OBITUARY NOTICES.

PHILIP RUFUS CARTER.

1921—1955.

PHILIP RUFUS CARTER was educated at Latymer Upper School, from which he proceeded to the Imperial College of Science and Technology in 1939. He graduated with Second Class Honours in 1941 and later in that year he obtained an appointment at the research laboratories of British Schering Ltd. at Alderley Edge. He was elected an Associate of the Royal Institute of Chemistry in 1943. In 1947 he obtained the degree of Ph.D. for work carried out at Alderley Edge, and at about the same time he moved to the research laboratories of Albright and Wilson, where he remained until his death under tragic circumstances in the early hours of the morning of June 4th, 1955.

Philip Carter was a most conscientious worker and a first-class experimentalist. His bench and his laboratory records were a model of neatness and efficiency. His main interests were in organic chemistry and analytical methods. He was the author of three publications in the *Journal* (1948, 143, 147, and 150) on " Acyl Derivatives of *p*-Aminobenzenesulphonylguanidine " (with D. H. Hey and D. S. Morris), " The Action of Chlorine on Aqueous Solutions of Ammonium Sulphinates " (with D. H. Hey), and " Synthetic Œstrogens of the Triphenylethylene Series " (with D. H. Hey). He was a member of the sub-committee on organophosphorus insecticides of the Ministry of Agriculture, Fisheries and Food and the Association of British Insecticide Manufacturers. His quiet and modest personality and his friendly disposition made him much liked and respected. He was a keen tennis player and excelled in dinghy racing. He took part in national and international races both on inland waters and at Falmouth and the Isle of Wight. Those who knew him will treasure the memories of his somewhat shy and boyish manner, of his sincerity and integrity, and of his good fellowship. His ambition was to apply his scientific training towards any ends which would improve the well-being of mankind, and this high ideal was faithfully reflected in his character. He leaves a widow and two young sons to whom our deepest sympathy is extended.

D. H. HEY.

SALAH ELDIN SAID EL WAKKAD.

1918—1955.

THE death of Salah Eldin Said El Wakkad on September 21st, 1955, in the London Clinic, London, cut short a career of great promise, and came as a great shock to his colleagues and students in Egypt. He was born on August 18th, 1918, at Abbassieh, Cairo, and received his early education in the schools of the same district. He proceeded thence in 1935 to the University of Cairo, obtained his B.Sc. with First Class honours in Chemistry in 1939, and was appointed in the same year a demonstrator in the Chemistry Department, Faculty of Science. In spite of the severe conditions which prevailed at that time owing to the outbreak of the second World War, El Wakkad, full of determination and enthusiasm, started research in the field of electrochemistry under the direction of Professor A. R. Tourky. He investigated with success the relation between solubility and particle-size, as observed with silver oxide of very high purity, and was awarded the M.Sc. degree in 1942. He started then investigating oxide-film formation on metals and the evaluation of the standard electrode potentials. In 1944 he was awarded the Ph.D. degree and offered a lectureship in the Department. The important achievements in these investigations appeared in a series of papers in the *Journal of the Chemical Society*, and the *Journal of Physical and Colloid Chemistry*, during 1948—1949.

Shortly after obtaining his Ph.D. degree El Wakkad started to suffer from mal-functioning of his liver. He showed some improvement now and then, but he became a chronic sufferer of this malady, his health remaining, from then, always very delicate. Nevertheless, he ably encouraged and supervised his younger research workers, and extended his investigations to mercury, lead, tungsten, and antimony electrodes. A group of papers on these studies carrying his name appeared in various scientific journals.

Early in the Autumn of 1949 he went on a study leave to Liverpool, and joined there the school of electrochemistry under the direction of Dr. A. Hickling. He became acquainted with the oscillographic technique of studying anodic behaviour, and applied it to antimony and cobalt anodes.

At the end of 1950, after his return to Cairo, he was promoted Assistant Professor of Inorganic and Physical Chemistry. Then he became interested in the anodic behaviour of metals at very low current densities. He conducted a great number of investigations in this direction on nickel, copper, palladium, gold, tin, zinc, and some zinc-tin alloys. He published more than ten papers in this field.

In 1952, El Wakkad's research was rewarded by a Government Scholarship enabling him to continue his researches in some distinguished institutes abroad. In November, 1954, he left for the U.S.A. as an associate research assistant in the John Harrison Laboratory of Chemistry, University of Pennsylvania, where he joined Dr. J. O'M. Bockris, acting Professor of Physical Chemistry at that time. There, and perhaps for the first time, El Wakkad felt that more care should be given to his health. He consulted a number of specialists, but apparently without much progress, and early in the Summer of 1955 he returned to Egypt, completely exhausted and looking very unwell. Following his doctor's advice, and aided financially by the Egyptian Government, he left, two months later, for England for treatment, but unfortunately he died ten days after his arrival there. He was buried in his native birth-place, Cairo, on September 30th, 1955.

Outweighing El Wakkad's achievements as a research worker, his part in stimulating the creation and growth of the school of electrochemistry of Cairo University will ever remain as one of his conspicuous contributions. In addition to his scientific activities there seemed to be few general interests that failed at various times to receive his attention : scouting, camping, sport, social, and many other activities came within range of his active short life. His health which had been poor for many years failed to destroy his keen sense of humour which made him popular among his colleagues and earned him many firm friends. His great gifts as a lecturer were much appreciated by his many students, and his experimental and intellectual grasp of his line of research was a source of admiration to his colleagues and co-workers and will long be remembered.

He leaves a widow, herself a Cairo University graduate, and two daughters, and he will be always held in affectionate remembrance by all of us.

A. A. MOUSSA.

BERNARD JACQUES FLURSCHEIM.

1874—1955.

BERNARD JACQUES FLURSCHEIM, who died on June 15th, 1955, in a hospital near his home in Fleet, Hampshire, was in his eighty-first year. So passes the last of the great pre-electronic builders of the theory of organic chemistry.

He was born on November 27th, 1874 at Baden-Baden. After a school education on classical lines at Baden and at Bournemouth, Flurscheim made his firsts cientific studies in the University of Geneva. Afterwards he worked with Werner at Zürich, and with Thiele at Strassburg. He took his Ph.D. in Heidelberg in 1901. In 1905 he set up his house in Fleet, in the garden of which he built the laboratory where he worked until other duties claimed him in the first World War. For the periods 1905—1907 and 1925—1928 he worked in the Royal Institution in London.

In his main scientific work, the provision of organic chemistry with a theoretical framework, Flurscheim was natural successor to both Werner and Thiele. He started from Werner's ideas of the divisibility of chemical affinity when discussing its distribution in molecules; and it ranks as a major and lasting discovery that his schemes of distribution involve a generalized idea of unsaturation and of Thiele's conjugation. as is today so readily appreciated in electronic terms.

Flurscheim's first two papers published in 1901—2 described experimental investigations of limited scope in the field of preparative organic chemistry. But in 1902 appeared also his first paper of general chemical importance. In it he propounded the first serious theory (as distinct from a rule) of orientation in aromatic substitutions, evolving for this purpose an idea of the attributes of chemical affinity, which was of so general a nature as to form the outline of a theory of organic chemistry. He assumed that chemical affinity, even apart from unsaturation in the conventional sense, was continuously divisible, and was partly in the bonds and partly free. He supposed that an atom, such as bivalent oxygen, which has the intrinsic ability to increase its valency, would, when bound to an aromatic carbon atom, make a large affinity-demand on the latter, leaving it with little affinity for its other bonds, and little free affinity. This atom would thus make only a small affinity-demand on the next atoms; and thus the disturbance would be propagated, and an alternating distribution of bound, and free, affinity would be set up; which would give to *ortho-* and *para*-carbon atoms an excess of free affinity, and so lead to *ortho-para*-orientation. On the other hand, a substituent atom in its highest valency state, such as the nitrogen atom of a nitro-group, was regarded as an atom whose resources of affinity were already overtaxed; and therefore, it would be unable to make more than a small affinity-demand on a nuclear atom to which it was bound, and would thus set up the other possible alternating distribution of bound and free affinity in the benzene ring, leading to *meta*-orientation.

Flurscheim's theory played an important rôle in the development of the modern theory. For it embodied a widened idea of unsaturation and of conjugation, recognising in the power of an atom to increase its covalency (or to share its unshared electrons, as we should now say) a condition which could, similarly to a double or triple bond, disturb the distribution of affinity in its neighbourhood. It described the affinity redistribution resulting from this kind of unsaturation quite correctly in its formula covering *ortho-* and *para*-orientation, a formula which could be, and indeed was, directly translated into electronic terms. Flurscheim's theory, even in this early stage of its development, thus provided much of the pattern of what is called the electromeric effect in the modern theory of organic chemical reactivity.

In 1905 he entered on another field of application of his ideas, and one which again implied a principle of general importance. A few years earlier Gomberg had discovered what he called triphenylmethyl, which was a colourless solid, giving a yellow reactive solution in which the molecular weight of the solute was approximately twice what would have fitted Gomberg's view of its nature. Flurscheim suggested that the solid was hexaphenylethane, and that in solution it underwent a small equilibrium degree of dissociation to yellow reactive triphenylmethyl. (Three years later Schmidlin experimentally confirmed this interpretation.) Flurscheim further explained that the reason why triphenylmethyl had sufficient stability to coexist with hexaphenylethane in solution was that the phenyl groups had such an affinity demand that the three between them could use up the affinity of the methyl carbon atom, except for a considerable residue of free affinity. This was Flurscheim's first application of his affinity redistribution theory to a problem of equilibrium, as distinct from one of kinetic reactivity. In thus extending his domain from kinetics to thermodynamics, he showed that his valency redistributions apply, not only to activated states, but also to normal molecules. Today with the aid of the quantum theory, we re-express this too in electronic terms, and call the result mesomerism or resonance. In his example, he was giving a preliminary description of mesomerism in the triphenylmethyl radical. Thus, in combination with his previous work, the new contribution set the pattern of the mesomeric effect in the modern theory.

In two papers published in 1909—1910, Flurscheim made another thermodynamic application, *viz.*, to the strengths of acids and bases. These phenomena involve obvious polar effects, and also, as Flurscheim was the first to show, steric effects, so that their discussion needed the whole apparatus of a theory of organic chemistry. It is interesting to note the extent to which the integrated pattern of theory offered by Flurscheim corresponded to that of the modern theory, and also how much of the one theory could be directly translated into the other. Three superposed effects were recognised. One was the effect of the electropolar quality of affinity: here Flurscheim was only taking over ideas earlier established by Michael, Vorländer, and others: he was taking over, and was handing on, what has since become re-expressed in the inductive effect. Another effect was that of affinity quantity, as determined by the redistributions originating in different degrees of generalised unsaturation: this played the same part as does the mesomeric effect in the modern theory, and could, for example, be made responsible for the lower acid-strength of *p*-anisic than of benzoic acid, despite the electronegativity of the methoxyl group. The third effect was that of steric hindrance, which causes benzenoid *ortho*-groups, no matter whether they are electronegative or electropositive, to make aromatic acids stronger and aromatic bases weaker: this also the modern theory accepts, with the difference that it allows for the secondary, as well as for the primary steric effect, which latter is all that Flurscheim envisaged.

Flurscheim's theory of organic chemistry was largely, but not wholly, correct in form; and a hint that something might be amiss was contained in a result that he discussed in his first major paper of 1902. Holleman had shown that phenylnitromethane is *meta*-orienting, whereas by this theory it should be *ortho*- and *para*-orienting. Flurscheim attacked this problem experimentally, and thought that he had found the answer. In fact he had only disclosed further complications, which were not fully cleared up until 1929—with the net result that the original difficulty remained. However, until the late 1920's, very few facts had appeared in the literature which could not be accommodated in Flurscheim's theory. That there were any such facts can be ascribed to two errors of form in the theory, *viz.*, (1) that it treats quantity of affinity as separable from polar quality, not recognising that a redistribution of affinity is necessarily one of polarity; and (2) that it does not allow for the great difference in the mobility of valency, as between saturated and unsaturated atoms. The first of these certainly, and the second possibly, are errors that could not have been corrected, excepting in the way in which they were, *viz.*, in the course of a translation of the theory into electronic terms. Therefore, we may say that Flurscheim's theory was about as correct as it was possible for a pre-electronic theory to be: indeed, its largely correct form made the task of remoulding it in electronic terms a particularly easy one for others.

Flurscheim never participated in this remoulding, for the basic reason that he did not accept the shared-electron theory of the chemical bond. His objection was that this theory of the bond purported to be physical, and hence must be electrostatic, since physics provided no other strong forces; and plenty of reason could be given why the bond forces could not be electrostatic. Therefore he concluded, the electrons " stay in the atoms," which are bound by some forces that physics did not recognise. Before Heitler and London's work of 1927, this argument was unanswerable. Flurscheim was good at unanswerable arguments, as came to be realised by some who opposed his theories. Moreover, Flurscheim's intellectual integrity was such that he was not prepared, as some were at that time, to make unphysical statements about a physical entity, the electron.

The experimental work which Flurscheim carried out, much of it single-handed in his laboratory at Fleet, was almost entirely directed to the control of his theoretical ideas. It was as an accidental result of this work that he made his outstanding discovery in the field of applied chemistry, that of tetranitroaniline (TNA), perhaps the most powerful contemporary explosive, which he described in 1910, and again much more fully in 1921. The accident was one he sometimes regretted, inasmuch as it led him into commercial work, to which he was not well suited. However, it enabled him to render notable service during the first World War, when, at the request of the late Lord Moulton, he undertook supervision of the large-scale manufacture of this explosive in the United States. During the second world war he worked as gas identification officer for the A.R.P. authorities. Other by-products of his experimental investigations on aromatic substitution include the discovery of pentanitroaniline and of hexa-aminobenzene. His last paper, in 1932, was on the addition of alcohols to nitroethylenes, a subject on which he had published an investigation 30 years earlier.

Flurscheim did not make human contacts easily or treat them lightly. He was devoted to his family, and to a few firm friends. In 1902 he married Norah Kathleen Northover, only daughter of the late Henry Northover of Fonthill, Wiltshire. He is survived by her, as by their son and daughter. His chief recreations were travel and climbing. In 1903 he visited New Zealand, where his father, Michael Flurscheim, lived, and there he made acquaintance with the New Zealand Alps. He knew the Alps of Europe intimately. His intellectual life was just as vigorously lived; for he had strong literary gifts and interests, as well as the penetrating analytical mind of the scientist. His early classical education started in him a long career of erudite classical scholarship. But this was only his second passion. His first was a deep devotion to pure science, for which he laboured, often alone, without any thought of material reward, or any motive towards a personal career. His greatest wish was to serve science, and in particular to elevate the status of organic chemistry by providing it with rational scientific system. Certainly the major and essential part which he played in the development of such a system for organic chemistry will immortalise his name as long as chemistry is studied.

C. K. Ingold.

HAROLD AUGUSTINE TEMPANY.

1881—1955.

HAROLD AUGUSTINE TEMPANY, the well-known expert on tropical agriculture, was born at Richmond, Surrey, on July 23rd, 1881. His father, Thomas William Tempany, was a solicitor practising in Bedford Row, a specialist on the rights and position of women after marriage, and widely interested in the local affairs of Richmond; among other activities he founded the Richmond Athenæum, a literary society before which he frequently lectured. His mother, Emily Ann, daughter of Job Palmer, was a descendant of the Tigou family who came to this country with William III, one of whom designed the Tigou screen in Hampton Court.

He therefore grew up in an atmosphere of literary activity and artistic tradition. His own taste, however, was for scientific work and after passing through the County School at Richmond he proceeded to University College, London, his father's old College, but instead of Arts or Law he studied Chemistry under Sir William Ramsay. After graduation he did not elect to follow an academic career or to accept one of the industrial appointments then opening up; the spirit of adventure was abroad and in 1903 he applied for and obtained the post of Assistant Agricultural Chemist in the Leeward Islands, attracted by the nature of the work and a desire to see what the West Indies were like.

It was a new and somewhat uncertain profession, but he was always a pioneer. The West Indies were still suffering severely from the competition of European sugar made from sugar beet and subsidised by the various Governments, but the Agricultural Department founded by Joseph Chamberlain and put under the direction of Francis Watts, a Kew man, was already improving the position by introducing new crops and better canes and by controlling crop pests and diseases. Tempany had no agricultural knowledge but he had enthusiasm and a lively interest in the problems: from his centre in Antigua he applied his chemistry to such good effect that after six years, in 1909, he was appointed Government Agricultural Chemist and Superintendent of Agriculture and held this post for a period of eight years. His chemical work was concerned with local problems; his papers on the determination of sucrose were not only of great importance to the sugar cane industry but also of more general interest: they were on the effect of temperature changes in the polarimetric determination of sucrose, and on the effect of clarification with basic lead acetate on the optical activity and copper reducing power of sugar solutions.[1]

Thanks to the work of the various Departments the economic position improved and by 1911 the West Indies had become solvent.

Tempany did so well that in 1917 he was appointed Director of Agriculture in Mauritius. By this time he had a wide knowledge of sugar cane, the chief crop of the island, and was able to organise experiments on its irrigation and manuring, the results of which if generally adopted would considerably improve their yields. Most of the planters, however, are French, retaining their old language and culture in spite of the island's having been in British possession since the Napoleonic wars: indeed Tempany related that some of the ladies made a point of not learning English. Fortunately Tempany had a good command of the French language and this, combined with an attractive personality, a fine baritone voice, a sound taste in music, and a love of amateur theatricals, broke down the barriers and helped greatly to establish friendly relations with the planting community; he quickly gained their confidence, and his sound advice based on his previous knowledge and on his experimental results was well received. He was largely responsible for the establishment of the Sugar Cane Research Station, which was later converted into the Mauritius Sugar Industry Research Institute.

In 1924 he added to his other duties the Principalship of the newly established Mauritius College of Agriculture; he held this post till 1929 when he was appointed Director of Agriculture in the Straits Settlements and Federated Malay States. This in effect was a new post: for some years before that date the Department of Agriculture had been in the charge of a Civil Servant as Secretary under whom rubber research had been transferred to the recently founded Rubber Research Institute, thus depriving the Department of one of its main functions, but of course releasing its energies for other work. Rubber was then by far the most important crop in the country. But the rubber market was very depressed, output was being restricted,

[1] West Indian Bull., Vols. VI, VII; *J. Soc. Chem. Ind.*, 1908, **27**, 53, 191.

and the country was suffering economically. Like some of the other experts Tempany saw the unwisdom of relying too much on one crop and recognised that the agriculture of the country must be put on a broader basis and must include more cash crops as well as food crops so as to reduce the need for imports. This meant a radical reorganisation of the Department. All research was co-ordinated under a Chief Research Officer and all field work under a Chief Field Officer; both were of equal status and directly responsible to the Director: the old water-tight compartments thus broke down. Steps were taken to enlist the co-operation of the small cultivators as well as the planters and the Rubber Research Institute, and to secure the interest and sympathy of the rural community generally. Malaya's climate is not conducive to hard work, but Tempany's boundless energy overcame all difficulties and enabled him to travel widely so as to discover the possibilities of the different regions, while his infective enthusiasm and friendly interest in his staff secured their loyal support and an affectionate regard which he retained long after he had left the country.

Pineapples were already grown in Johore; he saw the possibility of developing a canning industry and promoted the necessary research and legislation; experiments were also made with cocoa, manila hemp, palm, coconut, and other oil-bearing plants. Rice was—and is—the chief food: work on its improvement by breeding and selection already begun by Jack and Jagoe was further developed. Two large blocks of laboratories were started at Headquarters in Kuala Lumpur for the necessary chemical and biological investigations. At the same time there was a parallel development of the Extension Service to put the results into practice. A School of Agriculture was established on the main Experimental Station at Serdang: this later developed into the College of Agriculture. A stream of publications was issued in English, Malay, Chinese, and Tamil to ensure as wide a dissemination of sound information as possible. Agricultural shows were organised for the further education of the cultivators and the public.

In addition to his official activities he took an active interest in the Malaya Section of the Royal Institute of Chemistry.

His successes in Mauritius and Malaya marked him out for further advancement and in 1936 he was transferred to the Colonial Office in London to assist the Agricultural Adviser, Sir Frank Stockdale, in the vastly increased work being undertaken for agricultural developments in the Colonial Empire. Here he did so well that in 1940 he was appointed to succeed Sir Frank when the latter became Comptroller of Development and Welfare in the West Indies. This post involved considerable work on Committees and Commissions. He was always keenly interested in the expansion of the research institutions. He was largely instrumental in the establishment of the West African Cocoa Research Institute, the need for which he realised directly the swollen-shoot disease appeared and before its devastating effects became widespread; and also in the establishment of the East African Agriculture and Forestry Research Organisation which now has well appointed laboratories at Maguga near Nairobi under the direction first of Sir Bernard Keen and now of Dr. E. Walter Russell. He served on the Governing bodies of the Imperial Institute, the Imperial College of Tropical Agriculture, the Empire Cotton Growing Association, and on the London Advisory Committees for Rubber Research in Ceylon and Malaya and for the West Indian Sea Island Cotton Association of which he was for a long period the Chairman; he was also a most helpful member of the Editorial Committee of the *Empire Journal of Experimental Agriculture*. Throughout he retained his interest in chemistry: during the period 1940—1943 he was a member of the Chemical Council and a Vice-President of the Royal Institute of Chemistry.

In 1946 he retired from the Colonial Office on age limit, and his distinguished services were rewarded by a Knighthood; he had already in 1933 been awarded the C.B.E. and in 1941 the C.M.G. He was however far too energetic to give up work. Besides continuing to serve on various Committees he became editor of Messrs. Longman's series of books on tropical agriculture and in 1949 of *World Crops*, a new journal started by Leonard Hill, Ltd. He had already written in 1930 a book on " Principles of Tropical Agriculture " with G. E. Mann, and was the principal author of the Colonial office handbook on West Indian agriculture; he also wrote a detailed account of Soil Conservation in the British Colonial Empire, based on replies to questionaires sent out by the Commonwealth Bureau of Soil Science and published by that body in 1949. This question of soil conservation had always interested him as far back as his Mauritius days.

In his numerous and widespread activities he was greatly helped by his gift of making and keeping friends. His colleagues all liked him and were always ready to support him in any way they could; he retained for them a great affection and his personal mail was heavy but very gratifying to him. He married in 1911 Annie Frances Agnes, eldest daughter of

Robert Goodwin, and they had one son born in 1920 in Mauritius. She died in 1945. In the following year he married Kate, youngest daughter of William Welfare, who survives him.

He was still in good health when news came of the death of his only son in Kenya. The shock brought on a stroke from which he never recovered; he lasted only a few hours and died at his home in Kensington on July 2nd, 1955. Many of those interested in tropical agriculture felt that they had lost a good friend.

The author acknowledges with thanks his indebtedness to several of Tempany's friends and colleagues, especially D. H. Grist, J. N. Milsum, R. G. H. Wilshaw, and F. L. Okell, and to the Commonwealth Bureau of Soil Science for useful information on his life and work.

E. JOHN RUSSELL.