wrote: "The war had brought on rapidly rising prices peculiarly hard to bear by the older people. It had dissipated to the four winds domestic servants of any kind. . . . Delicate and sensitive, Heaviside suffered, at first inconvenience, later real want. . . . He lived on alone. He saw reared on his work and genius an industrial and economic edifice of enormous proportions, and he had no share in the rewards and little in the fame. . . ."

When he was seventy-one, the Institution of Electrical Engineers held its jubilee. On the proposal of Sir Oliver Lodge, a special message was sent to Heaviside, and a little later he received the first Faraday Medal founded to mark the occasion of the jubilee of the Institution; this was personally conveyed to Heaviside by the president, the late Mr. J. S. Highfield.

SUBMARINE GRAVITY SURVEY

A BRITISH EXPEDITION IN THE EASTERN MEDITERRANEAN

THE figure of the earth is so nearly an ellipsoid of revolution that people are apt to think that the distance between two places can be calculated exactly, once their latitudes and longitudes are known. This is not so. The actual shape of the mean sea-level surface depends on the distribution of matter within the earth and is appreciably distorted in the vicinity of large masses. A good example is found on Cyprus. It is known from triangulation that Limmasol and Kalokhorio, which lie on the northern and southern shores of the island, are 57 km. apart. Yet the distance between them, as calculated from astronomical observations, is 1.8 km. greater, a difference of approximately 3 per cent. This discrepancy at once suggests that there is an abnormal concentration of high-density material between them. A gravity survey has confirmed this, for large positive anomalies are found almost everywhere on the island. At Agros, which is approximately half-way between Limasol and Kalokhorio, the free air anomaly is + 282 milligals, and after allowing for the attraction of topography, the Bouguer anomaly is found to be + 174 milligals. It is estimated, however, that even these large positive anomalies would only account for about half the observed difference in the deflexions of the vertical: presumably the rest is due to mass deficiencies below the sea farther to the north or south.

The example just given is abnormal, but it is a striking reminder that the fundamental problem of geodesy, the determination of the shape of the earth, is still far from solved. It has been shown by Stokes that the shape of the geoid can be calculated if gravity is known all over the earth. Unfortunately, this method can only be applied very approximately at present, owing to scarcity of data, especially over the oceans. At sea, except in shallow water, the only practical method of measuring gravity with sufficient accuracy is to make observations in a submerged submarine. Such experiments demand close collaboration between naval and scientific personnel. In Great Britain, the Defence Services Research Facilities Committee of the Royal Society provides the necessary liaison. Since the War, two expeditions have been made in the vicinity of the British Isles.

The results of the first, made in 1946, have recently been published, and technical details of the second are also available. A third expedition is now planned in the Eastern Mediterranean and is due to sail from Malta in the middle of May. The necessary funds are being provided by a special grant from the Royal Society, and the Royal Navy is giving wholehearted co-operation. The technical arrangements have been made by the Department of Geodesy and Geophysics in the University of Cambridge, with the generous assistance of the Danish Geodetic Institutes.

The Western Mediterranean has already been studied by the French and Italians, and so, when the British results are known, a fairly complete general picture of the gravitational field of the whole Mediterranean Basin will be available. Quite apart from the geodetic importance of these observations, it should be possible to draw some most interesting geological conclusions. The Mediterranean is generally supposed to be that portion of the Tethys Sea remaining after the great earth movements, which formed the Alps and other folded mountains in southern Europe and Asia Minor, had subsided. But even now the crust of the earth is not quiescent, for volcanic eruptions and earthquakes are still experienced. A study of the gravitational field may well throw light on the cause of these phenomena. Particular points will also be examined. Comparative surveys around Pantelleria and Malta may show whether or not the latter is of volcanic origin. The structural relationship between the islands of Crete and Cyprus and the Taurus Mountains on the Turkish mainland should be plainly revealed if the large anomalies mentioned earlier are found to extend out to sea. Measurements over the Nile Delta and among the Dodecanese Islands will show how nearly these regions are in isostatic equilibrium. In addition, it is hoped to connect up the results of earlier surveys by making special observations, both at sea and in harbours, and to carry out an extensive programme of echo sounding.

The survey itself will last about twelve weeks, during which about a hundred and twenty gravity determinations will be made; but it will be several months before all the records are finally measured and the results known. More accurate estimates of relative deflexions of the vertical can then be made and tentative geological conclusions drawn. These may require revision as further data become available; but the actual gravity measurements and soundings will be of permanent value. Geophysical methods are rapidly becoming of great assistance to geologists, and in areas such as the Eastern Mediterranean, where sediments obscure the underlying rocks, they may well prove of major importance. The results of the proposed British submarine gravity survey will therefore be awaited with great interest.

B. C. BROWNE

OBITUARIES

Prof. J. A. Crowther

By the death, on March 25, of James Arnold Crowther, we have lost another of the remaining living links with the Cavendish Laboratory of J. J. Thomson's time. It was in those days—which now seem both so recent and so distant—that Crowther, after a brilliant undergraduate career (1903–6) at Cambridge, made his first indelible mark on physics history with his important investigations into the

scattering of X-rays and the properties of β -rays. He continued his researches first as Mackinnon Student of the Royal Society, later as Fellow of St. John's, and started his teaching career as demonstrator and lecturer in the Cavendish, a post which he held until 1924.

In the early days of the First World War he was associated with Alfred Robb in running an X-ray laboratory to help Addenbrooke's Hospital with the many war casualties pouring into Cambridge. This early experience, when X-ray facilities for radiological diagnosis were practically non-existent, no doubt deflected part of his research interests into the field of medical radiology, and one of his books was written on this subject; while his editorship of "The Handbook of Industrial Radiology" proved his realization of the import of X-ray radiological techniques in industry. He was lecturer in medical radiology in the University of Cambridge during 1921-24, and he became president of the British Institute of Radiology in 1936.

Crowther held the chair of physics in the University of Reading during 1924-46, when he retired as professor emeritus. During his tenure of the chair at this young and expanding university, Crowther spread his abundant energies in wide and influential spheres. His quick and ready brain, coupled with a flowing, happy pen, gave scope to his expository powers in a number of valuable text-books. The best known to students perhaps is "Ions, Electrons and Ionising Radiations", kept up to date in a series of editions, and deservedly popular with many generations of young students. A number of other books stand to his credit and will be a very real monument to his memory.

A powerful influence outside that of the written word flowed from his connexion with the Institute of Physics. A founder Fellow, he served continuously on its Board for twenty years, until his death, and was honorary secretary during 1932-46. During this period the Institute increased its membership and importance by leaps and bounds, due in great measure to his enthusiasm and self-sacrifice in its service. It was at the end of this period, 1944-46, that he became vice-chairman of the Parliamentary Science Committee.

Crowther was a Yorkshireman, born on August 28, 1883, in Sheffield, where he went as a boy to the Royal Grammar School. He had little of the traditional bluntness of the North—his was the gentle, kindly outlook of the true student—and those privileged to see behind the shy exterior always felt the better for the glimpses. He enjoyed a happy domestic life, and he leaves a widow and two sons.

R. WHIDDINGTON

Prof. Thomas Hugh Milroy

DR. T. H. MILROY, who died on March 20 at the age of eighty at his home in North Berwick, was the eldest son of John Milroy of Kirkeowan, Wigtownshire. He was educated in Edinburgh, Berlin and Marburg, and after a period as lecturer in physiological chemistry and assistant to the professor of physiology at Edinburgh, he was appointed to the Dunville chair of physiology at Queen's University, Belfast, a post which he held from 1902 until his retirement in 1935.

This was a period of rapid progress in the Belfast Medical School. Before the foundation of the Dunville

chair, physiology had been taught by the professor of anatomy. Milroy's predecessor was the first occupant of the separate chair and had held it for only a short time. The development of the new Physiology Department depended, therefore, almost entirely on Milroy; and it is a monument to his successful efforts. Among the duties of the holder of the Dunville chair in its early days was the delivery of a series of public lectures on human physiology. Milroy's lucid and interesting addresses attracted crowded audiences.

His teaching in the medical school was equally effective; not a few of his former students now hold chairs and other important positions in Great Britain and elsewhere. For many years his chief research interests lay in the physical chemistry of blood and the physiology of muscle, and he published a number of important papers on both these subjects. His profound knowledge of physiology and physiological literature was always at the service of other workers. With his brother, the late Prof. J. A. Milroy, he published a "Textbook of Practical Physiological Chemistry". This notable book contains much information not to be found in any similar work; and the methods described in it were tested personally before they were included.

Milroy had no undue regard for degrees and distinctions. Honours, which he doubtless appreciated but which caused no change in his unassuming disposition, came to him from various sources. He was an honorary D.Sc. of Belfast and of the National University of Ireland, an honorary M.D. of the University of Dublin, and an honorary LL.D. of Edinburgh.

He was a man of fine character with a keen and critical mind. He took a kindly interest in the welfare of his students, many of whom he helped by every means in his power. He enjoyed the esteem and affection of his colleagues. He and his brother occupied for years a unique place in the life of Queen's University and formed many lasting friendships in Belfast. Milroy's decision to return to Scotland when he retired was greatly regretted by his Ulster friends, who have heard with deep sorrow of his sudden death.

Prof. W. J. Dakin

THE death of Prof. W. J. Dakin occurred at Sydney on April 2 after a long and tragically hopeless illness which began on the eve of his retirement. He held the Challis chair of zoology in the University of Sydney from 1928 until two years ago.

William John Dakin was born at Liverpool in 1883 and after an unusually distinguished student career at the University of Liverpool he proceeded to further postgraduate studies at Kiel. He became an 1851 Exhibitioner, and working at Heligoland, Norway, Naples and at home made fundamental contributions in the physiology of marine animals. During the period 1909-13 he held lectureships at Belfast, Liverpool and University College, London, after which he became professor of biology in the University of Western Australia. He held the D.Sc. degrees of Liverpool and the University of Western Australia, and in 1920 was appointed to the zoology chair in the Liverpool department where he received his early scientific education. From there he went to take up the Sydney appointment that he held until shortly before his death.