Greenstein himself went outside the United States on two occasions only—to a conference at the Papal Academy in Vatican City in 1949, and to Japan in 1956. He did, however, take a very prominent part in American scientific affairs. He was, for example, a past chairman of the Division of Biological Chemistry of the American Chemical Society and a member of the National Research Council's Committee on Biochemistry. He was on the editorial boards of *Cancer Research* and *Archives of Biochemistry and Biophysics*, while in recent years he was joint-editor with Prof. A. Haddow of "Advances in Cancer Research". At the time of his death he was just completing a major treatise on amino-acid chemistry. Among many formal acknowledgments of his work were included a Distinguished Service Award from the U.S. Government (1954) and the Hillebrand Prize of the American Chemical Society (1957).

Though modest about his own contribution, he was visibly proud of the work of his section, of his country and above all of his family. He will be greatly missed and all will sympathize with those near to him at their loss.

DOUGLAS HAMER

DR. GREENSTEIN'S contributions extended widely in the fields of amino-acid, peptide and protein chemistry, and of nutrition. In the past few years he had devoted much effort to the elaboration of a completely soluble diet composed of chemically defined constituents; and at the time of his death he was engaged (with M. Winitz), in the final stages of a major work on the chemistry of the amino-acids, which is to appear in three volumes, of which the first is now in the press. But apart from these, his contributions to cancer research alone would have more than sufficed to establish him among the leading biochemists of his time. He was an accomplished writer, and his "Biochemistry of Cancer" had, and has, immense influence, and proved a very significant stimulus to the subject as a whole.

Of his own work, two aspects were of particular importance; first, his studies of the mechanism of production—and the significance—of the dramatic decline in liver catalase activity which is observed in tumour-bearing animals; and secondly, his analysis and comparison of the distribution and activity of a host of enzyme systems in normal and cancer cells. In spite of the extreme difficulty and complexity of these problems, there gradually emerged a real and satisfying conclusion, namely, that although tumours mostly possess the same enzymes as do normal tissues, qualitatively, none the less they tend, enzymatically, to converge to a common type, and hence show more resemblance to one another biochemically than to the normal tissues from which they arose.

All these, and many other contributions, embodied in upwards of 250 papers, brought him international acclaim. But we shall also remember him for his human qualities, and his combination of serious devotion with much courage and humour. Certainly I have good cause to be grateful for many years of happy association with him; and Bethesda without him can never be quite the same. All who admired him will be glad to know that there has now been established, in his remembrance, a Jesse P. Greenstein Memorial Foundation, to be administered by a small committee of his colleagues, and which will, in cases where it is necessary or helpful, provide tuition and support during the years of undergraduate study in

the arts or sciences, "to the son or daughter of a scientist who has made notable contributions to the medical, physical or biological sciences, and who is deceased".

ALEX. HADDOW

Dr. Arthur Walton

DR. ARTHUR WALTON, who died suddenly in Cambridge on April 6, was best known for his pioneering research in the field of sperm physiology and artificial insemination of farm animals. He was born in London, on March 16, 1897, of Scottish parents, and educated in Edinburgh, first at Daniel Stewart's College and later at the University, where he obtained in 1923 the degree of bachelor of science (agriculture). It was also in Edinburgh, at the Animal Breeding Research Department, where he received his early training in research methods and published, in 1924, his first paper, on "The Flocculation of Sperm Suspensions in Relation to Surface Charge". Keen interest in sperm physiology prompted Walton to move to Cambridge and take up research on animal reproduction. In 1926 appeared his first communication in *Nature*, on "Preservation of Mammalian Spermatozoa", a subject which he expanded in the following year in his Ph.D. dissertation, and to which he devoted his special attention throughout his scientific life.

Among Walton's most outstanding contributions to the subject of sperm physiology was the first demonstration that ram semen, properly collected and stored, can be sent on long journeys to distant countries, to be used there for successful insemination of ewes; next, there were the experiments which proved that 'cold shock' can destroy the fertilizing ability of bull and ram spermatozoa. Of great scientific significance was his observation that the metabolic activity of ram and bull spermatozoa, particularly their respiration, is directly correlated with motility; and the discovery that respiring spermatozoa produce under certain conditions hydrogen peroxide which, in turn, is responsible for a gradually developing inhibitory effect on respiration and a decline in sperm motility. During his more recent investigations, Walton developed a novel and ingenious method of maintaining sperm alive for long periods, in a perfusion apparatus where nutrient substrates are fed continuously to a sample of semen and the toxic metabolites removed at the same time.

In addition to the work on spermatozoa, Walton has been keenly interested in various other aspects of reproductive physiology, including mating behaviour in animals and female fertility. He was the first to make detailed observations on ovulation in the rabbit, and to study the effect of maternal influences on the size of offspring in reciprocal crosses between large and small breeds of horses.

As a member of the University School of Agriculture and the scientific staff of the Agricultural Research Council, Walton spent nearly thirty years of his life in Cambridge, much of it in his laboratory at the Animal Research Station, in close association with many young research workers, always ready to help, to guide, and to advise. Although primarily concerned with physiological problems, Walton had also a profound knowledge in the field of general biology and agriculture. His contributions to agriculture, especially those which led to the establishment of the practice of artificial insemination in farm animals, were recognized in 1957, by the award of