

attack on the problem by refusing to consider supraconductivity as the limiting case of ordinary conductivity and by considering it as a more elementary state in which the whole metal behaves like a large diamagnetic atom. A new equation, $\lambda C \text{ curl } J = -H$, relating current density and

magnetic field, is postulated, this assumption replacing Ohm's Law in a superconductor and leading directly to a solution in which stable persistent currents are possible, these currents being confined to a depth of 10^{-5} cm. below the surface of the conductor.

Obituary

PROF. H. M. MACDONALD, O.B.E., F.R.S.

HECTOR MUNRO MACDONALD was born in 1865 at Fearn, Ross-shire, and educated at Tain Academy, Aberdeen Grammar School and the University of Aberdeen, proceeding in 1886 to Clare College, Cambridge, and taking the Mathematical Tripos in 1889. The list of Wranglers was one of considerable distinction: Sir Gilbert Walker was senior, Sir Frank Dyson second, Macdonald fourth and A. S. Ramsey (president of Magdalene) sixth. He was soon elected to a fellowship at Clare, and in 1891 was Smith's Prizeman.

During Macdonald's formative period, the professorial chairs at Cambridge were occupied by Stokes, Adams (the discoverer of Neptune), Cayley, J. J. Thomson and G. Darwin; while of the other teachers, he seems to have owed most to Routh, Hobson, Glazebrook and Larmor. But perhaps his greatest debt was to Verdet's "Leçons d'optique physique", Maxwell's "Electricity and Magnetism" and the works of Horace Lamb and the third Lord Rayleigh.

Macdonald's first published papers were on hydrodynamics and the mathematical theory of electricity—waves in canals, electrical distributions on conductors of various shapes, and self-induction. In 1897, however, he began to write on pure mathematics—the relation between convergent series and asymptotic expansions, the zeros and the addition theorem of Bessel functions, various Bessel integrals, spherical harmonics and Fourier series. In the paper on the zeros of the Bessel functions (*Proc. Lond. Math. Soc.*, 29; 1898), he gave the result since known as Macdonald's theorem, that the number of zeros of a function $f(z)$ in the region bounded by a contour at each point of which $|f(z)| = a$ constant, exceeds the number of zeros of the derived function $f'(z)$ in the same region by unity, the function $f(z)$ being supposed analytic in the region.

Macdonald's reputation as a discoverer was, however, chiefly due to a third group of researches, which began with his Adams Prize essay of 1902 on electric waves, and was continued in a paper of 1903 on the bending of electric waves round a conducting obstacle, two memoirs on the diffraction of electric waves round obstacles (*Phil. Trans. Roy. Soc.*, 1911–12), several papers on the diffraction of light by opaque prisms, straight edges, etc. (*Proc. Lond. Math. Soc.*, 1913–15), and a series of papers (*Proc. Roy. Soc.*, A) from 1914 onwards on the transmission of electric waves round the earth's surface.

In 1905 Macdonald left Cambridge on being appointed to the chair of mathematics in his old

University of Aberdeen. The value of his work was recognised by the fellowship of the Royal Society in 1901, an honorary fellowship of Clare in 1914, a Royal Medal of the Royal Society in 1916, the presidency of the London Mathematical Society in 1916–18, and the Honorary LL.D. of Glasgow in 1934. During the last thirty years of his life, he took an active part in the administrative work of the University of Aberdeen and of educational institutions in the north-east of Scotland, and was almost invariably one of the delegates appointed to any conference of representatives of the four Scottish Universities. In recognition of his scientific eminence and public services, a subscription portrait was presented to the University of Aberdeen in 1933.

Macdonald never married. He died after a short illness on May 16, 1935. E. T. WHITTAKER.

PROF. W. R. HODGKINSON, C.B.E.

On April 8, at Blackheath, died, at eighty-three years of age, Prof. William Richard Hodgkinson, one of the older school of chemists, whose interests in chemistry covered a wide field. Born at Sheffield in 1851, and educated at the Royal Grammar School there, he early came under the influence of Sorby, the father of metallography, and to this is to be traced his later work on metals and their treatment.

Having gained a scholarship to the Royal School of Chemistry and of Mines in London, Hodgkinson studied geology, and under Sir Edward Frankland organic chemistry, before proceeding to the University of Würzburg, where his natural feeling for research was stimulated by Prof. Wislicenus, whose textbook on "Organic Chemistry" he translated. On returning to England his investigations at the Royal College of Science were mostly in organic chemistry, and in this branch of chemistry he published papers on such subjects as the action of the alkali metals on organic bodies, with W. H. Perkin, junr., and on organic bases and on naphthalene derivatives, with Dr. W. Limpach, whose sister he married nearly fifty years ago.

After a short period at the Royal Military Academy, Hodgkinson became lecturer in chemistry and metallurgy at the Ordnance College, and later professor of chemistry there, retiring in 1921 after thirty-one years of service in the College (now the Military College of Science). Most of Hodgkinson's work was thus carried out at Woolwich, and much of it was directed to Service problems and to training many generations of gunner officers, who look back to this

period of their career with much affection for their teacher, but the feature which impressed itself on all who knew him was the exuberance of his mind in suggesting new investigations. Of such as have been published may be mentioned his researches on the reducing properties of hydrazine and on hydrazine nitrate as an explosive, and on the carburisation of metals by acetylene. He edited and enlarged a textbook of chemistry known throughout many editions to generations of students—Valentin-Hodgkinson's "Qualitative Chemical Analysis".

It will thus be seen that as distinct from modern specialisation, Hodgkinson had an equal interest in and was fruitful in suggestion in organic, inorganic and metallurgical chemistry and became an authority on the chemistry of explosives, writing the Service treatise on that subject. For his work during the War in advising on and directing certain manufactures, he was made a C.B.E. in 1918.

Hodgkinson's personality endeared him to all, and his interests were not confined to his main subject. Thus he was chairman of the Blackheath School of Art and took a live interest in its work; for he himself was a wood-carver of great ability. He took part in the local government and in the educational affairs of the neighbourhood of Blackheath, and was founder of the Radium and of the Imperial College Lodges of Freemasonry.

Prof. Hodgkinson leaves a widow, a son (Capt. C. R. Hodgkinson, R.A.) and two daughters, one married to Mr. T. Morson. A much loved son was killed in the War.

R. ROBERTSON.

PROF. WILHELM KOLLE

By the death of Prof. Wilhelm Kolle at sixty-six years of age, on May 10, Germany loses one of her foremost bacteriologists, whose reputation was world-wide. Qualifying in medicine in 1892, Kolle entered the Institute of Infectious Diseases in Berlin in 1893 and became assistant to Robert Koch. By virtue of his position and work in that Institute, he was invited in 1897 by the Cape Government to conduct a scientific expedition in South Africa for the study of leprosy and rinderpest, and in 1900 was sent on a similar mission by the Egyptian Government to the Sudan, where he founded a laboratory at Khartoum. He was afterwards for a time professor of hygiene and bacteriology in the University of Berne, and in 1915 succeeded Paul Ehrlich as director of the Institute for Experimental Therapy in Frankfurt-on-Main, where he remained for the rest of his life.

On plague, cholera, leprosy and rinderpest, Kolle made important contributions. He was the first to prepare an effective antiserum for an ultra-microscopic virus, that of rinderpest or cattle plague, and the simultaneous method of protection against this disease with virus and immune serum was due to him and to the late Sir George Turner, formerly Medical Officer of Health for the Transvaal. In association with R. Otto, he devised a method of immunisation against plague with attenuated culture of the plague bacillus, and with R. Pfeiffer evolved

a method of protection against cholera by means of dead culture. At Frankfurt, where he was also director of the Georg Speyer-Haus research institutes, Kolle carried out investigations upon syphilis and spirochaetes, and was the first to produce the drug 'neosalvarsan', and also another drug, 'spirocid', the forerunner of stovarsol, which was discarded on account of toxicity.

Kolle's literary activity was prodigious, and he was the author in collaboration with Wassermann of the classical handbook of pathogenic micro-organisms, the last edition of which runs to ten volumes, as well as of a handbook on salvarsan treatment, a textbook of clinical methods of investigation, and one on experimental bacteriology.

R. T. HEWLETT.

PROF. V. POSEJPAL

WITHIN a few weeks of the death of Prof. B. Brauner, Czechoslovak science sustained a second heavy loss. Prof. Václav Posejpal, professor of experimental physics at the Charles University of Prague, died suddenly on April 8. He was born at Chlumec in Moravia on December 20, 1874, and studied at Hradec Kralové before going to Prague and taking his degree in natural sciences in 1900. He selected for his dissertation a thesis on Fourier series. After a period in Paris, studying certain Volta effects on magnetic fields, he returned to Prague, becoming *Privatdocent* at the University in 1910. In 1919 he was installed as professor of physics, and was Dean of the Faculty of Sciences in 1929-30.

Prof. Posejpal was one of the leading Central European research workers in experimental physics, and carried out noteworthy investigations on such subjects as the refractivity of gases at low pressures, fluorescence phenomena, X-ray spectroscopy and resonance. He also contributed to our knowledge of the ether and the neutron. Most of his work appeared in Czech scientific journals, but he also published papers from time to time in the *Comptes rendus* of the Paris Academy of Sciences and in German publications.

Prof. Posejpal was a Chevalier of the Legion of Honour and honorary member of many physical societies. He was general secretary of the Czechoslovak National Research Council and a vice-president of the International Union of Pure and Applied Physics. His colleagues and students held him in high esteem and he will be greatly missed in scientific circles in Czechoslovakia. He was known to a wider public through his popular broadcasts on scientific matters.

Prof. Posejpal was keenly interested in winter sports and frequently conducted parties of friends and students on ski-ing expeditions to the High Tatras and to the Austrian Alps.

J. G. F. D.

MR. R. E. RICHARDSON

THE Middle West of the United States lost an outstanding ichthyologist and aquatic biologist by the death on April 14 of R. E. Richardson, best