is spent. A review of the few surveys in which both intake and expenditure were measured shows good agreement on the average over a period of days. In a recent careful study⁴, however, no correlation was found between individual daily intake and expenditure of calories: there was no correlation even between the mean expenditure of the group on any one day and the intake on that day. There was a correlation between the mean expenditure on one day and the intake two days later. Here is revealed an aspect of metabolism that is but imperfectly understood. The human body is able apparently to adjust its intake of food to an expenditure of energy which took place days before. Indeed, there is evidence that such belated adjustment may extend over a much longer period.

R. Passmore discussed the time-course of the daily expenditure of energy by human beings. With increasing mechanization in industry, with '*Homo sapiens*' becoming '*Homo sedentarius*', we tend, in our estimation of the severity of work, to place undue emphasis on the nature of the employment. Lying, sitting and standing occupy a large part of the twenty-four hours even for an active man. Roughly 500 Calories are spent asleep in bed, and 1,500 Calories in recreation and off-duty activities; and this seems to hold whether the occupation involves light or heavy work. Should there be a diminution in expenditure of energy in the period of recreation, as there may well be with advancing years, and if the appetite is not correspondingly curbed, obesity will rear its ugly head.

J. V. G. A. Durnin had the rather thankless task of talking about the influence of age on expenditure of energy. The report on calorie requirements by a committee of the United Nations Food and Agriculture Organization⁵ suggests that the intake of calories at twenty-five years of age should be decreased by 7.5 per cent for every ten years beyond that age. There is very considerable criticism of this proposal; but the original suggestion, and all criticisms thereof, suffer alike from a practically complete lack of known facts. Information is badly needed in all communities where shortened working-hours for the young make an increasing demand for labour from the elderly. How do advancing years affect muscular efficiency, and what load can we place with safety on the age group 55-70 years? We do not know. A short pilot experiment showed that elderly men used more energy in walking than did younger men. The elderly, however, spent no more energy when the exercises were confined to the muscles of the arms. There is no reason why the metabolic processes in the muscles of the elderly should not be as efficient as those in younger people; perhaps neuromuscular control is not so efficient.

H. R. Nollie dealt with the expenditure of energy by athletes, a subject on which information is scanty: with the older techniques it was scarcely feasible to find with any degree of accuracy the expenditure of energy during the more strenuous and competitive forms of exercise. Golf is known to make comparatively modest demands on expenditure of energy, about 5 Cal./min.; fast walking, due to swinging of the arms, can be expensive in energy and even more expensive than slow running: sustained running at speed may demand 25 Cal./min. Swimming makes very great demands, and so does skiing. But the ski, from the point of view of energy expenditure, is, in all circumstances, more economical than the snowshoe. It is possible, too, to estimate the influence

of style and of length of stride in running. The 'fast start' is costly in terms of energy expenditure. Thus, it is not beyond the bounds of possibility that athletes, trainers, and spectators with a financial interest in the outcome will all have ultimately to discuss athletic contests in relatively pure physiological terms.

General discussion after the final paper tended to focus on obesity, on its causation and on the very real problem of the control of body-weight: restrict the food intake and we are unhappy, increase exercise and we become all the hungrier. What is the cause of fatigue? What causes muscle soreness after unwonted severe exercise? We have no answers. These may come by future closer integration than in the past between the physiological and biochemical approaches to the problems of nutrition.

¹ Regnault, V., and Reiset, J., *Ann. Chim. (Phys.)*, **26**, 299 (1849).

² Kofranyi, E., and Michaelis, H. F., *Arbeitsphysiologie*, **11**, 148 (1940).

³ Fletcher, J. G., and Wolff, H. S., *J. Physiol.*, **123**, 87P (1954).

⁴ Edholm, O. G., Fletcher, J. G., Widdowson, Elsie M., and McCance, R. A., *Brit. J. Nutr.*, **9**, 286 (1955).

⁵ "Calorie Requirements" (Washington, D.C.: F.A.O., 1950).

OBITUARIES

Dr. W. K. Spencer, F.R.S.

DR. WILLIAM KINGDON SPENCER, whose death occurred at Ipswich on October 1 at the age of seventy-six, was a prominent figure in the world of education who, notwithstanding exacting official duties, found time to carry out important researches on fossil starfishes and other Echinodermata. The son of J. F. Spencer, formerly of Parkstone, Dorset, he was born at Barrow-on-Soar, and spent his boyhood at Upper Hopton, Yorkshire, where his father had been appointed headmaster of the village school. From Batley Grammar School (where he was a contemporary of Sir Owen Richardson) he gained a demyship in natural science at Magdalen College, Oxford, where he proceeded in 1898 after studying for a short time at the University of Marburg. Graduating in 1902 with first-class honours in zoology, he was awarded the Burdett-Coutts Scholarship and began his researches on fossil invertebrates.

For a year (1903-4) Spencer held the post of lecturer and demonstrator in the University Department of Geology at Oxford, under W. J. Sollas. His career as a teacher of palaeontology soon terminated, however, for in 1904 he was appointed to a post under the Board of Education, and before long became the Board's chief examiner in science. In 1914 he was appointed inspector of schools for East Suffolk, where he guided the educational programme until his retirement in 1938 and was largely responsible for the very effective reorganization and the extension of the schools of that area which followed the Hadow Report of 1926. On retirement he lived for a time in southern France and continued with his research work in the University of Montpellier. When France was overrun by the German army he escaped to Portugal and proceeded to South Africa, where he resumed educational work. After the War he again retired to France, first re-visiting Great Britain in 1953.

Spencer's first echinoderm paper, published by the Royal Society in 1904, dealt with the Palaeozoic genera *Palaeodiscus* and *Agelacrinus*, to the investigation of which he applied Sollas's technique of serial sections.

He then turned to the Cretaceous Asteroidea, completing (1905-7) for the Palaeontographical Society the monograph on that group which had been begun by W. Percy Sladen in 1891-93. The evolution of these forms was the subject of a subsequent paper in the *Phil. Trans. Roy. Soc.* (1913). His major work was his monograph of the British Palaeozoic Asterozoa, ten parts of which were published by the Palaeontographical Society between 1914 and 1940, when the War made further progress impossible. Spencer's last work, in which he described and discussed the earliest known starfishes, which occur in the Lower Ordovician of southern France and Bohemia, was published in 1951 by the Royal Society.

Spencer's work was concerned largely with ancient and often indifferently preserved fossils; but he was an adept at getting the most out of his material and always regarded the subjects of his researches primarily as animals which had once lived in harmony with their environment, and the functional significance of every structure of which demanded interpretation. The skilful reconstructions of these animals and their organs, well depicted under his guidance by his artist, F. T. Jones (an Ipswich art master), are a notable feature of his papers. He received his Oxford doctorate and the Lyell Award of the Geological Society of London in 1918, and in 1931 was elected to the fellowship of the Royal Society.

L. R. Cox

Mr. R. B. Pilcher, O.B.E.

THE name of Richard Bertram Pilcher, who died at his home in Northwood on October 1 in his eighty-second year, will remain indelibly impressed on the records of two distinct professional organizations—the Royal Institute of Chemistry and the Chartered Institute of Secretaries. A native of Patrichtown, near Canterbury, he was appointed clerk to the Institute of Chemistry in 1892 and became successively assistant secretary (1894), secretary (1895) and registrar and secretary (1900-45). Pilcher had known all the presidents from 1877 onwards, and from his youth completely identified himself with the profession and with its interests and aspirations. His tall, lean and dignified figure, with a hint of the ascetic, due more to the delicate state of his health

in early manhood than to any avoidance of the pleasures of life, was well known in scientific and official circles for many decades.

During the First World War the Institute became the chief agency whereby the various ministries and Government departments obtained chemists, and Pilcher, then secretary to the Glass Research Committee, was in constant demand. After the War he interested himself in the re-settlement of officers and other careers matters, serving on committees of the Ministry of Labour. He was appointed O.B.E. in 1920. He served as honorary secretary of the Chemical Council from its inception in 1935 until 1943. He became a member of the Parliamentary and Scientific Committee in 1935, and a vice-president in 1943. In 1952 the Institute paid tribute to his long service and abiding interest in the profession by admitting him as one of its first honorary Fellows.

An avid reader, fond of honest labour, and prone to contemplation, his pen never rested long. Several of his compilations became standard reference works, passing through a number of editions. Among these were "Official Chemical Appointments" (1906); the joint work "What Industry Owes to Chemical Science" (1918); and "The Profession of Chemistry" (1919). Having a keen interest in the history of chemistry, and particularly in chemical biography and iconography, he acquired a mass of manuscript material and a well-known collection of prints.

A Fellow of the (then) Institute of Secretaries in 1897, Pilcher served it as a member of council from 1908, as vice-president (1924-26) and as president (1926-27). He introduced the system of registered studentship, and was ever pleased to think that many thousands of young people had thereby increased their knowledge and worth to the community. He was also a past chairman of council of the Association of Men of Kent and Kentish Men.

Pilcher was intensely human and loved all growing things. This, perhaps, provides a clue to the main interests of his life—children and flowers; students and the history of science; the nurturing and service of two rapidly expanding professional organizations: in these matters his years did not weary him nor diminish his ardour. He is survived by his widow, Violet Frances, two sons and a daughter.

F. W. GIBBS

NEWS and VIEWS

Royal Society: Award of Royal Medals

H.M. THE QUEEN has been graciously pleased to approve recommendations made by the Council of the Royal Society for the award of the two Royal Medals for the current year as follows: Sir Alexander Todd, professor of chemistry, University of Cambridge, for his distinguished work in organic chemistry; Prof. V. B. Wigglesworth, Quick professor of biology, University of Cambridge, for his distinguished experimental contributions of outstanding value to many aspects of insect physiology.

Electronic Engineering at Liverpool:

Prof. J. D. Craggs

THE Robert Rankin chair of electronic engineering in the University of Liverpool has been filled by the appointment of Dr. J. D. Craggs, formerly reader in electronic engineering. Dr. Craggs graduated in 1937

in the University of London and, after a year's research in the Mechanical Engineering Department at King's College, London, he was awarded a Department of Scientific and Industrial Research grant to enable him to work under the direction of Sir Charles Ellis on the development of a high-voltage accelerator for nuclear research. This work was carried out in the Research Department of the Metropolitan-Vickers Electrical Co. at Trafford Park, Manchester. In 1940 Dr. Craggs joined the research staff of this Company and continued to work on the accelerator until 1941, when he became concerned with the development of high-power spark modulators for radar. During 1944-45 he spent six months in the University of California, Berkeley, on studies of collision process connected with the uranium fission programme. In 1945 he returned to the Metropolitan-Vickers Research Department and was responsible for the construction of a 20-MeV. betatron. He also carried out work on