stration talks for boys and girls throughout the school year, in collaboration with the science teachers, at which large-scale experiments are shown which cannot easily be staged with school resources. An approximate estimate of the cost, based on the proportion of overhead charges allocated to the scheme, is £5,000 a year, which is defrayed by the generous assistance of industrial firms and other bodies which are interested in the venture. Some 16,000 tickets are issued annually. The young people come from an area which includes about one-quarter of the schools in England, and their keenness indicates that this is a very repaying way of using the resources. Some half-dozen such centres operating on a similar whole-time basis would cover most of Great Britain. Certain famous annual lectures sponsored by various bodies are by tradition the occasion for numerous carefully prepared experiments, and these lectures draw enthusiastic audiences. Television can, of course, be a powerful means of transmission ; but the laboratory resources must still be there behind the scenes for providing the programmes. My contention, therefore, is that merely increasing the number of talks and articles about science will not get us very far in interesting the general public, that on the other hand one gets the most rewarding response if one stages shows of experiments for them, and that if their interest is first so aroused, they will be much more able to appreciate the talks and articles.

OBITUARIES

Prof. D. R. Hartree, F.R.S.

Prof. D. R. Hartree, who died suddenly in Cambridge on February 12 at the age of sixty, had been Plummer professor of mathematics in the University since 1946. Before that he had spent fifteen years in Manchester, first as Beyer professor of applied mathematics and later as professor of theoretical physics. He was elected a Fellow of the Royal Society in 1932.

Hartree was born in Cambridge in 1897 and was seventeen years old when the First World War broke out. He served in the Munitions Invention Department and held a commission in the R.N.V.R. When the War ended, he returned to Cambridge to take the Natural Sciences Tripos. He became a Fellow of his own College, St. John's, and later migrated to Christ's College, where he held a fellowship for a short time before going to Manchester.

Some of Hartree's earliest work was on the propagation of radio waves in a magneto-ionic medium, and he wrote several important papers on this subject. His principal contribution to physics, however, was the development of the method of self-consistent fields for the computation of atomic wave functions. Early applications of wave mechanics had been to simple atoms such as those of hydrogen and helium, but Hartree saw a way of obtaining, by numerical means, wave functions for heavier atoms. He exploited this method with great vigour, and a long series of papers appeared in which Hartree and his collaborators presented the results of calculations for a large number of atoms.

Hartree's work on atomic wave functions led him to a more general interest in numerical analysis, and this eventually became his major preoccupation. To him numerical analysis was above all a practical subject and he brought the same kind of enthusiasm to computing as others bring to practical work in a laboratory. He always liked to tackle a new problem, and anyone who brought a problem to him would, as like as not, be given practical help as well as advice.

Although Hartree enjoyed computing—a little while before his death he claimed that he had some 10,000 hours of personal computing to his credit—he appreciated very early the advantages which might be obtained from mechanical aids. He was responsible for introducing the differential analyser into Britain, and the machine which, at his instance, was installed in the University of Manchester in 1935 was used to solve a wide range of problems. During the Second World War the machine was occupied with military problems of various kinds including, notably, an investigation into the mode of operation of the radar magnetron.

When the War ended, Hartree visited the United States to study the developments then going on in automatic digital computers. His practical experience of numerical analysis enabled him to make a distinctive contribution in this field and he rapidly became accepted as an authority. He was much in demand as a lecturer, and a course he delivered at the University of Illinois in the autumn of 1948 was published in book form.

When Hartree arrived in Cambridge in 1946, development work on an electronic digital computer was starting in the Mathematical Laboratory. Hartree associated himself with this project with characteristic enthusiasm and the Laboratory owes much to him for encouragement, advice and practical assistance. He continued his close association with the Laboratory until his death and took a prominent part in the running of successive summer schools in programme design and in the teaching for the diploma in numerical analysis and automatic computing.

Hartree did much to advance the interests of the Cavendish Laboratory, where he had his office. In particular, he was largely instrumental in reorganizing and improving the teaching of mathematics to science students, and in establishing theoretical physics as an optional subject in Part 2 of the Natural Sciences Tripos. In addition to his scientific interests, Hartree was a very keen musician, and played an important part in the founding of the Faculty of Music in the University of Manchester.

Hartree will be greatly missed by his many friends. He was the kindest and most unassuming of men, and endeared himself to all who worked with him.

M. V. Wilkes

Dr. C. J. Davisson

Physicists all over the world, and especially those of the older generation, will have heard with deep regret of the death on February 1 of C. J. Davisson.

Davisson is known best for his work on the diffraction of electrons by metal crystals, which established for the first time the wave character of free electrons and proved L. de Broglie's relation $\lambda = h/p$ between the wave-length λ and the momentum p of an electron. In fact, this work was the outcome of a long series of experiments started for quite a different purpose.

Davisson, who was born in Bloomington, Illinois, on October 22, 1881, took his degree in the University of Chicago in 1908. R. A. Millikan was there at the time and claimed with pride to have directed him towards physics. Davisson then went to Princeton, where he took his Ph.D., and his first published paper appeared in 1909 from Princeton. In 1911, working under O. W. Richardson, then a professor at Princeton, he published another paper on the emission of positive ions from heated salts of the alkali ion and established that they are singly ionized atoms of the metal. In the same year he married one of Richardson's sisters. He then went as instructor to the Carnegie Institute of Technology. His connexion with the laboratory where his life-work was done started as a consequence of the First World War. In 1917 he went to what is now the Bell Telephone Laboratories, then part of the Western Electric Company's organization, to take up a temporary post; he stayed there until 1946.

His war-time work was concerned with the physics of the then new thermionic valves and vacuum technique. After the War he continued to work on the fundamental principles of thermionics and was allowed a free hand in choosing his researches to an extent unusual in those days in an industrial laboratory. He was the first to show experimentally that the variety of Richardson's formula, which in fact makes the electron follow the Fermi–Dirac electron statistics (not then discovered), is preferable to the original form. He also did work which turned out to be of considerable commercial importance on oxide-coated filaments.

Davisson's discovery of electron diffraction arose from a study of the scattering of electrons, and the production of secondary electrons, from metals. The first paper on nickel, with C. H. Kunsman, appeared in *Science* during November 1921. It described surprisingly sharp peaks of reflected electrons which Davisson considered could be explained by scattering (classical, of course) from two shells of electrons. In 1925, after studying some other metals, he returned to nickel. Until then, the experiments had all been on ordinary polycrystallic metals; but by an accident the specimen became oxidized and in restoring the surface by heating was changed into an aggregate of only a few crystals. There was a complete alteration in the pattern of scattering and the former theory had to be abandoned. He was inclined at first to replace it by one of 'transparent directions' of the lattice; but, partly as a result of a visit to the British Association meeting at Oxford, he came to believe that the effect was connected with the new theories of de Broglie and Schroedinger. As a result of a careful search, he and Germer found the first electronic beams in positions which could be explained in this way on January 6, 1927. The consequences of this work of Davisson and Germer are well known, but it is not always realized what a supreme experimental feat these early experiments were. The slow electrons of the order of 150 volts which were used are most difficult to handle, and if the results are to be of any value the vacuum has to be what would still be considered good, and was then quite outstanding. In fact, very few experimenters have since been successful with the method; much faster electrons are used when electron diffraction is employed for the study of surfaces.

In 1937 Davisson shared with me the Nobel Prize in Physics for this discovery.

In the 30's Davisson was interested in electron optics, and with C. J. Calbick could claim the discovery of the principle of the electrostatic lens. During the Second World War he worked on the cavity magnetron. In 1946 he retired from the Bell Telephone Laboratories on reaching retiring age, and was appointed research professor in the University of Virginia and lived at Charlottesville until his death. He leaves a wife, three sons and a daughter. Among many other honours he was awarded the Hughes Medal of the Royal Society.

Davisson was a man of exceptionally lovable character. Slight in build and with a hesitant manner of speaking, which made him seem shyer than he really was, he had a delightful sense of humour and was full of fun. Though he worked most of his life in an industrial laboratory, he was essentially an individualist. Yet he had the reputation of being very accessible in the laboratory and most helpful to all who consulted him. Among those who had close contact with him at the Bell Laboratories are Lee Du Bridge, Merle Tuve, Philip Morse and William Shockley.

George Thomson

Mr. J. L. Baker

Julian Levett Baker was, when he commenced in 1900, the first chemist appointed to a London brewery. Born in 1873, he had trained at Finsbury Technical College and had worked as a chemist for the Beetroot Sugar Association before brewing became his life-work.

From the first, he energetically studied the many possibilities of improvement in brewing which science could suggest at that time, and in the course of his work he published some fifty papers—a number of them inspired by his original studies on sugars. In 1905, he also published a concise and readable book on "The Brewing Industry".

In 1904 he was joined by Henry Everard Hulton, and the two engaged in the work of the brewery and in numerous scientific studies. It was a memorable collaboration which lasted for thirty-four years until Hulton's death—at which time Baker wrote: "Throughout the long years no shadow was ever cast over an enduring friendship".

Indeed, all Baker's pursuits created something of a record for length. He was an original member at the formation of the Institute of Brewing in 1904 and was a vice-president for forty years (1918–58). He was a scientific editor for forty-two years—first of *The Analyst* (1907–20) and then of the *Journal of the Institute of Brewing* (1920–49); while his service with Watney, Combe, Reid and Co., Ltd., lasted for forty-six years.

His merits were recognized by the award in 1948 of the Horace Brown Medal of the Institute of Brewing.

Baker's interests and energies were not confined to brewing aspects of chemistry, for, besides his editorship of *The Analyst*, he was honorary secretary of the London Section of the Society of Chemical Industry from 1903 until 1909 and its chairman in 1919.

In his retirement, Baker, lovingly tending his garden, outlived his contemporaries to recall to later generations with graciousness and charm something of the marked individuality and wide culture which a band of young London scientists had displayed so outstandingly in the early part of this century.

He died on January 29. He is survived by his two sons and his daughter.

L. R. Bishop