Sir Walter Cawood

THE death of Sir Walter Cawood has robbed us of a distinguished scientist and an able administrator. For most of his professional life he served in government departments and research establishments primarily concerned with military affairs, but he was always deeply interested in the problems involved in putting science to work. The identification of future need, the deployment of large resources, the delicate balancing of basic and applied research, advanced technology and development are equally relevant to the growth of our economy; these are the tasks in which Cawood built up his reputation.

Born in April 1907, he was educated at Archbishop Holgate's School and at the University of Leeds, where he took his Ph.D. degree in chemistry. He was a Cohen prizeman, a Ramsey Memorial Fellow and a Moseley Scholar of the Royal Society. His research during this period was concerned with the properties of aerosols and the theory of coagulation; and despite his widening experience, particularly of aeronautical matters, he always maintained his original interest in physical chemistry. In 1938 as the international situation worsened, he joined an Air Ministry team engaged on chemical warfare. This involved him in the design of proximity fuses, and from 1942 his most valuable work was in instrumentation. He was responsible for the development of bomb and torpedo sights and for synthetic training aids particularly for night flying. He improvised a simple preset range finder for use in aircraft attacking the flying bomb, and to improve this device he took part in operations against these missiles; for this he was awarded the honorary rank of Wing Commander.

He was deputy director at the Royal Aircraft Establishment from 1947 to 1953 and it was during this time that he acquired an abiding interest in aviation and in ground and airborne avionics. In 1954 when Theodor von Karman was creating A.G.A.R.D., a unique organization which did so much to restore the European aeronautical fraternity, Cawood gave enthusiastic support and as a national delegate gave a great deal of his time in the critical early stages. From 1953 until 1959 he was at the headquarters of the Ministry of Aviation, where he was responsible for the aeronautical research programmes. He believed in identifying the few important growth points from a wide range of promising alternatives; and once he had made his choice he was single-minded in his support. He foresaw the potential of vertical take-off and as early as 1958 provided support for Sir Sydney Camm's deflected thrust aircraft, the forerunner of the Kestrel now entering service with the Royal Air Force. He understood the need to supplement wind tunnel measurements with actual flight trials. He encouraged the investigation of light weight lifting engines in the "flying bedstead" and later with Short's S.C.1; and of the low speed handling properties of the slender wing with the Fairey Delta which did so much to validate the design of the Concord.

In 1959, when responsibility for research and development in the munitions field was transferred from the Ministry of Supply to the War Office, Cawood became the first chief scientist of that department and later in 1964 the first scientist to be a member of the Army Board. He had already in 1955 brought together armament research and development into one establishment at Fort Halstead and his wide experience was invaluable in welding into one team the various scientific and engineering organizations within the War Office, and in building up confidence between the scientists and their military colleagues. His own personal knowledge of aviation technology was particularly useful to the Army, which was beginning to invest heavily in helicopters and in air transportability; and his earlier training as a chemist found new application in the affairs of the Chemical Defence Establishment at Porton and the Ordnance Factories.

In 1964 he returned to the Ministry of Aviation as chief scientist and became involved in the redeployment of effort after the defence reviews, which led up to the integration of the Ministry of Aviation within the new Ministry of Technology. His particular concern was to extend the mandate of the defence establishments so that their unique resources would be more directly available to civil industry. Although he had not been in good health for the past year, he continued to carry his heavy responsibilities and at the last he was among his colleagues and friends at the Royal Aircraft Establishment where he had spent so many active years.

ROBERT COCKBURN

Dr. R. J. Van de Graaff

ROBERT JEMISON VAN DE GRAAFF, the inventor of the widely known Van de Graaff high voltage generator, who died at Boston, Massachusetts, on January 16, 1967, at the age of 66, was born in Tuscaloosa, Alabama.

He graduated in mechanical engineering from the University of Alabama in 1923 with the degree of B.S. and in 1924 as M.S. This background in engineering proved later to be of great value to him in his experimental work in physics. After a short period spent with the Alabama Power Company on an investigation of the flotation of ores, he proceeded in 1924 to the Sorbonne where he supported himself from his savings and with a grant from the State of Alabama.

It was at the Sorbonne, where he attended lectures and demonstrations by Madame Curie, that Van de Graaff acquired his life-long interest in fundamental atomic and nuclear physics. In 1925 he was elected Rhodes Scholar for Alabama and went to Oxford where he worked in Townsend's electrical laboratory for the D.Phil. degree. Here he soon showed his outstanding characteristic as a scientist: the ability to think deeply and critically about familiar topics and practices and to recognize potentialities in them that had been overlooked. He selected his own research topic, the accurate measurement of the mobilities of ions in gases, and by the use of a new form of electrical shutter he was able to publish in 1928 measurements of the mobilities of positive ions in hydrogen that represented the first real advance in this field since the pioneering measurements made at the end of the last century. His paper, however, anticipated the first publication by Tyndall and Powell of their independent and similar measurements by only a few weeks.

At this time speculation about the possibility of disintegrating atomic nuclei by artificially accelerated particles and the need for a source of high voltage was much "in the air", and it is interesting that Van de Graaff's fundamental contribution first came into his mind during his work on mobilities. Observing at dusk one evening the spectacular display of luminosity from the Whimshurst machine that activated his point source of gaseous ions, he remarked on the gross inefficiency of the device and realized that a large hollow conducting sphere charged continuously on the inside from an endless belt would not only attain a high voltage but would enable currents to be drawn from it equal to the rate of charging. By 1929, when Van de Graaff returned to the United States as a National Research Fellow at Princeton, he had already worked out the essential design of his electrostatic high voltage generator. Dr. K. T. Compton, with whom he was to work, immediately recognized the importance of Van de Graaff's ideas and gave him full support and encouragement. A demonstration model was rapidly constructed which was later described by Compton as "... being made out of a tin can, a silk ribbon and a small motor, at no expense. This model developed 80,000 V, being limited by the corona discharge from the edges of the can". A two million volt generator was next built in a deserted dirigible hangar and the Van de Graaff generator became thereafter a major scientific device

with many uses. The remainder of Van de Graaff's scientific career was dedicated to the improvement and uses of high voltage generators.

In 1931 he followed K. T. Compton to the Massachusetts Institute of Technology, and during the war as director of the High Voltage Radiographic Project there for the Office of Scientific Research and Development, with the help of a small group, he built and installed five generators. This experience suggested that electrostatic generators could be produced commercially as standard instruments for use in nuclear research and medicine and led to the formation in 1946 of the High Voltage Engineering Corporation of which Van de Graaff and Drs. John Trump and Denis Robinson were directors. The phenomenal success and growth of the company are well known and its products are to be found in physical research laboratories and hospitals all over the world. Van de Graaff served the company first as chief physicist and later as chief scientist, and was responsible for many of its major scientific advances, such as the recent ingenious insulated core transformer. His most recent work was directed to the improvement of rotating electrical generators both for the direct production of high voltages and for large powers, and with his usual acumen he was able to circumvent some of the limitations of conventional machines.

As a scientist who left his mark on the science of his generation Van de Graaff received many academic honours including the Elliot Cresson Medal of the Franklin Institute; the Naval Ordnance Development Award; the Dudell Medal of the Physical Society; the Tom W. Bonnor Prize of the American Physical Society, and honorary degrees from the Universities of Alabama, Florida and Utrecht.

Van de Graaff was among the most courteous and considerate of men; he evoked deep affection, admiration and loyalty in friends and colleagues alike, and his conversation, both scientific and social, was stimulating, provocative, just and vivid. Those privileged to know him will, in retrospect, echo Reynolds' tribute to Johnson—"He qualified my mind to think justly".

L. G. H. HUXLEY

Dr. Nabor Carrillo

DR. NABOR CARRILLO, who died on February 19 at the age of 54, was a prominent Mexican scientist. He had represented his country at the U.N. Atomic Energy Commission. He began to teach at the National University of Mexico when he was still a student. Dr. Sotero Prieto, a pioneer in modern mathematics, regarded Carrillo as his most distinguished student. In 1942, Carrillo completed his doctoral thesis at Harvard University.

His best known work includes the first quantitative explanation of the subsidence of Mexico City and the analysis of the subsidence of Long Beach, California. In the latter case his theory of "tension centres" was an important contribution to soil mechanics. One of his notable achievements was the design of the Angostura arch dam, the first such enterprise to be undertaken by Mexican engineers. Carrillo's many publications in physics, applied mathematics and engineering covered such topics as elasticity, plasticity, soil mechanics and the strength of materials.

Carrillo was a professor at the National University of Mexico—here he was for several years co-ordinator of scientific research—at Harvard University and at the universities of New York and Havana. In 1946 he was named adviser on nuclear energy to the Mexican government, and represented his country at the U.N. Atomic Energy Commission and at the experiments at Bikini. From 1956 he was a member of the board of directors of his country's Nuclear Energy Commission. In 1957 he

received Mexico's National Prize for science; he was twice president of the Mexican National Academy of Sciences, and was also president of the Mexican Mathematical Society. Carrillo was awarded a number of honours, including the Humboldt Medal and the Légion d'Honneur, but he regarded his eight years, from 1953–61, as Rector of the National University of Mexico as the highest honour he ever received.

Dr. Joseph Bamforth

THE death of Dr. Joseph Bamforth at the age of 78 on February 10, 1967, deprived clinical pathology of one of its greatest exponents and of one of its most lovable characters. After graduating M.B., Ch.B. from the University of Liverpool in 1911, and taking the Conjoint Diploma in the same year, he held appointments as house physician and house surgeon in Liverpool Royal Infirmary before becoming a Holt Fellow in Pathology and later lecturer in the university. He proceeded M.D. in 1914, his thesis being a histological study of the cyclical changes in the endometrium, thus pointing towards an interest in gynaecological pathology which he was to exploit to the full in later years. The First World War, however, involved service in the forty-ninth General Hospital, British Salonika Force, which not only turned his interests for the time being towards bacteriology but also had a profound effect on his later career, in that association with L. S. Dudgeon, consulting pathologist to this force, resulted in Bamforth becoming assistant bacteriologist at St. Thomas's Hospital, London, in 1922. In 1924 he took the M.R.C.P. and described the first British cases of dysentery caused by Sonne's bacillus. Studies on atypical *Escherichia coli* and investigation of *Staphylococcus aureus* with the production of a "toxoid" for the treatment of furunculosis (which was still in demand for some years after the introduction of antibiotics) followed, together with publications on megakaryocytic myelosis and aplastic anaemia. After Dudgeon's death in 1938, Bamforth became director of clinical pathology at St. Thomas's, and during the Second World War he also served as an Emergency Medical Service sector pathologist when the hospital was evacuated to Hydestile, near Godalming. In 1940 he was elected F.R.C.P.

After returning to London at the end of the war, he concentrated more on histology and especially on diagnostic cytology, in which he had been interested since Dudgeon developed the technique, and to which he contributed much original work culminating in the publication of his book, *Cytological Diagnosis in Medical Practice*, in 1966—when he was 77 years old.

He retired from St. Thomas's in 1953, but his work continued at the Imperial Cancer Research Fund, Royal College of Surgeons, and at King's College Hospital. Election as F.R.C.O.G. in 1958 and as first President of the British Society for Clinical Cytology in 1962 gave him great pleasure.

Such an account of Joe's public achievements gives little idea of his outstanding personal qualities which included a charming and genuine modesty and an enthusiasm for his work which he was able to communicate—without conscious effort on his own part—to students, colleagues or even the first person he happened to meet after making a particularly interesting discovery in his laboratory. His application of laboratory investigations in clinical diagnosis was aided by an astonishing memory of details of previous cases, a characteristic which also made him a stimulating teacher. Neither his enthusiasm nor his vast experience, however, deviated him from his course of strict scientific honesty.

Joe was a great pathologist; his kindness, generosity and wit will be remembered with affection and gratitude by his very many friends who knew him also as a great man.

K. R. DEMPSTER