OBITUARY NOTICES

ERNEST GOULDING.

1870—1938.

DR. GOULDING died in London on February 15th, 1938, after an operation. He was born in London, and educated at Tollington Park College. After serving an apprenticeship in the Moorgate Street pharmacy of Mr. J. M. Wyborn, F.C.S., he was a successful candidate for a Jacob Bell Scholarship and in 1892 entered the Pharmaceutical Society's College, where he acquired his diploma as a pharmaceutical chemist in the following year. He matriculated at London University in 1894, took his B.Sc. degree in 1898 and the D.Sc. degree in 1903. He became an Associate of the Institute of Chemistry in 1899 and a Fellow in 1902. At his death he had been a Fellow of our Society for 40 years. He served as an abstractor from 1900—1918.

Goulding began research work in the Pharmaceutical Society's Research Laboratories in 1893 and remained there until 1896, when he joined the staff of the Scientific and Technical Department of the Imperial Institute, under the direction of Professor (now Sir) Wyndham Dunstan, with whom he published nine papers in the *Proceedings* or *Transactions* of the Chemical Society during the period 1894—1901. Seven of these dealt with derivatives of hydroxylamine and established a number of interesting points. Among these mention may be made of the preparation of the first amine oxide, *viz.*, trimethylamine oxide, which in recent years has acquired biological interest as a product of animal metabolism, and is of special importance as the prototype of a group of substances which undergo reactions of peculiar chemical interest. An outstanding example of their application is Haworth and Perkin's oxidation of anhydromethylcanadine to the amine oxide and isomerisation of the latter to β-homochelidonine, a process subsequently applied by the same authors to the synthesis of the allied alkaloids cryptopine and protopine. Goulding was also associated with Dunstan in determining the constitution of methazonic acid and in work on the mechanism of the formation of *iso*oxazoles by the action of alkalis on nitroparaffins.

Like all his colleagues, Goulding gradually became immersed in the main task of the Imperial Institute, which was to make itself a centre of information regarding the raw materials of the Empire. He specialised at first on plants yielding essential oils, on which he published a series of papers beginning with his thesis on the oil of *Cinnamomum pedatinervium* bark in 1903. He was also responsible with Mr. F. W. Barwick for work on textile fibres and it was this subject which occupied the rest of his working life. From 1903 onwards hundreds of samples of cotton from British Tropical Dependencies were examined as a result of pioneer efforts to establish an Imperial supply of this raw material, of a quality suitable for use in this country. After the war there was less demand from the Institute for work on cotton owing to the installation of the magnificently equipped Shirley Institute by the British Cotton Industry Research Association in 1919, and the establishment two years later of the Empire Cotton Growing Corporation.

It was also Goulding's duty to deal with long fibres such as flax, jute, hemps of various kinds, and similar materials used for coarse textiles and cordage and after 1919 he was chiefly concerned with products of this kind and acted as Secretary of the Vegetable Fibres Committee of the Imperial Institute.

Goulding was of a singularly modest disposition and never made any parade of his remarkable fund of information on fibres, and it was a source of satisfaction to his friends that in 1936, shortly after his retirement from his post as Vice-Principal (Investigations) of the Plant and Animal Products Department of the Imperial Institute, he was invited to give the Mather Lecture of the Textile Institute and selected as his subject " Textile Fibres of Vegetable Origin : Forty Years of Investigation at the Imperial Institute." The lecture was published in the quarterly *Bulletin of the Imperial Institute* and gives an admirable summary of the large amount of work accomplished from 1896—1936, of which details will be found in the numerous reports published in the same *Bulletin* from 1903 onwards.

He found time to take an interest in Esperanto and to cultivate a taste for music, especially church music. He was a staunch Churchman all his life and for more than a quarter of a century served as Vicar's Warden at St. Cuthberts, Chitts Hill, and as a Lay Reader for almost as long, and it was characteristic of him to end his Mather lecture with a quotation from the Gospel of St. John.

Goulding will be best remembered by his colleagues and the numerous friends he made among colonial technical officials, for his cheerful outlook on life and his unfailing courtesy. No matter how busy he might be he was always ready to deal with enquirers, and only those who have done duty in any kind of institution functioning as a place of public enquiry know how trying some seekers after truth can be.

Goulding was married twice; in 1905 to Charlotte, daughter of the late William Larney of Finsbury Park, who died in 1907, and in 1909 to Kathleen Irvine, elder daughter of Nathaniel Irvine Hawkes of Crich, Derbyshire, who survives him with an only son.

T. A. HENRY.

CEDRIC WILLIAM JACOB.

1889—1937.

CAPTAIN C. W. JACOB died at his home, Merle Dene, Bidston, on October 15th, 1937, at the age of 48. The son of the late Alderman A. E. Jacob, a former M.P. for a Liverpool division, he was a Director of W. and R. Jacob and Co. Ltd., Dublin, of W. and R. Jacob and Co. (Liverpool) Ltd., and of the Liverpool Gas Company. He was well known in Liverpool public life, being a Trustee of the Bluecoat School, a Vice President of the Union of Manufacturers, and President of the Shipping Football League.

Jacob was born in Liverpool, and was educated at Clifton College, and Göttingen University, where he studied chemistry. After world-wide travels, he served in the war with the 12th Battalion of the King's (Liverpool) Regiment, and was awarded the French Medal of Honour. When invalided from his battalion, he was transferred to Head-Quarters Staff as a liaison officer, where his knowledge of European languages proved of great value.

His post-war energies were directed chiefly to the welfare of ex-servicemen and to the re-organisation and expansion of the Liverpool Factory of his Company. Here, his technical knowledge, shrewd appreciation of the nature of manufacturing problems, sound commercial judgment, capacity for staff control, and habit of quick decision led to great advances in technique and output. From his visits to the United States and to the Continent he brought back much that was new in machinery and method.

He leaves a widow, a son, and three daughters. His wide circle of friends will long remember his great qualities and immense capacity for friendship. F. S. THURSTON.

WILLIAM JAGO.

1853—1938.

WILLIAM JAGO, doyen of cereal chemistry, died at Hove on March 28th, 1938, aged 85, after an outstanding career largely devoted to the application of chemistry to industry. He had survived the majority of his famous contemporaries, but to the end he was vigorous and continued to take a keen interest both in professional matters and in the municipal affairs of Hove.

Jago was born in Cornwall and was educated at Truro School. Later he proceeded to the Royal College of Chemistry and the Royal School of Mines, where he studied under Edward Frankland. One of his early posts was that of Headmaster of the School of Science, Brighton, and shortly after this he interested himself first with scientific problems connected with brewing and then with the chemistry of breadmaking. It was in the latter field that he became well known, although many of the older chemists will recall that their introduction to the subject of chemistry was from Jago's popular textbooks on Elementary and Advanced Inorganic Chemistry. Jago's "little red book" was a recognised text-book for teaching chemistry in many schools.

Cereal chemistry owes a great deal to him, and his work is quoted and will be quoted for years to come the world over by all those who are studying cereal problems. His first book on this subject "The Chemistry of Wheat, Flour and Bread," was published in 1886, but his main work was the "Technology of Bread-Making," 1911, which he wrote jointly with his son, William Claude Jago. He, probably more than anyone else, was responsible for the proper application of science to breadmaking and a great deal of the research work which is still being done is really only a direct continuation of the work commenced by him.

As an expert witness, Jago attained some reputation in the courts, but he was not satisfied with this and he studied for and was called to the Bar in 1904. In 1909, he published a further work entitled "Forensic Chemistry and Chemical Evidence."

Besides these striking achievements in the world of science, Jago found time to interest himself in the municipal affairs of Hove. He was, for many years, an important member of Hove Borough Council and was Mayor from 1922 to 1925. While many in Hove may know little of his scientific achievements, they appreciated the work Alderman Jago did for their home town.

In view of these attainments it is not surprising that Jago had an outstanding personality. Although he always held definite views and was a determined opponent, he had that cheerful type of personality which endeared him to all with whom he came into contact. The writer, who was in touch with him for a long period, can testify to the help and kindness he gave to all of the rising generation of chemists whom he met.

His death has been regretted by numerous friends throughout the world, as is instanced by a large number of letters which have been received by those who were associated with him. He remained vigorous to the end and it is some consolation to know that he passed away quietly in his sleep. His name and work, especially that connected with the bread-making industry, will be remembered with appreciation for generations.

He was elected a Fellow of the Chemical Society on May 16th, 1878.

D. W. KENT-JONES.

ARTHUR PEARSON LUFF.

1856—1938.

THE announcement of the death of Dr. A. P. Luff on May 1st, 1938, at the age of 82 was received with great sorrow and regret by his many friends and former colleagues and pupils.

Luff had a unique and distinguished career. Before taking up the career of medicine, which was his ultimate ambition, he had the great advantage of a sound preliminary training in science and pharmacy and was well known as an accomplished lecturer and research worker in chemistry. He was a student of the Royal College of Science and obtained the B.Sc.Lond. in 1883.

Luff, in 1873, gained the Jacob Bell Memorial Scholarship of the Pharmaceutical Society of Great Britain and from this time up to gaining his medical qualification in 1886 was actively engaged in teaching and research in chemistry and pharmacology.

He was elected a Fellow of the Chemical Society on February 15th, 1877, and published several research papers in the *Journal* of the Society, amongst which was an important joint contribution with the late Professor C. R. Alder Wright, F.R.S., on the constitution of morphine and its derivatives. For his researches in pharmacology he was awarded the Pereira Medal of the Pharmaceutical Society.

In 1883 Luff joined St. Mary's Hospital Medical School. His student career was distinguished by the gaining of an Entrance Science Scholarship and many of the School prizes, and at the University of London M.B. Examinations he obtained honours in medicine, forensic medicine, physiology, organic chemistry, and materia medica.

He passed the L.S.A. and M.R.C.S.Eng. in 1886 and the M.B.Lond. in 1887. His great abilities were immediately recognised by the Staff of St. Mary's Hospital Medical School, for Luff had the unprecedented distinction of being appointed Lecturer in Forensic

Medicine and Toxicology in 1887, in the same year as taking his M.B. degree. He held this post until 1908. In 1890 he succeeded the late Sir Shirley Murphy as Lecturer on Hygiene and Public Health and filled this post for 12 years.

Luff was undoubtedly one of the most brilliant lecturers of his day on these subjects. The material of the lecture was most carefully selected from the point of view of its practical importance, so that the ground was covered in the relatively short course allotted to these subjects. The essentials of forensic medicine and hygiene were so clearly expounded and illustrated by diagrams and specimens that students obtained a sound knowledge of the subject quite apart from any reference to text books.

Luff published an excellent " Manual of Chemistry for Medical Students," which was very popular and has gone through many editions. His text book on forensic medicine (2 vols.), like his lectures, a clearly and concisely expounded and admirably illustrated work, was in popular use by students for many years.

Luff did yeoman service to St. Mary's Hospital Medical School in those years before Government aid was granted to medical education and when the schools were largely dependent on the voluntary efforts of members of the Hospital Staffs.

Luff was appointed Physician to Out-Patients in 1890 and in 1905 became full Physician, retiring in 1913.

He was elected F.R.C.P.(Lond.) in 1896 and in 1897 was appointed Goulstonian Lecturer. In 1898 he published " Gout, its Pathology and Treatment," a book which for some years had a wide circulation on account of its valuable assistance to medical practitioners, and which contained the subject matter of his Goulstonian lectures.

Luff in his medical practice specialised on gout and rheumatic diseases. His great practical knowledge of therapeutics enabled him to deal effectively with those painful conditions, so that he established a great reputation and his advice and help were much sought after by medical practitioners. He had for many years a very large consulting practice, and he possessed in a remarkable degree the faculty of establishing the confidence and appreciation of his patients, who loyally sought his advice until his retirement.

Luff published many papers on gout and rheumatic conditions and was one of the first to call the attention of the medical profession to the many manifestations of the conditions allied to rheumatism which are classified under the term " fibrositis." In 1913 he gave the Harveian Lecture to the Harveian Society of London on " The Various Forms of Fibrositis and their Treatment."

Luff's special scientific attainments in analytical chemistry and toxicology were recognised by the Home Office, from whom he held the appointment of Scientific Analyst from 1892—1908. During this period he was colleague of that great toxicologist, the late Sir Thomas Stevenson, and he played a prominent part in many noted criminal poisoning cases, the last one in which he gave evidence being the Crippen case.

In the beer poisoning epidemic in the North of England in 1900, which was found to be due to arsenical poisoning, Luff, in conjunction with Sir Thomas Stevenson and Prof. Dixon Mann, played an important part in the investigation of the cause of the epidemic.

Luff was much sought after in medico-legal cases, both civil and criminal. His capacity of clear exposition and imperturbability, and knowledge of legal procedure made him a powerful and excellent witness whose evidence always carried great weight.

Luff performed so many important public duties that it is impossible to mention more than a very few. He was a member of the " Departmental Committee on Preservatives and Colouring Matter in Foods " in 1923. He was Examiner in Forensic Medicine and Public Health at various times for the University of London, the Royal College of Physicians and the Victoria University.

He was a member of the committee on " The Cause and Treatment of Arthritis and Allied Conditions " of the British Medical Association (1931—1933). He retained his interest in medicine after his retirement and during the last ten years acted as Honorary Director of Collective Investigation for the British Medical Association, carrying out valuable statistical work on varicose ulceration, gastro-enterostomy operations, and cancer of the breast, etc.

During the War Luff was attached as Lieut.-Col. R.A.M.C.(T.) to the 3rd London General

Hospital, and performed his military duties with that conscientious carefulness, ability and punctuality which were characteristic of him throughout his civil career. He was mentioned in dispatches and awarded the C.B.E.

Luff married in 1893 Miss Amy A. Leon, who always keenly co-operated with him in his devoted work and support of St. Mary's Hospital.

The deep sympathy of his many friends and colleagues is tendered towards Mrs. Luff, her son, and her daughter, Dr. Mary Luff. WILLIAM HENRY WILLCOX.

JAMES ERNEST MARSH.

1860—1938.

BY the death of James Ernest Marsh on April 15th, 1938, the Chemical Society lost one of its older Fellows, for he was elected on February 15th, 1883. The announcement of his death would be read with real sorrow by many old friends, and the large number of medical students who passed through his classes in organic chemistry and materia medica will recall with sadness his dapper figure, immaculately dressed, and his smiling, courteous manner.

Marsh was born on July 5th, 1860, and was a son of John Marsh, J.P., and Charlotte Marsh of " Rann Lea ", Rainhill, Lancashire. He was educated at Rugby, where he gained a scholarship, and subsequently at Balliol College, Oxford, under the late Professor H. B. Dixon, F.R.S., from 1879—1882. Marsh came out Head of his year and was placed in the first class in the Final Honours Schools. He took his B.A. degree in 1882 and his M.A. in 1891. After taking his degree in Oxford, he spent a year (1882—1883) in Professor Kekulé's laboratory in Bonn. Subsequently, in 1893, he spent a year in Paris, partly in the laboratory of Professor Friedel, studying materia medica, during which period the writer deputised for him in Oxford. Marsh's first appointment was that of science master at Exeter School, but at the beginning of the Michaelmas term 1885, he was appointed by Professor Odling a Demonstrator in the University Museum, a status he enjoyed until his retirement in 1930. During the period 1893—1897 he held, in addition to his demonstratorship, the post of Lecturer in materia medica, succeeding Professor W. R. Dunstan, F.R.S. This lectureship was abolished owing to changes in the medical curriculum. Marsh was elected a Fellow of Merton College in 1906, a Fellowship which he held until his retirement. He was also Lecturer and Tutor of Exeter College. In 1906 Marsh was elected a Fellow of the Royal Society. During his academic career Marsh acted from time to time as examiner in the Final Honours School of Natural Sciences, and in various medical examinations of the London University.

On September 25th, 1903, he married Lavinia, daughter of Mr. J. E. Painton, by whom he had five daughters, and who survives him.

After his appointment as Demonstrator of organic chemistry at the Museum, Oxford, Marsh devoted his energies to teaching and research. A man of original mind, he seems to have preferred pioneer work in more or less new fields.

His first paper, with Odling, on some zenoene or diphenyl products and their reactions was published in the *British Association Reports* for 1887. In 1889 he wrote in the *Philosophical Magazine* on van 't Hoff's hypothesis and the constitution of benzene. Marsh was evidently much interested in this (then) new development of chemical theory, for it influenced much of his subsequent work. In 1889 (J., **75**, 656) G. J. Burch and J. E. Marsh published a preliminary paper on " Dissociation of amine vapours ", dealing with the valency of nitrogen and the possibility of stereoisomerism due to nitrogen, but this physical work was not continued.

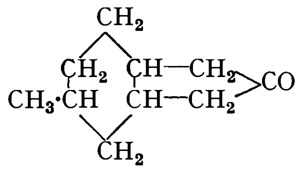
Marsh's first important paper was published in the *Proc. Roy. Soc.*, 1889/90, **47**, 6, entitled " Researches on the chemistry of the camphoric acids." In this he described the preparation of camphoryl chloride from ordinary *d*-camphoric acid. This on treatment with water produced camphoric anhydride and a new acid, *l*-camphoric acid, m. p. 170°

and $[\alpha]_D$ — 48·09.° This *l*-acid formed no anhydride and was unaffected by treatment with acetyl chloride, whereas the dextro-acid was quantitatively converted into the anhydride. On distillation this lævo-acid was partially converted into the anhydride of the dextro-acid. It was different from the lævo-acid obtained by Chautard by the oxidation of *l*-camphor, which corresponded in every respect, except rotation, with *d*-camphoric acid. When concentrated alcoholic solutions of the two were mixed, a precipitation of crystals and a rise in temperature took place. This did not happen with Marsh's acid. Marsh regarded his lævo-acid as of the type of fumaric acid or *trans*-, while the other two acids are of the maleic acid or *cis*-type. He predicted the existence of a second dextro-acid of a *trans*-type. He described the inactive acid formed by mixing the two *cis*-acids and predicted another obtainable by mixing his new lævo-acid with the yet unknown *trans*-dextro-acid. The old, so-called, *meso*camphoric acid was shown to be a mixture of *cis*-dextro- and *trans*-lævo-acids, and was not a definite compound, so could be readily separated into its constituents. This early work of Marsh, neither at the time nor since, received the recognition it deserved. In this paper Marsh also described chlorocamphoryl chloride, from which he obtained in good yield chlorocamphoric anhydride, which by prolonged boiling with water gave camphanic acid, $C_{10}H_{14}O_4$ (J., 1896, **69**, 82). This was " rediscovered " much later by Aschan.

Early in 1891 Marsh published in the Clarendon Press series a useful little volume entitled " Chemistry in Space." This was a translation from Professor J. H. van 't Hoff's " Dix Années dans l'Histoire d'une Théorie." This book was in fact a very considerable extension of the French edition, though Marsh with characteristic modesty states in his preface that whatever merit it may possess in that respect is chiefly due to the invaluable assistance and advice which he has received from the author.

In 1890 he gave an account of a new monobromocamphor (J., 1890, **57**, 828) and explained the existence of this *iso*-monobromocamphor by the assumption that the α-substitution products of camphor may exist in stereochemically different forms. Starting from some work by Marsh and R. Stockdale on the production of camphor from turpentine (J., 1890), Marsh and J. A. Gardner began work on the mode of preparation of camphene and its properties. Their results are embodied in a series of papers " On Camphene " (J., 1891, **59**, 648), " On Turpentine " (*ibid.*, p. 725), " On Phosphorus Derivatives of Camphene " (J., 1894, **65**, 35), and " On Products of Oxidation of Camphene, Camphoic Acid and its Derivatives " (J., 1896, **69**, 74). They found that camphene on oxidation with nitric acid gave a tribasic acid, $C_{10}H_{14}O_6$, of the malonic acid type, which they named camphoic acid. This on dehydration with acetyl chloride gave a monobasic acid, anhydrocamphoic acid, $C_{10}H_{12}O_5$. This could be easily hydrolysed to camphoic acid, but when heated above its melting point lost carbon dioxide quantitatively and formed camphopyric anhydride, $C_9H_{12}O_5$. This yielded *cis*-camphopyric acid, $C_9H_{14}O_4$. This *cis*-camphopyric acid was also obtained directly from camphoic by heating just above its melting point. By treatment with phosphorus pentachloride, camphopyryl chloride was prepared. This on treatment with water behaved differently from camphoryl chloride and yielded a *meso*-camphopyric acid, which by treatment with acetyl chloride could be separated into the anhydride of the *cis*-acid, leaving the *trans*-camphopyric acid unchanged. By use of excess of phosphorus pentachloride and a higher temperature chlorocamphopyryl chloride was obtained and hence chlorocamphopyric acid. On reduction with hydrogen iodide camphopyric acid yielded hexahydroxylene. They found that camphene, except with hydrogen chloride, underwent substitution rather than addition by the action of reagents. By the action of phosphorus pentachloride on camphene in the cold there was no evolution of hydrogen chloride, but a substitution derivative, $C_{10}H_{15}Cl_4P$, was formed, from which they prepared beautifully crystalline α-camphenephosphonic acid, $2C_{10}H_{15}\cdot PO_3H_2 + H_2O$, and β-camphenephosphonic acid, $C_{10}H_{15}\cdot PO_3H_2$. The α-acid at 100° lost two molecules of water and gave $(C_{10}H_{15}\cdot PO\cdot OH)_2O$. Phosphonic acids from different camphenes differed in rotatory power without apparently differing in chemical properties. By the action of phosphorus pentachloride at a higher temperature, $C_{10}H_{14}Cl\cdot PCl_4$ was obtained and from this, chlorophosphonic acid.

Marsh held rather heterodox views on the constitution of camphor and strongly criticised the formula proposed by Bredt and similar modifications. He proposed for camphor and camphoric acid the formulæ



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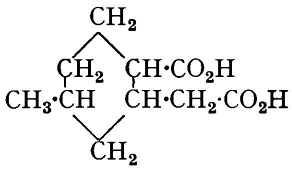
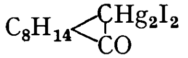


The most probable view of the constitution of camphoic acid seemed to him to represent it as a hexamethylene ring with the two carboxyl groups replacing hydrogen attached to the same carbon atom and one carboxyl group replacing hydrogen attached to an adjacent carbon atom. To derive the foregoing formulæ for camphor and camphoic acid from camphene we have to explain the six-carbon and five-carbon rings of camphor and the six-carbon ring of camphoic acid, which Marsh and Gardner maintained is necessarily different from the six-carbon ring in camphor and in camphoric acid. We have then in camphene a pentamethylene ring and two different hexamethylene rings. They had therefore to give to camphene a tridimensional formula, in which the atoms are not regarded as situated in a plane, but on the surface of a sphere. Such a formula may be regarded as derived from triply linked carbon atoms in the same way that Baeyer represented cyclic formulæ as derived from doubly linked carbon atoms, as, for example, his comparison of the hexahydroterephthalic acids with fumaric and maleic acids. The formula proposed for camphene was derived from the triple hexamethylene spheric formula by interposing in one ring a bridge link of one carbon atom. They maintained that the suggested formulæ accounted for the principal facts relating to the terpene and camphor group. Further support for their views was brought forward in a paper on " Halogen Derivatives of Camphor and their Reactions " (J., 1897, **71**, 285), in which α- and β-tribromocamphene hydrobromides, tribromocamphene, α- and β-chlorocamphene hydrochlorides and chlorocamphene were described. They found that chlorocamphene was acted on by concentrated sulphuric acid, giving, in good yield, a substance which they regarded as hydroxycamphene or camphenol. This behaved as a tertiary alcohol. Its properties were more closely examined by Marsh and Hartridge (J., 1898, **73**, 855), who found that it was not a true substitution derivative of camphene, but bore a close relation to carvacrol. By the action of phosphorus pentachloride it was converted into chlorocymene ($CH_3 : Cl : C_3H_7 = 1 : 2 : 4$), and by benzoyl chloride into *p*-cymene. They renamed it carvenol, and described its reduction product carvanol, $C_{10}H_{20}O$, and the corresponding ketonic carvanone, $C_{10}H_{18}O$. The formulæ suggested differed from those of their respective isomerides, menthol and menthone, in the position of the CH·OH and CO groups, which in these are attached to the carbon atom adjacent to the *iso*propyl group. The carvenol is a dihydrocarvacrol with two double linkages : the position of one of these, owing to the tautomeric nature of carvenol, is adjacent to the C(OH) group on one side or the other. Marsh next found that when fenchone is warmed with concentrated sulphuric acid, acetylxylene ($CH_3 : CH_3 : Ac = 1 : 2 : 4$) is formed practically quantitatively (J., 1899, **75**, 1058), a finding difficult to reconcile with the formula of fenchone, based on Bredt's camphor formula, proposed independently by Wallach and by Gardner and Cockburn. Marsh remarks " I have from time to time ventured to criticise some of the formulæ proposed for members of the terpene group, partly on the ground that they do not account for the derivatives of benzene which are obtained from them by comparatively simple reactions. Nor does it seem to me obvious why it should be regarded a sounder principle to base the constitution of closed chain compounds such as the terpenes on the products obtained by breaking down their cyclic structure, than on those products in which a ring remains."

In 1905 Marsh and Struthers (J., **87**, 1878) published an interesting paper on the condensation of ketones with mercury cyanide. They found that a solution of mercury cyanide in caustic soda or in alcoholic sodium ethoxide forms a delicate test for small quantities of acetone : 0·0005 gram of acetone gives a precipitate at once in about 25 c.c. of solution. The test can be applied to acetone in the presence of alcohol, when the iodoform test is inapplicable. The compound has the composition $C_5H_2ON_2Hg_3$. Later (J., 1909, **96**, 1778) they obtained similar derivatives of other ketones, but only with those which have a methyl group attached to the carbonyl. By using mercuric iodide instead of cyanide, mercury derivatives of other ketones are obtained, provided the ketones contain hydrogen in the α-position with respect to the carbonyl group.

In this way they prepared mercury derivatives of acetone, acetophenone, diethyl ketone and camphor, but not fenchone. They subjected camphor to the action of mercuric iodide in the presence of an alcoholic solution of potassium ethoxide and an aqueous solution of potassium hydroxide, with and without the addition of potassium iodide and with and without the action of heat. By the action of potassium ethoxide and by the action of a cold aqueous solution of potassium hydroxide dimercuricamphor di-iodide, $C_{10}H_{14}O,Hg_2I_2$, is formed. A more condensed compound, *viz.*, tetramercury tricamphor di-iodide, $(C_{10}H_{14}O)_3Hg_4I_2$, was also obtained, and evidence of the formation of still more complex substances. They described mercury camphor bromide, mercury camphor chloride, $C_{10}H_{15}O,HgCl$, and mercury camphor oxide, $(C_{10}H_{15}OHg)_2O$. They also got a double salt of the compound $KHgI_3$ with camphor of crystallisation, $KHgI_3,4C_{10}H_{16}O$.

Marsh continued this work and (J., 1910, **97**, 2410) published an account of the action of halogens on mercuric camphor compounds. By the action of iodine on any of the mercury compounds $C_{10}H_{14}O,Hg_2I_2$, $(C_{10}H_{14}O)_3,Hg_4I_2$ and $(C_{10}H_{14}O)_4,Hg_5I_2$ he obtained the same di-iodocamphor. This di-iodocamphor is unstable in solution but is best crystallised from aqueous pyridine. If dry air is bubbled through a solution of dry di-iodocamphor in chloroform solution, iodine begins to separate and if the product is mixed with caustic soda and distilled in steam, camphorquinone appears in the distillate as yellow crystals. The yield of camphorquinone is more than 90% of the theoretical.



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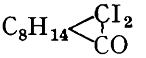
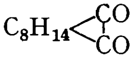


$C_8H_{14}\left\langle\begin{matrix}CI_2\\CO\end{matrix}\right.$



$C_8H_{14}\left\langle\begin{matrix}CO\\CO\end{matrix}\right.$

This complex quinone is readily oxidised to camphoric acid by warming with a solution of sodium peroxide. Working on solutions of organic salts in organic solvents, Marsh discovered that certain salts take up a limited amount of solvent for solution and also that certain homogeneous solutions separate on warming into three different liquid phases: and in an interesting paper (J., 1910, **97**, 2297) he described the phenomena observed when potassium mercuri-iodide is dissolved in ether and water. In conjunction with Mr. W. C. Rhymes (J., 1913, **103**, 781) Marsh published an account of double salts with acetone of crystallisation and the crystallisation of silver iodide, silver bromide, and cuprous iodide. In the same year (*ibid.*, p. 837) in conjunction with Mr. T. V. Barker, he published an important paper on "Optical Activity and Enantiomorphism of Molecular and Crystal Structure." In 1914 he had the good fortune to discover a quite new phenomenon, namely, the crystallisation of a salt combined with two solvents at the same time, for example, $KHgI_3,H_2O,3Me_2CO_3$, $NH_4HgI_3,H_2O,2Me_2CO_3$, and $RbHgI_3,H_2O,2Me_2CO_3$, and wrote a paper (J., 1914, **105**, 2368) entitled "A Class of Salts which contain Two Solvents of Crystallisation." He also wrote two short papers on "Experiments on the Colours of some Cobalt Salts in Solution" (*Chem. News*, 1914, 171), and "Colour of Cobalt Salts in Solution" (*ibid.*, p. 193), in which is described the curious phenomenon of a blue acetone solution going to one pole and a red aqueous solution to the other pole on the electrolysis of a cobalt solution in mixed solvents.

About this period he became associated with Mr. P. J. Kirkby in quite a different type of work, and they published a paper on "The Electrical and Chemical Effects of the Explosion of Azoimide" (*Proc. Roy. Soc.*, 1913, **88**, 90). Their experiments showed that the number of ions set free is very small in comparison with the number of molecules decomposed in the explosion, the ratio being always less than 1 in 100,000. From experiments at different pressures it was found that the azoimide could not be exploded by a spark when the pressure was below 10 mm.

When the War broke out, Marsh, like many others, turned his attention to research work likely to be of value to the country. He devised a method for the cheap production of pyrogallol, and made experiments on absorbents for poisonous gases, for which he received the thanks of the Physiology War Committee of the Royal Society. He also undertook the preparation of certain classes of drugs for experimental use in military hospitals, chiefly alkaloids and a number of new mercury compounds—altogether thirty substances, some of them new. Mercurycamphorimide, I believe, proved useful. In this connection he published a short paper with Mr. O. Lye in the *Analyst* (1917) on the " Estimation of Mercury in Organic Compounds."

He also patented a periscope rifle for trench use, and spent much time devising smoke bombs without nitre or phosphorus. During 1918 he did much work on the replacement of hydrogen, other than acidic hydrogen, in the aliphatic organic acids, principally acetic acid, by metals. This arose out of his work for War hospitals and was continued much later in conjunction with Struthers; and they published a paper on " Mercury Derivatives of Acetic Acid " (J., 1927, 2658). In this paper they dealt with a compound discovered, but not analysed, by Stromeyer in 1809. They named it mercuretin and described the action of nitric acid and ammonia on it. In the same year Marsh also published an interesting note (J., 1927, 3164) on the use of hydrogen peroxide to facilitate iodine and other substitution in aromatic compounds.

For many years after the War Marsh interested himself in the causes of decay of stone in buildings and its prevention; he experimented not only with Oxford limestone from Oxford buildings, but with stone from as varied sources as calciferous sandstone of Glasgow and the silicious sandstone from Delhi buildings. He found that decay was most active just beneath the surface, but affected also, though not so obviously, the surface layer. It was especially marked in the more sheltered places, under string courses and other projecting parts, and generally on the less exposed sides of buildings. He showed that micro-organisms exist in stone, that nitrate is present in stone, that ammonia is converted into nitrate in stone as it is in soil: he concluded that life in stone is one of the most destructive and possibly the most destructive agent of stone decay. The treatment he advocated was to make the stone clean and sterile, which could be effected most readily with a solution of sodium peroxide. He successfully carried out his ideas on several Oxford buildings. He dealt with the whole subject in two bright and witty little volumes, *viz.*, " Suggestions for the Prevention of the Decay of Building Stones," and " Stone Decay and its Prevention," the former published in 1923 and the latter in 1926 by Basil Blackwell, Oxford. These we may perhaps be permitted to recommend for the careful study of architects and others responsible for the preservation of buildings. Marsh was disappointed that his ideas were not more widely accepted, but I see that in recent years attention is being again drawn to the subject and one may perhaps hope that Marsh will receive some of the credit due to him.

Marsh was most interested in the history of chemistry, and from time to time gave interesting courses of lectures on the subject. In 1929 he wrote a fascinating little volume entitled " The Origin and the Growth of Chemical Science," which was published by John Murray, Albemarle Street, London. Marsh attacked the subject from an original point of view. The book begins with some account of the fire theories which, though based on error, led to the amassing of a great store of practical knowledge. This is followed by the history of scientific chemistry, beginning with the theory of salt formation and the work of Robert Boyle. The influence of this—the oldest real chemical theory—is traced in the theory of the fixation of gases, and in quantitative analysis. From the last follow the laws of chemical combination and the atomic theory with all its modern developments. The late Professor W. H. Perkin told the writer that he had read the volume more than once with great interest and proposed to read it again.

After his retirement in 1930, in spite of severely failing eyesight, Marsh continued keenly interested in everything—not only in matters scientific but in affairs in Oxford and in the world at large. To the end he was a busy worker, and at the time of his death was halfway through a book on Taste. He had always taken a great interest in food and diet, and in his younger days, if the writer's recollections are as correct as they are pleasant, he was somewhat of a bon viveur.

Marsh was for many years a keen, highly respected Freemason, and attained provincial grand rank in the Order.

Marsh's hobby over a period of years was sailing, and his centre-board, the " Isomer," was well known on the River, and even abroad, for he sailed her across to Calais and over the French and other canals. The writer can recall many happy days spent with him on board this boat. Marsh was also fond of his garden.

Socially Marsh was a very delightful person, absolutely genuine and a really good man. He was somewhat shy, or perhaps reticent, and retiring, and for casual acquaintances I should think rather difficult to know, though he was not a bad mixer. By those who knew him well he was much beloved and he was a most loyal friend. He had a keen sense of humour, which must have stood him in good stead in the rough and tumble of life, and was, among his intimates, a good conversationalist. He had a marvellous way of correcting people, much delighted in by his friends, but perhaps not always appreciated by others who did not know his real goodness of heart. J. A. GARDNER.

HUGH RAMAGE.

1865—1938.

HUGH RAMAGE died suddenly at Norwich on April 16th, 1938, at the age of 73. For 26 years he had been Principal of the Norwich Technical College and Organiser of Higher Education. His memory will live in Norwich as an able administrator at a time of rapid development in the local educational system and throughout the difficult period during and after the War. When he retired in 1930, he continued to live in Norwich, where his quiet unassuming manner and sterling character gained him the genuine respect of all his associates in the various cultural interests of the city—religious, musical, and educational.

For a quarter of a century Ramage had sacrificed his real passion, research in his chosen branch of science, the spectroscope, for the rough and tumble of administrative and staff work. Yet, in the midst of it the little dark-room which he reserved in the Technical College bore witness that his urge to research would not be denied. Here he was happy during such hours of leisure as he could snatch. The outcome of those hours was his communication to *Nature* in 1920 describing for the first time his extension of spectrographic analysis to living matter both animal and vegetable. After his retirement this became his life-work for the further 8 years he survived.

Ramage was born in Buckinghamshire on March 31st, 1865, of Scottish parents. He was only 4 days past his 13th birthday when he left his elementary school to enter the Railway Carriage Works at Crewe and start earning his living. After 4 years and assiduous attendance at the evening classes of the Crewe Mechanics' Institute he won his way to the laboratory of the Locomotive Works. At the end of another 4 years he obtained through success in examinations a Royal Exhibition at the Royal College of Science, Dublin.

In 1889, after gaining his diploma and a medal, he returned to the Crewe laboratory as senior assistant to Joseph Reddrop. With him he worked out an improvement in the well-known bismuthate method for the volumetric determination of manganese (J., 1895). In 1891 he returned to Dublin to become demonstrator in chemistry under Prof. Hartley. Here he devoted much work to the study of flame spectra, Prof. Hartley enlisting his assistance in his own researches in this direction. From this time onward spectroscopic work was Ramage's predominating scientific interest. In 1899 he left Dublin to enter St. John's College, Cambridge, as a research student. Here under Prof. Liveing he intensified his studies in flame spectra, gaining his degree from the Board of Studies.

In 1904 he was appointed Principal of the Technical Institute, Norwich, and he spent the rest of his life in that city.

In conjunction with Prof. Hartley, Ramage contributed 14 papers to the leading scientific journals on the spectrographic analysis of minerals. In addition he published papers as sole author on kindred subjects, *e.g.*, the spectra of the rarer elements and of the electric spark. During the War, whilst examining flue-dust from the Norwich

Gas-Works as a possible source of potash, he discovered that the dust contained more gallium than had been found in any material hitherto examined.

Ramage's most original work was done during the last years of his life, when he devoted himself to an ever-widening survey, by means of the spectrograph, of the distribution of the metallic elements in animal and vegetable tissues. With Prof. Munro Fox he published the results in the *Proceedings of the Royal Society*, the *Biochemical Journal* and in *Nature*. For instance, he found that the kidney and liver of crabs and lobsters always contained silver, that strontium concentrated in the genital duct of the snail and manganese was present in its liver. He used to carry tiny pellets of silver and copper in his pocket, assuring listeners that the metals had been separated from half an ounce of dried mushrooms grown in his garden.

Such facts concerning organic materials interested him however remote they might seem from proving of any practical value, and he was justified. In connection with soil constituents, however, an analysis by him proved of great economic importance. After years of trial and error it was suspected that a certain deficiency disease prevalent amongst sheep in some districts of New Zealand was due to the absence of some " trace " element. In 1935 samples of soil from the " sick " areas and from the " healthy " areas were sent to Ramage for careful spectroscopic analysis. He found that the " healthy " soil contained 0·0007% of cobalt, but the " sick " soil contained none. On following up this pointer it was proved immediately that cobalt was in fact the effective element. Apparently the disease has now practically disappeared, thanks to the administration of minute doses of cobalt chloride or sulphate to the sheep or to dressings of the grass-lands with cobalt salts.

Hugh Ramage married Miss Pye-Smith in 1904, and she survives him, with a son and a daughter.

W. LINCOLNE SUTTON.

ALFRED EDWARD SIBSON.

1865—1938.

ALFRED EDWARD SIBSON, whose death took place on March 8th, 1938, was born at Notting Hill on August 27th, 1865, his father being an architect. Educated privately, he entered the laboratory of his uncle, Alfred Sibson, Agricultural Chemist, in St. Mary Axe in 1880, where he was engaged in the analysis of chemical manures, food products and cattle foods. Besides collaborating with his uncle in revised editions of " Agricultural Chemistry " and " Artificial Manures," he contributed articles to the *Westminster Review*, the *Educational Review* and other journals, and gave occasional lectures on scientific subjects. On retirement from the laboratory in 1908 on the death of his uncle, Sibson interested himself in the study of astronomy, in which he took a great interest, and in carpentry. Though taking a keen interest in his work, which was carried out with great ability, he found it difficult to discuss his achievements with his colleagues. A man of great modesty and of a retiring disposition, he nevertheless succeeded in winning the esteem and affection of all those with whom he came into contact.

In 1894 he married Miss Lucy Jebb, of Buckhurst Hill, and is survived by his widow and one son.

A. J. SIBSON.

ERIC HARTWIG WHYTEHEAD.

1877—1937.

ERIC H. WHYTEHEAD, whose death took place in Johannesburg on July 19th, went to South Africa in 1900, and at the conclusion of the South African War was appointed Chief Laboratory and Technical Chemist to the B.S.A. Explosives Co. at Modderfontein. From there he went to Japan to take charge of another dynamite factory and afterwards returned to England to become chemical adviser to Messrs. Brotherton and Co. at Leeds. Later returning to South Africa, he joined The New Transvaal Chemical Co., Ltd., at Delmore—an associated company of Messrs. Lever Bros. Ltd.—and later took charge of the Herald

Soap and Industries Ltd. at Denver as General Manager. He was on the board of directors of Messrs. Lever Bros. Ltd. and of The African Oxygen and Acetylene (Pty.) Ltd., at Germiston, a Vice President of the South African Federated Chamber of Industries, a Member of the Government Assize Board, and External Lecturer in Chemical Engineering at the Witwatersrand University. At one time he was a Captain in the Imperial Light Horse.

Whytehead was elected a Fellow of the Chemical Society on February 15th, 1905.