Obituary

SIR ARTHUR SCHUSTER, F.R.S.

ON Sunday, October 14, Sir Arthur Schuster passed away at Yeldall, his home near Twyford, Berkshire, after a long and distressing illness. Thus is broken one of the few remaining links with the physics of the second half of the nineteenth century.

Sir Arthur Schuster was a member of a Frankfort-on-Main family which, so early as the middle of the eighteenth century, had established a business in cotton goods in England. His father, while retaining an interest in the English business, founded a successful banking firm in Frankfort-on-Main; but in 1869 he removed with his family to England, taking charge of the Manchester branch of the firm of Schuster Brothers. Arthur Schuster was born in Frankfort on September 12, 1851, and spent the first sixteen years of his life in that town. He received his early education in the Gymnasium and then was sent to Geneva where, during two happy years, he studied French and attended lectures at the "Academy". In 1870 he joined his parents in Manchester and entered his father's business. There can be little doubt that his experience during these early years had a great influence on his future life, for he gained a complete mastery of the English, French and German languages and, although against the grain, learnt something of business methods.

Schuster was not happy in the business; he found more pleasure in attending evening classes at the Owens College, and in less than a year he had induced his father to let him take up science as his life's work. He now entered Owens College as a day student, and for a year studied under Balfour Stewart; and then having become interested in spectrum analysis he went, on the advice of Roscoe, to Heidelberg to study under Kirchhoff. He spent two years in Heidelberg, obtaining his Ph.D. in 1873.

On his return to Manchester, Schuster found that Owens College had been removed from its cramped and primitive quarters in Quay Street to its present site, where three rooms in the basement had been set aside as a physical laboratory. Balfour Stewart was still the professor of physics and Schuster became his unpaid demonstrator. Little did Schuster foresee, as he worked in the three-room laboratory, that only twenty-seven years later he himself would be the professor of physics with a laboratory, built to his own design, consisting of forty rooms. But at this time Schuster had no intention of settling down at Manchester; that was to come seven years later. In the meantime, he studied at Göttingen under Wilhelm Weber and Riecke and at Berlin under Helmholtz; led (at twenty-four years of age) the British eclipse expedition to Siam; put in another year as honorary demonstrator at Manchester, when —as he was proud to recall—he gave a course of lectures on Maxwell's theory of electricity which was attended by J. J. Thomson; worked for nearly five years at the Cavendish Laboratory, Cambridge, first under Clerk Maxwell and later under Lord Rayleigh; and during the summer vacation of 1878 took part in his second eclipse expedition, this time to Colorado.

In 1881 a professorship of applied mathematics was founded at Owens College and Schuster was appointed to the chair. He held this professorship for seven years, during which his work was physics rather than mathematics, and he took part in two more eclipse expeditions, to Egypt in 1882 and to the West Indies in 1886.

In 1888 Balfour Stewart died and Schuster was appointed to succeed him as Langworthy professor of physics in the Owens College, a professorship which he retained until his retirement in 1907, when he was succeeded by Lord Rutherford. Thus Schuster's association with Owens College, Manchester, was a long one, commencing when he first attended Roscoe's lectures as a night student in 1870, and terminating in 1907 after he had been professor of physics for twenty-six years. It was a period of great development: in 1873, when Schuster first taught in the laboratory, there were only about ten students; when he retired in 1907 there were about 150 students taking elementary courses and 100 doing more advanced work.

Schuster commenced his active scientific life just at the time when physical laboratories were being established at the British universities and, as we have already seen, he worked in two of them in their very early days. The period of qualitative discovery of new physical phenomena appeared to be over: the main facts of electricity, magnetism, optics, spectrum analysis, etc. were known; and, as a matter of fact, no further discovery of a fundamental nature was made until the discovery of Röntgen rays at the end of 1895, by which time Schuster's period of active research was nearing its end. Schuster's scientific work was, therefore, concerned almost entirely with what may be called the 'old physics'; but he lived long enough to follow with the greatest interest and pleasure the progress of the 'modern physics' in which his old laboratory at Manchester has taken such a distinguished part.

It has already been mentioned that Schuster while still a student, was attracted to spectrum analysis, and his first paper, published when he was twenty-one years of age, was on the spectrum of nitrogen. It was spectrum analysis which gave him his interest in eclipse work, and on his third eclipse expedition he succeeded in photographing the spectrum of the solar corona for the first time. Laboratory work on spectra, mainly the spectra of gases in Geissler tubes, naturally led him on to problems connected with the discharge of electricity through gases, on which subject he wrote many papers and delivered two Bakerian Lectures (1884 and 1890). He was the first to attribute the conductivity of gases at low pressure to the formation of gaseous ions, and he made the first determinations of e/m by means of the magnetic deflection of cathode rays, but did not obtain a good result.

Schuster became more and more interested in what we now call geophysics, and the relationship between geophysical and solar physical phenomena. One of his most important papers was an analysis of the daily variation of terrestrial magnetism, in the course of which he proved that the electrical currents responsible for the daily magnetic changes were external to the earth ; and in a later paper he showed that qualitatively these currents could be explained by the induction currents which would be set up by the daily variation of the barometer if the upper atmosphere were highly conducting. This was a development of a suggestion made previously by Balfour Stewart and was itself the forerunner of Heaviside and Kennelly's explanation of the propagation of wireless waves around the earth. Schuster made other valuable contributions to the theory of terrestrial magnetism and was particularly interested in the relationship between magnetic storms and the processes taking place on the sun.

Schuster did not himself carry out investigations in seismology ; but he was deeply interested in this branch of geophysics and was for some time chairman of the Seismological Committee of the International Association of Academies and served on other committees both international and British dealing with seismology. In 1910 he presented a set of Galitzin's horizontal seismographs to Eskdalemuir Observatory. In 1925 these instruments were transferred to Kew, and during the last few years in particular their records have been the subject of intense and very productive original work.

Meteorology was always a favourite subject with Schuster, and he gave much time and thought to the organisation and administration of the Meteorological Office. In 1900 he was appointed by the Royal Society to be an additional member of the Meteorological Council, the Meteorological Office then being under the control of the Royal Society. When the constitution of the Office was changed in 1905, Schuster became the Royal Society's representative on the new Meteorological Committee, a post which he held until November 1932, when his failing powers made it no longer possible for him to serve. Thus for more than thirty-two years Schuster sat on the governing body of the Meteorological Office, seldom missing a meeting, and taking intense interest in the development of the meteorological service. He also showed his interest in meteorology by persuading the University of Manchester to establish in 1905 a University lectureship in meteorology, the first post for the teaching of meteorology in a British university, and at his own cost he established in 1907 a readership in meteorology at Cambridge.

No one will question Schuster's eminence as a man of science ; but it is doubtful whether he was not an even greater administrator. It was impossible for Schuster to be connected with any undertaking without being called upon to take part in its organisation and administration. During the whole of his association with Manchester, he was a leading spirit in all University affairs and he took a large part in the movement for the conversion of the old Victoria University into three independent universities in Manchester, Liverpool and Leeds. He was elected a fellow of the Royal Society in 1879, at the early age of twenty-eight years, and always took a prominent part in the work of the Society. He served two periods as an ordinary member of Council and was secretary for seven years (1912–19) embracing the difficult period of the War. On retiring from the secretaryship he served on the Council for five more years, first as vice-president and then as foreign secretary. He received a Royal and a Rumford Medal from the Society, and eventually, in 1931, the Copley Medal. He was also an active member of the British Association, serving as president of Section A (Edinburgh, 1892), of the Sub-section of Astronomy and Cosmical Physics (Belfast, 1902) and finally of the whole Association at Manchester in 1915. It would be tedious to enumerate all the committees, commissions and conferences on which he served ; but mention must be made of the Royal Commission for the Universities of Oxford and Cambridge under the chairmanship of Lord Oxford and Asquith, in the work of which he was deeply interested.

There is still another side of Schuster's life to relate, and one to which he devoted the greater part of his time after retiring from the professorship at Manchester. I have already mentioned that Schuster's education had given him complete command of the three main European languages. He was always fond of travel and became personally known to the leading men of science in all parts of the world. Also his family connexions were international rather than national. Thus he was by circumstances, training and temperament eminently fitted to take a leading part in the international organisation of science. It is not surprising therefore that he should be sent by the Royal Society as delegate to the preliminary meeting held at Wiesbaden in 1899, for the organisation of the International Association of Academies. He took an active part in the subsequent formation of that Association and in 1905 was appointed by the Royal Society to be the representative of the Society on its Council. To facilitate Great Britain taking a proper share in the work of the International Association of Academies, Schuster endowed the Royal Society with a fund of £3,500, the income of which was to be used in paying the annual subscription to the Association and in defraying the expenses of delegates.

The War destroyed the International Association of Academies, much to the distress of Schuster ; but even before the end of hostilities, he commenced to build up again an international organisation for science by the foundation of the International Research Council, of which he became the first secretary, an office he held from 1919 until 1928. It is impossible here to give any details of Schuster's struggles after the War to re-establish real international co-operation in science ; trusted by both French and German men of science, no one was more fitted to bring about an understanding ; but circumstances were too strong, and even to-day the breach caused by the War in international co-operation amongst men of science is far from being repaired.

For a man of his outstanding ability and force of character, Schuster was of a very retiring nature. It was not easy to get to know him well; his manner was reserved and he had a disconcerting habit of letting his mind wander—or appear to wander—from the subject of conversation. But all of us who came into close contact with him knew how superficial these mannerisms were: behind them there was a lively human interest and a great desire to help. Few professors took a more active interest in their students, and in this he was ably assisted by Lady Schuster, whose hospitality at Kent House in Victoria Park, Manchester, is a happy recollection of all those who studied under, or worked with, Sir Arthur in Manchester. An outstanding characteristic was Schuster's loyalty to his friends, for he never lost an opportunity of advancing the career of anyone who had gained his confidence. Mention has been made above of three valuable donations which he made in the cause of science; but there is good reason to believe that these are only a small fraction of the contributions he made to scientific objects.

For months it has been known that Sir Arthur could never recover and he has been withdrawn from his most intimate friends; but the passing of one who has had such an influence on the lives of individuals, on the progress of science in his own country and on the attempt to attain international co-operation in scientific matters cannot but come as a shock, and there will be many in all parts of the world who will feel a personal loss in the death of Sir Arthur Schuster. G. C. S.

MR. GEORGE FLETCHER

THE many friends of Mr. George Fletcher will have received the news of his death on September 20 with deep regret and a sense of personal loss. While an electrical engineer on the old Midland Railway, he studied at the Derby Technical School, and soon made his mark as a lecturer of exceptional ability. His success as an organiser attracted the attention of Sir William Abney and led to his appointment in 1894 as inspector under the Science and Art Department. He worked for two years in the west of England and was then put in charge of the Midland Division, comprising many important schools. As an inspector Fletcher was at his best and may be said to have established a new standard of inspection. His personal charm, wide knowledge of the aims and methods of practical studies, and his tendency always to help rather than to criticise, made him universally popular among teachers and colleagues.

On the establishment of the Department of Agriculture and Technical Instruction for Ireland, Fletcher was appointed by Sir Horace Plunkett in 1901 as Chief Inspector, and on Sir Robert Blair's appointment to the post of Education Officer to the London County Council, he succeeded him in the post of Assistant Secretary, Technical Instruction, to the Department. In this capacity he did much to foster the growth of a public sense of responsibility for education, and the local committees under his sympathetic guidance became responsible and progressive bodies.

The recent wide extension of the administrative and rating powers of local committees have been rendered possible by Fletcher's patient work during the past twenty-five years. His many-sided interests made him a constant contributor to educational discussion at international conferences, and at meetings of the British Association.

News and Views

Prof. L. J. Henderson

THE cost of the new University Library at Cambridge, which is to be opened by the King on October 22, was defrayed, in part, from a munificent benefaction given by the Rockefeller Foundation; the rest of that benefaction having been devoted to the development of biological science. It is appropriate, therefore, that the University should utilise the occasion to confer the honorary degree of Sc.D. on two biologists from the United States, Dr. Lawrence J. Henderson, professor of biological chemistry at Harvard University, and Dr. K. Landsteiner, of the Rockefeller Institute for Medical Research. Dr. Henderson comes of that old New England stock from which so much of the flower of Harvard has grown. He graduated at that University in 1898 and has held his present chair since 1919. It is difficult to-day to imagine that at the commencement of the present century, there were no exact ideas about the 'reaction' of biological fluids and that the sign '*p*H' did not exist. To-day, hydrogen ion concentration is regarded as one of the most fundamental conditions which govern the reactions of the body. Henderson had a great hand in this revolution, and especially in the investigation of the balance between carbonic acid and base, by which the hydrogen ion concentration of the body is maintained so close to neutrality. The famous 'Henderson-Hasselbalch equation' stands like a monumental stone testifying to the part which Henderson played. After the War, Henderson concerned himself with a more comprehensive study of the equilibria occurring in blood. The investigation of these centred principally about three groups of factors: (1) the properties of hæmoglobin; (2) the composition of the plasma; and (3) the nature of the membrane which separates one from the other.

IT had been recognised that in the simultaneous presence of oxygen and carbonic acid, the equilibria which hæmoglobin forms with each gas is not independent of the other. Henderson showed, however, the existence of an equilibrium to which eight factors contributed: oxygen, carbonic acid, water, chlorides, serum proteins, serum bases and intracellular bases and hæmoglobin. If the concentration