the Elie Golf Club, and as usual he took his duties seriously and effected many improvements. Until the last few years he enjoyed excellent health, his long illness was patiently borne, and he remained cheerful and maintained his interests until the end.

F. J. WILSON.

JOHN ALBERT HALL.

JOHN ALBERT HALL died at Esquimalt in British Columbia on May 18th, 1932, at the age of 63, after a long and painful illness. Although resident for many years in British Columbia, he lived in this country during the war and was well known as an enthusiastic worker and genial companion. His death will be much regretted by all his co-workers.

Hall was born in Manchester on August 24th, 1868, and studied at Owens College. He graduated with distinction in 1888, and then took up a post with the Clayton Aniline Co., where he remained until 1893. During this time he received the degree of M.Sc.

In 1893, he and two other venturesome spirits decided to start a chemical factory in British Columbia, where acids were required for other industries. This appears to have been very successful, and after a few years, Hall and one of his companions started the "Victoria Chemical Company," which also had a successful career and was ultimately absorbed into "Canadian Explosives." Hall continued his connexion with this for some years in the capacity of chief research chemist and then retired to his private laboratory on the outskirts of Victoria.

In 1900 Col. Hall entered upon his military activities as a junior officer in the Fifth Regiment and quickly rose to the top. In 1905 he was gazetted commanding officer of the regiment, and held this command until, in 1908, he retired to organise the 88th Fusiliers. In 1913 he was placed in command of the Civil Aid Forces raised to quell the rioting among colliery workers in the coal-mining areas of Vancouver Island, and made his headquarters at Nanaimo.

At the outbreak of war in 1914, Col. Hall became very active in organising recruits, and early in 1915 went overseas in command of the 30th Battalion, with which was incorporated the 88th Fusiliers. After a short period in France he was recalled by the War Office for special duty in connection with the manufacture of munitions.

In 1919 he received the honorary degree of D.Sc. of the Victoria University of Manchester. He retired to British Columbia after the war and worked in his private laboratory, but several times "threatened," in his impulsive and outspoken way, to come back to England and help to "clear up the mess."

Hall's earliest researches on salts of phosphoric, arsenic, and vanadic acids and on esters of vanadic acid were published in the *Transactions* for 1887. During his period of occupation at the Clayton Aniline Co. his name appears in patents for improvements in dye manufacture and his subsequent work was mainly industrial, dealing with such subjects as absorption towers for nitric acid. On his retirement he reverted to pure research, but little if any of this was published. He was a Fellow of the Chemical Society from 1889 until the date of his death.

R. C. FARMER.

JAMES WALLACE WALKER.

JAMES WALLACE WALKER, a native of Blebo Craigs, matriculated in the University of St. Andrews in 1883. The curriculum for the M.A. degree in those days was rigid, some knowledge of Latin, Greek, Mathematics, Natural Philosophy, Logic, Moral Philosophy, and English being compulsory, and there were no soft options. Not every one of those subjects was congenial to Walker, and this doubtless explains why for no less than six years he wore the scarlet gown of the undergraduate. This was far from being a disadvantage, for it laid within him a sound foundation for a lasting appreciation of much that is beautiful in literature and philosophy, and at the same time developed the intellectual independence which enabled him to deviate from the beaten track. Thus, perhaps more by accident than by design, he took Purdie's lectures in Chemistry, and in due course became lecture assistant, was initiated into research, and eventually left for Germany with an "1851." Since both Purdie in St. Andrews and Percy Frankland in Dundee had been pupils of Wislicenus, the choice of the laboratory of this master of organic synthesis can readily be understood. But of the two stars who adorned the Leipzig school of Chemistry in 1892 it was Ostwald rather than Wislicenus who made the greater appeal to him. With the advent of the ionic theory a new era had already dawned for Physical Chemistry, and the inspiration of Ostwald is clearly reflected in the whole trend of Walker's subsequent work.

He returned to St. Andrews to act as private assistant to Purdie for over a year before he took his Doctorate in Leipzig in 1896. The next two years were spent on the teaching staff of University College, London. The story of those thrilling times has been graphically told by Travers in his book, " The Discovery of the Rare Gases," where reference is made to the small part incidentally played by Walker in the detection of krypton and neon. In 1898 came the appointment to the MacDonald Professorship of Chemistry in the University of McGill, Montreal, and Canada was indeed fortunate in securing the services of a man who brought with him from overseas something of the spirit of research of the Old World.

In McGill the administration of a large department was in itself no easy task, and Walker's energies were largely devoted to teaching, where he never ceased to emphasise the importance for the undergraduate of an adequate training in Physical Chemistry. At the same time he did not permit himself to be submerged in routine, and the series of papers which emanated from his laboratory provides evidence of a well-sustained interest in research. Then came the tragedy when, some 15 years ago, he felt himself obliged to retire from duty owing to defective eyesight, his chemical career thus terminating abruptly just at a time when so much more might have been expected from him. In his affliction the call back to Scotland was strong, and he spent his last years at Bridge of Allan, where he passed away suddenly on the 8th of June, 1932. He is survived by Mrs. Walker, a daughter of the late Rev. J. B. Irvine, of Strathkinness Free Church.

Walker was fortunate in being associated with Purdie in the pioneering work of the latter in Stereochemistry. The resolution of lactic acid by means of strychnine was first described, and the two authors succeeded in isolating the acid identical with sarcolactic acid, and also the enantiomorphous lævo-form, identical with that found by Schardinger from the bacterial decomposition of sucrose. Walker also took a share in elaborating the resolution of lactic acid by the addition of a nucleus of (+) or (−) zinc ammonium lactate to a supersaturated solution of the inactive double salt, a method which is rarely applicable for the preparation of optically active compounds but still remains the most practical for the preparation of the active lactic acids in quantity. The influence of dilution on the rotations of solutions of metallic lactates was also studied. In the same period the resolution of ethoxysuccinic acid by *Penicillium glaucum* and by cinchonidine was carried out with the objective of testing Guye's theory where the influence on optical activity of the radicals attached to an asymmetric carbon atom was supposed to depend chiefly on their respective masses. It was, however, found impossible to reconcile Guye's theory with the high rotatory powers of the alkoxysuccinic acids. Walker's subsequent independent work in St. Andrews on the esters of optically active lactic, chloropropionic, and bromopropionic acids with reference to Guye's theory led him into paths more tangled than was realised at the time. For one reason, the active ethyl lactates, prepared from the optically pure (+) and (−) lactic acids by the silver salt method, were not optically pure, as Walker naturally thought they were; the rotations were too high, the esters being contaminated with small amounts of the highly active alkoxypropionates. Moreover, Walker failed to realise that the action of phosphorus pentachloride or pentabromide on active lactic esters is accompanied by considerable displacement racemisation. The work, however, was useful inasmuch as it proved that a change of sign of rotation took place when the hydroxy-group in the lactates was displaced by halogen, an observation which was utilised later by Purdie and Williamson for the interconversion of the optically active lactic acids by the Walden inversion.

It would be out of place here to trace the various stages which led Purdie to discover the silver oxide method of methylation. Meanwhile let it suffice to recall the fact that Walker's experiments on lactic esters laid the foundation for the discovery of a reaction which has been of immense value in the modern developments of carbohydrate chemistry.

A study made by Ostwald of the interaction of bromic and hydriodic acids suggested to Walker the investigation of the reduction of bromic acid by hydrobromic acid. Velocity measurements indicated that the action could be split up into three phases :

$$\begin{aligned} HBr + HBrO_3 &= HBrO + HBrO_2 \\ HBr + HBrO &= H_2O + Br_2 \\ 3HBr + HBrO_2 &= 2H_2O + 2Br_2, \end{aligned}$$

the velocity being directly proportional to the concentrations of the bromate and bromide ions, and proportional to the square of the concentration of the hydrogen ions.

Walker's contributions to the stereochemistry of amygdalin are important in connexion with racemisation phenomena. He showed that amygdalin undergoes catalytic racemisation in aqueous solution in the presence of a small amount of baryta, the racemisation occurring at the (+) mandelonitrile complex of the glucoside. Moreover, the swing round of this (+) complex may even go so far as to give a preponderance of a glucoside with a (−) mandelonitrile complex. According to the conditions under which the racemisation was effected, it was thus possible to obtain a lævorotatory, a racemic, or a dextrorotatory mandelic acid by hydrolysing the product and splitting off the gentiobiose residue. The course of the decomposition of amygdalin was also shown to be different according as concentrated or weak hydrochloric acid was employed as the hydrolyst. With the concentrated acid the first point of attack is the nitrile group, which is hydrolysed to carboxyl, the elimination of glucose taking place subsequently, whilst with dilute hydrochloric acid the gentiobiose section is first attacked (Caldwell) with the formation of Fischer's glucoside of (+) mandelonitrile. Walker's experiments were suggestive to other authors such as Tutin, Dakin, Krieble, whilst recently Isobel Smith has isolated the crystalline optically pure (+) mandelonitrile, and studied the asymmetric catalytic racemisation of amygdalin effected by a trace of sodium methoxide.

In a paper on ionisation and chemical combination, Walker showed that, by the addition of aluminium chloride, representatives of alkyl halides and aromatic hydrocarbons which so far had been regarded as media incapable of sharing directly in the production of ions became good conductors. The conductivity was traced to the formation of compounds, the comparative stability of which in the Friedel–Crafts reaction being evidenced by the fact that very little acid was evolved until the concentration of the aluminium chloride passed a certain value. A subsequent research with McIntosh and Archibald on ionisation and chemical combination in the liquefied hydrogen halides and hydrogen sulphide lent support to the view, expressed in the previous paper, that ionisation is subsequent to chemical combination with the solvent and that, at least in some instances, the latter phenomenon is to be ascribed to potential valency. The conclusion, made so far back as 1904, that combination with the solvent is the necessary precursor of ionisation, although such combination does not necessitate ionisation, is interesting.

Other investigations dealt with compounds of aluminium chloride with organic substances containing oxygen, most of those compounds containing one molecular proportion of aluminium chloride. The iodides of copper, the interaction of alcohols and phosphorus halides, and the electrical conductivities of some salt solutions in acetamide were also studied.

Wallace Walker was held in great affection by many, and especially by those younger men who were privileged to gain his confidence and were influenced by his idealistic outlook. The memory of this gentle friend will ever be fondly cherished by the writer.

ALEX. MCKENZIE.

CHARLES EDWARD WHITELEY.

CHARLES EDWARD WHITELEY was born in Leeds on January 29th, 1880. As a pupil at the Leeds Central Higher Grade School he showed a partiality for the physical sciences, and the further study of chemistry was his primary object when in 1896 he was admitted to the Yorkshire College. His undergraduate record was exceptionally brilliant and after proceeding to the B.Sc. degree, in which he was awarded First Class Honours, he was invited to collaborate with Professor J. B. Cohen in a series of experiments on the production of optically active from inactive substances. These experiments (J., 1901, **79**, 1305), although they did not lead to the desired result, represent in all probability the first systematic attack on the problem of asymmetric synthesis. In this work Whiteley's capacity as an experimental chemist was established on a firm basis and his nomination to an 1851 Exhibition Scholarship was definitely assured, but for personal reasons he declined this distinction.

In 1902 he was appointed to a Demonstratorship in Chemistry at the Yorkshire College and for several years rendered admirable service to the Department. During this period he was associated with Professor Arthur Smithells in the investigation of the equilibrium of the gases in the divided flames produced by the combustion of ethylene in air and showed not only remarkable ingenuity in the design and elaboration of the apparatus but meticulous care in the conduct of the work.

His connection with the University ended in 1907 when he was appointed chief chemist to Messrs. G. Bray & Co. Ltd., who as gas-lighting engineers were at the time mainly concerned with the manufacture of gas burners. In later years the firm's activities were extended to the production of incandescent mantles and still more recently to the manufacture of refractory materials and units for the electrical heating industry. For twenty-five years, the chemical, physical, and engineering problems involved in these developments provided Whiteley with ample scope for the application of his sound scientific knowledge and fertile resource and these were devoted unsparingly to the service of his employers.

His professional work left him little time for diversion, but he developed a keen interest in the phonetic problems presented by various modern languages, and by way of physical exercise and refreshment he not infrequently tramped the Yorkshire moors, which were a great joy to him.

When 35–40 years old, Whiteley's activities were severely restricted by ill-health, and although he appeared to make a complete recovery, it seems probable that the spinal trouble, from which he suffered in early childhood, had a marked influence on his outlook on life in later years. Social engagements had no attraction for him, and formalities of all kinds were distasteful to his nature. No one could fail to realise that he was inspired by great qualities of heart and lofty eagerness, and those who saw him at work knew full well how strong and pervading was the influence of his personality. He desired to see men and things as they really are, and to have the affairs of everyday life conducted in accordance with his own idealistic views, which at times were somewhat disconcerting to those who most completely appreciated his sterling qualities.

Whiteley was unmarried and his death took place on September 26th, 1932, at Weeton, near Leeds. H. M. DAWSON.

WINIFRED MARY WRIGHT.

THE death at an early age of Winifred Mary Wright removes from our midst one whose work by determination, both in respect to accuracy of manipulation and clear thinking, gave all promise of forming a valuable contribution to our science.

Freda Wright came up to Girton College, Cambridge, in 1920, from a school where the facilities for teaching science were not very good, with no more than a keen interest in science. She took Part I of the Tripos in 1922 and Part II in 1924. The double third was a great disappointment to her and precluded her following her main interest, research in biochemistry, but her keenness to do research work found her a place in the Department of Physical Chemistry, Cambridge. With her biochemical leanings she had been much interested in Warburg's work on oxidative reactions taking place at the surface of moist charcoal and the alleged inactivity of such in the absence of traces of iron. Methods of preparation of charcoals of different catalytic activities were worked out and the relative active areas as well as the specific activities of the various active areas, both those containing iron and nitrogen and those free from these substances, were investigated by methods of selective poisoning, the results of which were communicated in a series of papers in the *Journal*. The successful development of her work obtained for her an Alfred Yarrow Studentship, which was renewed for two years in succession.

Miss Wright then worked for a year under the direction of Professor Freundlich in Berlin, where she investigated the influence of silver salts on the catalytic decomposition of hydrogen peroxide in glass vessels, work which was described in the *Zeitschrift für Elektro-*

chemie and extended more elaborately in the *Transactions of the Faraday Society*. On her return from Berlin she reverted to her interest in oxidative reactions at charcoal surfaces, investigating the relationship between the electrokinetic potentials and the rates of oxidation of various organic acids. She was awarded the Ph.D. degree in 1928, worked successfully for a year as assistant to Dr. C. G. L. Wolf in the Biochemical Laboratory of Addenbrooke's Hospital at Cambridge, presenting two papers on the serological diagnosis of cancer, and eventually obtained a post in the Department of Pharmacology at University College, London, where she commenced investigations on the evaluation of anæsthetic values, which formed the subject matter of several scientific communications. At this period she began to feel the lack of a truly biological background and decided to come up to Cambridge for the Long Vacation to work at anatomy in preparation for her second M.B. A few days before the Long she had a breakdown and was ordered complete rest.

Serious overwork terminated the life of one who, although working all day, found time in the evening to take classes of small children and participate in the activities of the International Students' Union, was always cheerful, and was a loyal unselfish friend.

ERIC K. RIDEAL.