OBITUARY NOTICES.

ROBERT JOHN FLINTOFF.

1873—1941.

ROBERT JOHN FLINTOFF, the eldest son of Frances Egerton Flintoff, was born at Manchester on August 15th, 1873. He received his education at the Manchester Grammar School, and at Owen's College. On leaving college he carried on the business of a calico printer (Messrs. Fred Scott and Co., Ltd.), and on retirement in May, 1908, lived for a time at Haxby, near York, afterwards at Bridlington, and for the last 16 years of his life at Water Ark Lodge, Goathland.

He was one of the best known figures in North Country natural history circles, and was looked upon as an authority on the natural history of the fauna and flora of the district in which he lived. He was the author of many contributions to the *North Western Naturalist* and to other journals. As founder in 1936 of the Northern Ecological Society, he harnessed a remarkable team of scientific workers to study the life-forms as conditioned by native environment. He took a particular pride in his own beautiful garden at Water Ark Lodge, where visitors were always welcome.

When a young man he took a keen interest in rowing and for many years was captain of Hollingworth Lake Rowing Club. As a man, he was cheerful and forthright; a stickler for accuracy in scientific matters, and though not suffering fools gladly, his disarming smile and deep sincerity banished any feeling of resentment that one less endowed might have aroused. Though not a Quaker himself, he was proud of his Quaker ancestry. His great grandfather, Joseph Flintoff, who became Chairman of the Manchester Royal Exchange in 1823, and with another Quaker assisted in founding the firm of Jacob Bright and Co., lies in the old Quaker burial ground of Bishophill, York. As a friend, Flintoff's loyalty was complete, transcending the barriers of race, creed or class, and he could number among his intimates not only men of high intellectual ability but simple-hearted village craftsmen.

He was a Fellow of the Linnean Society, and was elected a Fellow of The Chemical Society in June, 1894.

His death took place suddenly at his residence in Goathland on September 13th, 1941. He was a bachelor, and leaves one brother, Mr. Thomas Flintoff, and many friends to mourn the loss of one who was devoted to the widening and dissemination of human knowledge, and who ever cultivated the joys of true friendship.

T. FLINTOFF.

MR. WILLIAM MACNAB, C.B.E.*

BY the death of Mr. William Macnab, on September 2nd, at the ripe age of eighty-four, we have to record the loss of one who not only made original contributions to our knowledge of explosives, both as to their properties and manufacture, but who in addition must be considered as a pioneer in the recognition of the importance of chemical engineering in Great Britain.

Coming from Greenock, his father being a ship-builder there, he took up the subject of sugar chemistry, after a training at the University of Glasgow, where he made a life-long friendship with Ramsay. Fond of travelling, he spent some time in Germany in connexion with sugar and later in Canada and the United States; in Siberia also he passed an adventurous two years engaged in prospecting. He could converse readily in French, German, and Russian.

About the age of thirty Macnab took up a consulting practice in partnership with C. Napier Hake and carried this on after his partner had left for Australia to become Inspector of Explosives for Victoria. It was at this period and in collaboration with Napier Hake that he undertook the translation and collation of Berthelot's papers on explosives, publishing in 1892 " Explosives and their Power," which is a handbook constantly referred to by all explosives chemists. This book describes the application of thermochemistry to explosives, gives Berthelot's calorimetric data for explosive reactions over a wide field and deals with many explosive phenomena.

At this time Macnab began his original contributions to the study of explosives, and with E. Ristori published researches on partially gelatinized and on fully gelatinized propellants (*Proc. Roy. Soc.*, **56**, 8; 1894). A bomb of the Berthelot type was used; heat values and volumes of gases given off with their composition were measured, together with the metamorphosis undergone by gelatinized mixtures of nitroglycerine with various nitrocelluloses when exploded in the bomb. This work had importance as well as

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accuracy, as was shown by the agreement of products with original composition of explosive. Pressures were measured in another bomb and these agreed with the values found by Sir A. Noble. Later (*Proc. Roy. Soc.*, **66**, 221; 1900) the same authors described attempts to determine the temperature of explosion (apart from its calculation from heat values and specific heats) by a method depending on the use of thermocouples of gradually decreasing diameter, the deflexion of a galvanometer mirror being photographically recorded. Although absolute values for temperature were not obtained, the results placed different explosive mixtures in a comparative sequence. This subject was continued in collaboration with A. E. Leighton (*J. Soc. Chem. Ind.*, **23**, 298; 1904) when the heat values were compared with the galvanometer throws, the order of the powders being broadly the same in both cases.

Always interested in chemical manufacture, Macnab played an important part during the War of 1914—18, when he became a technical adviser on Lord Moulton's staff, where full use was made of his experience in the manufacture, as well as knowledge of the properties, of explosives. Working in close conjunction with Kenneth B. Quinan he was intimately associated with the design of factories for high explosives and propellants, as well as with their administration when erected. Impressed by Quinan's method of holding monthly meetings of his factory staffs at which costs and efficiencies were minutely discussed, resulting in notable improvements in technique, Macnab undertook after the War the compilation of an important series entitled " Technical Records of Explosives Supply, 1915—1918 " (H.M. Stationery Office), dealing with intermediates and finished explosives. These are valuable studies in which the chemical engineering aspect is emphasised, and serve as text-books for any school in that subject, for they include not only the theory of the processes, but also sketches of designs of plants, instructions for running them, calculations of heat-transfer and loss, and choice of materials of construction. They are so framed as to assist a student engaged in general chemical engineering problems, not necessarily those dealing with explosives.

This methodical approach appealed to Macnab, who lectured on the subject at University College, London, and led to his support in starting the Department of Chemical Engineering there. This movement was strongly urged by Quinan also who had felt the grievous lack of chemical engineers during the War of 1914—18. Some chemical achievements during this time were described by Macnab in his Hurter Memorial Lecture in 1922. For the same reason he acted as one of the founders of the Institution of Chemical Engineers, becoming its president in 1934, the William Macnab Medal of that Institution commemorating his name. Much of the success of the Seventh International Congress of Applied Chemistry in 1909 was due to him. For his work in the War he was made a C.B.E. in 1920.

Of striking appearance, suggesting robust health, with rosy cheeks and pointed beard, always dressed with perfect neatness, he will be remembered for his geniality and unselfish kindliness; and his friends will remember the hospitality of his charming wife and himself at his house on the river, where it was his custom to entertain them, take them out in one of his craft, for he was a master sailor, and to some of them show his experiments in calorimetry with a large bomb that needed his athletic frame to manhandle. In his London house also, his skill at the piano and liking for good music will be remembered by many.

ROBERT ROBERTSON.

HERMANN GÜNTHER GOTTSCHALT MOHRHENN.

1909—1941.

THE death of Dr. Mohrhenn in a road accident at the early age of 32 is a serious loss to our Society. On the evening of July 3rd he was cycling to his home in Crouch End when he was struck from his bicycle and killed by a trailer drawn by a heavy lorry.

About half his short scientific life was spent at University College, London, and half at the British Launderers' Research Association. He was a man who made friends particularly easily, and in both these institutions, as well as the social and religious circle in which he moved, his loss will be severely felt by many whose esteem and affection he commanded.

Mohrhenn received his general education at Tollington School, Muswell Hill, and then proceeded to University College, where he graduated with Second Class Honours in Chemistry in 1930. He remained at College as a research student and worker for a further five years, obtaining his Ph.D. degree during this period. In 1935 he joined the staff of the British Launderers' Research Association. Here he was concerned for several years with problems connected with wool washing. Shortly before his death he had taken sole charge of applied research in the experimental laundry of the Association.

The work carried out by Mohrhenn in the chemical laboratories of University College is described

in two papers of the Journal of the Chemical Society (J., 1935, 949, 1482). They represent a development of Bjerrum's well-known method of measuring the molecular dimensions of a dibasic acid by the determination of its first and second dissociation constants. The original crude theory had been to some extent refined, and in 1930 it seemed that further advance along those lines would be very difficult (although substantial new improvements of the theory have since been secured by Kirkwood and Westheimer). Mohrhenn therefore set out to check, and empirically correct, the method by applying it to a number of isomeric and stereoisomeric acids of the *cyclo*pentane series, believed to have a rigid structure and known dimensions. In the second paper he applies a corresponding method to the parallel theory which connects the molecular dimensions of dicarboxylic esters with the rate constants for the first and second stages of their saponification.

Mohrhenn had a most acute scientific conscience and a high sense of responsibility—his personal responsibility to posterity, for the accuracy of his work. Neither care nor patience was spared in carrying purifications to the limit, and in squeezing the last possible drop of precision out of the physical methods employed. Twice he insisted on discarding the results of nearly two years' labour because of small imperfections which could be corrected by repetition. His published work is a memorial to his sincerity and devotion.

Most people who are hard on themselves feel they have a right to exact high standards from others; but this was not Mohrhenn's way. Severe with himself, he was singularly gentle with others. His gift of sympathy and willingness to help others without counting time and trouble brought him many friends whom he kept for life. He was closely identified with the social and religious life of Park Chapel, and was associated with its Youth Fellowship and with the Hornsey Christian Youth Council.

At the time of his death he was living with his mother and sister at " Sonningholme," Clifton Rd., Crouch End, N.8.

C. K. INGOLD.

WILLIAM REGINALD ORMANDY.

1870—1941.

To those who had the honour of personal friendship the loss of Ormandy leaves a gap impossible to fill and a loss that is irreparable, for he was not only a man of science with many facets of interest but also a very human and kindly personality. He was born in 1870, and educated at Wigan Grammar School and at Owen's College, Manchester, where he graduated, becoming Bishop Berkeley Fellow in 1890. He took his Doctorate in 1894 after three years' work at Tübingen. For four years he taught at the Crewkerne Grammar School and at the Technical School, St. Helens. These four years probably helped to formalise Ormandy's mind—he always remained a teacher, informative in matter and impressive in diction, with a wide range of reading and knowledge and no little share of wisdom.

He had an astonishingly wide range of professional interests. He was research chemist to Messrs. Pilkington Ltd., to the St. Helens Cable and Rubber Works, to Joseph Crosfield's of Warrington, and eventually head of a well-known firm of Consultants in Manchester and London.

Being a man who believed his fellow-creatures to be as interesting as chemical entities, he rapidly found scope for his abundant energy in a multiplicity of societies. He served on the Council of the Institute of Petroleum for many years, on the Council of the Institution of Chemical Engineers, of the Institute of Metals and of the Ceramic Society. He was a Past President of the Institute of Automobile Engineers, and Chairman of the Chemical Engineering Group of the Society of Chemical Industry.

He was specially interested in liquid and gaseous fuels, and perhaps it is not generally known that he was intimately concerned with the earliest work on hydrogenation of coal and oil carried out by Bergius. In point of fact he pioneered the development of this subject in Great Britain.

In no less degree was he active in insisting on the value of alcohol as a component of motor spirit, and indeed was Consultant to the Distillers' Company for many years.

One of his outstanding researches was concerned with the action of sulphuric acid on olefins. In this work he showed that a saturated hydrocarbon was produced. This statement brought about a storm of controversy but subsequent investigation showed that Ormandy was right. Is it too much to say that here he was the lineal ancestor of modern processes of hydro-polymerisation?

But reverting to Ormandy the man, those who knew him best carry pleasant memories of an outstanding personality, a controversialist brilliant in speech and repartee, kindly and tolerant in his dealings with his associates, a man of great knowledge but not deficient in understanding.

A. E. DUNSTAN.

ROBERT ROBISON.

1883—1941.

ROBERT ROBISON died suddenly on June 18th, 1941. By his passing at the early age of 57 the Society has lost a distinguished Fellow.

Robison was born at Newark-on-Trent in 1883 and obtained his early education at the Magnus Grammar School in his native town. He entered University College, Nottingham, in 1900, attended the usual course of study for an honours degree in chemistry, and graduated B.Sc. in 1906. He commenced research, under the direction of Professor F. S. Kipping, some time before he obtained his degree and after a year's further research he was awarded an " 1851 Exhibition " scholarship for his work on the benzyl and benzylethyl derivatives of silicone (Robison and Kipping, J., 1908, **93**, 439). The next two years were spent in the laboratory of Professor Hantzsch at Leipzig, where Robison carried out investigations bearing on the relationship between the colour and constitution of organic compounds. The result of these researches were embodied in two papers (Hantzsch and Robison, *Ber.*, 1910, **43**, 45, 92) and the degree of Ph.D. (*summa cum laude*) was awarded to him for his thesis entitled " Über die polychromen Salze aus Dimethyl und Diphenyl-Violursäure."

Robison returned to England in the summer of 1909 and a few months later was appointed lecturer and demonstrator in chemistry at University College, Galway, where work was started on possible methods for the synthesis of acridines, in collaboration with the late Professor Senier. The investigation remained unfinished, however, as in October, 1910, he was appointed to the post of lecturer and demonstrator in chemistry at University College, Nottingham. The problem of organic compounds of silicon was again resumed in collaboration with Professor Kipping, and during the next three years he investigated the preparation and properties of some silicanediols of the type $SiHR(OH)_2$ and certain condensation products of diphenylsilicanediol (Robison and Kipping, J., 1912, **101**, 2142, 2156; 1914, **105**, 40, 984). It seemed at this stage in his career that Robison was destined to occupy a Chair of Organic Chemistry. In February, 1913, however, he applied for the post of Assistant in the Biochemical Department of the Lister Institute of Preventive Medicine, and was appointed a Member of the Institute Staff the following month. Here for the first time Robison came in contact with biochemical problems. He commenced work with characteristic thoroughness and enthusiasm and, in collaboration with his new chief, Profession Harden, was soon able to announce, in a preliminary note (Harden and Robison, Proc., 1914, **30**, 16) the discovery of a new hexosephosphoric ester, which, although not at that time obtained in a pure condition, was identified as a hexosemonophosphoric ester. This ester, or more correctly, mixture of esters, was later known as the " Robison ester " and was destined to play an all-important part in the post-war development of biochemistry.

The War caused a complete break in Robison's work which lasted for the years 1914—1918. In December, 1914, he enlisted in the Sanitary Section of the Royal Army Medical Corps and after a short period of training at home was placed in charge of a sanitary unit and left for Egypt with the 29th Division early in 1915. Soon after his arrival at Alexandria he became ill with dysentery; although still far from well, he proceeded a few weeks later to Mudros, where he was stationed during the whole of the campaign in Gallipoli. During this period his general health suffered considerably, but on his return to Egypt he spent some months doing general hygiene work at El Kantara before giving up and going into hospital at Alexandria. He was finally invalided home early in 1917. With his return to health later in the same year Robison was posted with the rank of captain to a hygiene unit laboratory attached to the Italian Expeditionary Force; he remained in Italy until some months after the armistice in 1918.

After his return to the Lister Institute, Robison at first collaborated with Harden in a number of investigations concerned with the antiscorbutic properties of concentrated fruit juices and the nature of the sulphuric acid test for liver oils. Subsequently he worked on the biological value of proteins in milk, wheat, and gelatin and availed himself of this opportunity to study the distribution of the nitrogenous constituents of the urine on a diet containing a minimal amount of nitrogen. During these investigations Robison became his own experimental animal and as a result of the severe strain thrown on his digestive machinery he was forced to go into hospital for repair. On restoration to reasonable health he reverted to an investigation on the hexosemonophosphoric ester he had previously described with Harden in 1914. The isolation and purification of the ester proved to be a difficult problem, but Robison finally published an account of this important work (*Biochem. J.*, 1922, **16**, 809). His thoroughness caused him to investigate in extreme detail the products of a particular reaction and for many years he was busy separating and identifying the phosphoric esters produced during alcoholic fermentation. The care and skill with which his work was undertaken can be judged from the fact that six new hexose-

phosphoric esters were discovered. In a series of papers in collaboration with numerous co-workers he was thus able to record the isolation and identification of trehalosemonophosphoric ester (Robison and Morgan, *Biochem. J.*, 1928, **22**, 1277), glucose 6-phosphate (Robison and King, *ibid.*, 1931, **25**, 323), mannose 6-phosphate (Robison, *ibid.*, 1932, **26**, 219; Robison and Jephcott, *ibid.*, 1934, **28**, 1844), fructose 6-phosphate (Macleod and Robison, *ibid.*, 1933, **27**, 286), fructose 1-phosphate (Tankó and Robison, *ibid.*, 1935, **29**, 961), and an unidentified ester (Robison, Macfarlane, and Tazelaar, *Nature*, 1938, **142**, 114), the sugar component of which resembles in many ways mannoketoheptose, a 7-carbon atom sugar that was isolated from the avocado pear by La Forge. A close examination of these papers shows the tenacity and resolution with which Robison carried out his investigations and up to the time of his death he was still actively engaged on the isolation of certain unidentified sugar phosphoric esters.

Early in 1923 Robison discovered the enzyme, phosphatase, in the aqueous extracts of bones of young, rapidly growing animals and worked out a method for obtaining very active phosphatase preparations which could hydrolyse many different monosubstituted phosphoric esters but had only slight action on disubstituted esters such as diethyl phosphate, and little or no hydrolytic action on lecithin. Robison used the bone phosphatase as a biochemical reagent in several investigations, of which those dealing with the removal of the phosphoric acid groups from the methylated phosphoric esters of hexose di- and mono-phosphates (Morgan and Robison, *Biochem. J.*, 1928, **22**, 1270; King, McLaughlin, and Morgan, *ibid.*, 1931, **25**, 310), the isolation of crystalline trehalose from trehalose monophosphate (Robison and Morgan, *ibid.*, 1928, **22**, 1277), and the preparation of gluconic acid from the phosphogluconate obtained by the bromine oxidation of glucose monophosphate (Robison and King, *ibid.*, 1931, **25**, 323) are interesting examples and are sufficient to show the importance of this method of attack on the chemical constitution of the sugar phosphoric esters.

In some of his earlier experiments Robison observed that during the hydrolysis of fructose diphosphate (1 : 6-diphosphofructofuranose) by preparations of the bone phosphatase, a part of the sugars liberated, following the removal of the phosphoric acid groups, suffered an intramolecular change and gave rise to a mixture of aldose and ketose sugars (Martland and Robison, *ibid.*, 1929, **23**, 237), and similar results were also obtained with the glucose monophosphoric ester (Robison and King, *ibid.*, 1931, **25**, 323). A more detailed study of these changes was undertaken later (Macleod and Robison, *ibid.*, 1933, **27**, 286) and the investigation soon revealed that the proportion of aldose formed during the hydrolysis varied with the phosphatase preparation employed. In a later communication in collaboration with Tankó (*ibid.*, 1935, **29**, 901) he announced the discovery of the enzyme phosphohexosekinase, which he isolated from crude preparations of bone phosphatase and from bone marrow extracts. Robison finally showed that the phosphohexosekinase converts fructose 6-phosphate and glucose 6-phosphate into equilibrium mixtures of aldo- and keto-esters, and demonstrated that the enzyme had no action on fructose 1-phosphate or on fructose 1 : 6-diphosphate unless phosphatase was present and first removed the phosphate group from position 1.

Robison's more biological work involving contributions to our knowledge of the chemical mechanism underlying the formation of bone has been reviewed in detail elsewhere * and need be given here only in outline. Early in 1922 he observed that by the action of the enzyme emulsin on the soluble calcium salt of hexose monophosphoric acid, hydrolysis occurred and inorganic phosphate was precipitated from solution as insoluble calcium phosphate. This observation suggested to him that a similar mechanism might be concerned with the deposition of the calcium salts of bone. The next step was to obtain direct experimental evidence for the presence of phosphatase in cartilage that was about to calcify and this he did by placing the bones of young rats in solutions of calcium hexose monophosphate. In the course of a few hours a deposit of calcium phosphate was formed and thus his original idea seemed to be correct. Further experiments, carried out with the proper controls, soon confirmed the fact that ossifying cartilage does indeed contain a very active phosphatase. From this time on he slowly developed a theory of bone calcification and produced much valuable experimental evidence to support the view that the full calcifying mechanism consists of a complex enzyme system of which phosphatase is one component. According to this idea, which was first published in 1934, the bone may itself be able to synthesise phosphoric esters from inorganic phosphate, these esters being subsequently hydrolysed at the site of calcification. From this time on his conception of the mechanism underlying the general process of calcification has been generally accepted. The many papers written on this subject in collaboration with several co-workers is a record of Robison's greatest work and is a rare example of beautifully planned research carried out with outstanding skill.

Robison was elected a Fellow of the Royal Society in 1930 and was appointed, some months later,

* *Biochem. J.*, 1941, **35**.

head of the Biochemical Department of the Lister Institute and Professor of Biochemistry in the University of London in succession to his former chief, Professor Harden. In 1931 Robison was invited to deliver the Herter Lectures on Pathological Chemistry in the New York University and Bellevue Medical College, and he subsequently published the substance of these lectures in book form under the title " The Significance of Phosphoric Esters in Metabolism." The book gives in clear and simple language an excellent account of his work up to 1932. In 1933 Robison was awarded the Baly Medal of the Royal College of Physicians, an honour he greatly valued.

Robison was elected a Fellow of the Chemical Society in 1909 and served as a member of the Council from 1936—9. For some years he was a member of the Society's Publications Committee.

Those who came in contact with Robison in his daily life must have realised that few men could have shown such whole-hearted devotion and enthusiasm for their subject. The solution of a problem was its own sufficient reward. It would be difficult to imagine a more stimulating and conscientious director of a research department. Indeed his conscience sometimes diminished his effectiveness by exhausting his supply of energy and it can be said with truth that he worked unselfishly for his Department and for the Lister Institute. Robison was held in great affection by many and more especially by those younger workers who, while working at the Lister Institute, were privileged to gain his confidence. Robison had many interests beyond the realms of science and showed a strong inclination towards the arts. His interest in music, more especially in German opera and " Lieder," was sincere, and his reading of German literature, cultivated with care during his stay in Leipzig, was never allowed to lapse. He was an active gardener and found especial pleasure in this pursuit during the present difficult years.

The additional burden of Civil Defence undertaken freely and with an enthusiasm which the state of his bodily health could ill support proved too much. His colleagues and friends are left to mourn the loss of a man of rare charm and fine character; they deplore his passing and extend their sympathy to his widow and daughter who survive him.

I am indebted to the Biochemical Society for permission to reproduce parts of a more comprehensive Obituary Notice which appeared in their Journal.

W. T. J. Morgan.

HENRY HARBEN WHITELEGG.

1916—1941.

Henry Harben Whitelegg, the only child of his parents, was educated at Denstone, and afterwards at Downing College, Cambridge. He left school somewhat earlier than the usual leaving age, and spent two years in the works of the London Midland and Scottish Railway at Crewe before entering the University, which he did at the normal age. This contact with industry was of great advantage to him in many ways, particularly in enlarging his outlook and thus giving him an exceptionally broad and sympathetic attitude towards others.

His principal subject of study was chemistry combined with physics, mineralogy, and biochemistry. As an undergraduate he rightly put his work before everything else, and graduated B.A. in 1938 with Honours in Part I of the Natural Sciences Tripos. A year later he obtained Honours in Part II of that Tripos. Although in every sense a serious student, he had numerous other interests both in the College and in the University. At Downing he was an active member of the Debating Society, and helped to start a Bridge Club which played matches with other Colleges. Although he was not strong physically, he took a keen interest in the Boat Club. The activities of Harper House for students from the Overseas Dominions enlisted his sympathetic interests.

Since the outbreak of the war he had been engaged in chemical industry, and his death at the early age of 25 years has closed the career of one who was well endowed with many of the qualities which contribute to success in this walk in life. His passing will be mourned by a large circle of friends.

A. J. Berry.