Staub had detected the same antihistamine properties in thymoxyethyldiethylamine (929 F) and, some years later, the study of some derivatives of phenylethylenediamine and aminopyridine showed equally favourable properties. As a result of other work by A. M. Staub (1939), Halpern proved in 1942 the relatively high antihistamine effect of N-(2-dimethyl aminoethyl)-N-benzylaniline or Antergan on spasms in unstripped muscles and pointed out the possible use of this compound in human therapy.

In 1944, another compound appeared, Neoantergan, equally suitable for human application which, while chemically similar to Antergan, was more active (Bovet *et al.*, 1944). Still more important appeared to be the N-alkylamine derivatives of phenothiazine, among which Halpern noted the efficacy of Phenergan (1946). It is well known that, apart from its antihistamine effects, this compound was found by doctors to be a psychodepressant and formed the starting point for many neuroleptic derivatives currently used in psychiatry.

From 1950, following research by Jancsö, the work of Halpern and his collaborators took another direction: the functional study of the reticulo-endothelial system (RES). Profiting from the granulopoietic activity of this tissue, they investigated the removal from the blood of various colloids as a function of time. These data once established, the authors found that stimulation of the RES increases the level of immunity of the organism against various infections.

In 1959, Bernard Halpern showed, for the first time, that administration of BCG increases the resistance of the organism to malignant tumors.

In 1964, he described the outstanding immuno-stimulatory properties of *Corynebacterium parvum* on the reticulo-endothelial system. This effect is shown by the increase in the phagocytic index of macrophages and by the increase in liver volume and of splenic cells. Later, Halpern established that the administration of *Corynebacterium parvum* inhibits the development of grafted malignant tumours and their propensity to metastasis. In May 1974, he chaired the first international conference on *Corynebacterium parvum* and its use in oncology, a conference which has led us to revise our ideas of the relations between the host and the malignant tumour. *Corynebacterium parvum* has been employed for several years in human therapy in the treatment of cancers in combination with antimitotic chemotherapy and the results of this method appear promising.

*G. Valette*

# W. O. James

PROFESSOR WILLIAM OWEN JAMES, FRS, who died on 15 September 1978 will be remembered as one of the leading British plant physiologists of this century.

The major part of his academic life as a scholar, teacher and author (from 1929 to 1958) was spent as Demonstrator and then Reader in the Department of Botany at Oxford University. He was elected to the Royal Society in 1952. Latterly from 1958 until his retirement in 1967 he was an innovative Head of Botany at Imperial College, London at a time when the college was rapidly expanding.

During his professional life of over 50 years, W. O. James made many distinguished contributions to several different fields of plant physiology including photosynthesis, mineral nutrition, anaerobic and aerobic respiratory metabolism, alkaloid metabolism and to the understanding of the function of subcellular organelles. His endeavour was always to discover and understand the biochemical events responsible for the physiological functions of plants and to account for these responses quantitatively. He wrote with exceptional clarity and his many scientific papers and several books reflect his scholarly analysis of plant physiological phenomena and his imaginative application of contemporary experimental techniques as aids in understanding them. He retained an enthusiasm for plant biology to the end of his life and was always particularly delighted to hear of progress in the several areas of research in which he himself had been involved.

W. O. James brought to the study of the many-faceted problems of the physiology of plants incisive thought and great care in the design and execution of experiments. These qualities were already manifest in his first paper on the external factors affecting photosynthesis reporting his studies as a graduate student under F. F. Blackmann in Cambridge in the mid 1920s. James demonstrated departures from the limiting factor form of the curve for photosynthesis and explained why they were to be expected. During his postdoctoral years, spent from 1925 in V. H. Blackmann's unit of Plant Physiology at Rothamsted, his interest in mineral nutrition of plants, particularly of potassium, developed, and on his move to Oxford in 1927, the effects of potassium deficit on extractable enzyme activity and respiration rate were among the first problems he tackled. He soon realised that useful interpretation of the experimental effects of mineral nutrition on plants was severely limited by lack of understanding of the respiratory processes occurring in normal plants and he and his associates turned their attention to the study of plant respiration.

It is for his contributions to our understanding of plant respiration that James will probably be best remembered. His group in Oxford carried out some of the first definitive work on glycolytic systems in plants and in the early 1940s demonstrated unequivocally that pyruvate was produced from fructose diphosphate in extracts of barley. Later they examined the enzyme systems involved using the phosphorylated intermediates and cofactors which had recently become available commercially, and showed the key enzyme enolase was present in barley sap.

His group published detailed descriptions of the respiratory characteristics of several different plant tissues including leaves, roots and embryos and sought to explain their *in vivo* respiration quantitatively in terms of the activity of enzymes which could be isolated from them. It was demonstrated, for example, that sugar lost from carrot tissue during a period in $N_2$ could be accounted for entirely by alcohol and $CO_2$ production. In attempts to explain the terminal oxidation processes in plants whose respiration was differentially inhibited by specific respiratory inhibitors, James and his associates also devoted considerable attention to the examination of soluble and insoluble plant oxidases. Much useful detailed information about the distribution and activity of the variety of plant oxidases was assembled, although no convincing evidence that any oxidase other than cytochrome oxidase plays a major role in plant respiration has yet emerged. H. Beevers in James' laboratory in the late 1940s first examined the exceedingly rapid cyanide-insensitive respiration of the *Arum spadix* and later the Oxford group were the first to show the location of this activity in isolated mitochondria. James' years of study of the respiratory processes in plants culminated in the publication of his book *Plant Respiration* in 1953, hailed as a scholarly summary of a whole epoch of plant respiratory studies.

During his years in Oxford, in addition to his research activities, James also taught plant physiology to several generations of undergraduates and, during the second World War, was a prime mover in the Oxford Medicinal Plants Scheme. The objective of the scheme was to supply medicinal drugs by extracting them from natural plant sources. Many of these drugs were alkaloids and in addition to improving methods for their extraction and

analysis, his group obtained much fundamental information about the synthesis and internal concentration of alkaloids in cells.

Shortly before his move to London, James' group had been amongst the first in the world to isolate active mitochondria from plants and study their oxidative and phosphorylative capacities. The group had also begun to use the new techniques becoming available for the examination of the ultrastructure of cell organelles for James had the vision to see the potential of structural studies in understanding intracellular metabolic processes. At Imperial College he set up a Unit of Analytical Cytology where electron microscopists and biochemists worked together to isolate, purify and characterise subcellular plant organelles. New election microscopical techniques were developed to monitor the purity and integrity of the isolated organelles used in a continuation of the studies of mitochondria to localise cellular respiratory activities. Later plant nuclei, ribosomes and chloroplasts were examined and the group were the first to publish methods for the isolation of structurally intact chloroplasts and also plastoglobuli and grana from them.

In addition to introducing the study and teaching of analytical cytology of plant cells, James also initiated and fostered the development of new sections of the department at Imperial College to study plant taxonomy, palaeobotany and nitrogen fixation. He guided and encouraged those who shared his enthusiasm for all aspects of plant biology and by example and positive criticism showed the high standard of scientific expertise required to gain a true insight into plant function.

In addition to publishing numerous papers reporting his own research findings, for many years James was a co-editor of *New Phytologist* and a member of the editorial panel of *Endeavour*. His uncluttered literary style also contributed to his skill as a good writer of school and university texts and semi-popular articles and books. All his publications were characterised by the high standard of the beautifully presented and appropriate illustrations. For almost 50 years his now classical text *Introduction to Plant Physiology* (first edition 1931, seventh edition 1972) has been the introduction for successive generations of schoolchildren and undergraduates to this field. In the preface to the fourth edition he looks forward to the time when the reader of his book will take part in finding some of the answers to unsolved physiological problems: indeed there have been many whose initial interest was aroused by his text and who have gone on to make their own contributions as professional plant physiologists. His *Introduction to Plant Biology* is still used as 'the bible' for school and university courses. His amusing book *Background to Gardening* became a best-seller. After his retirement he published *Cell Respiration* (1971) which gives a comprehensive account of the respiration of the whole range of living cells.

James' distinguished contributions as a scientist were made despite recurrent ill-health throughout his life. All who knew W. O. James and his wife recognise the magnificent supportive role she played throughout his career. His many former colleagues now working in all parts of the world have cause to be grateful to W. O. James for his scholarly example.

*R. M. Leech*

## Francis Aylward

PROFESSOR FRANCIS AYLWARD who was Professor of Food Science in the University of Reading from 1968 to 1976 died on 28 September 1978, aged 67. A memorial service for him was held in Westminster Cathedral on Thursday, 7 December.

After graduating at Liverpool University with first class honours in chemistry, he remained at Liverpool studying lipid chemistry under Hilditch (whose school was of international repute) and obtained his PhD. His subsequent contribution to lipid chemistry and biochemistry was recognised by the award of a DSc in 1958.

Francis began his scientific career by holding research fellowships at the Hannah Dairy Research Institute and Johns Hopkins University. The war years were spent with ICI Ltd. In 1947 he was appointed Head of the Department of Chemistry and Food Technology at the Borough Polytechnic. It was at this time that it began to be recognised, largely as a result of food research carried out in USA and UK, that a substantial and systematic body of knowledge had accumulated, and the time had arrived for food technology to be taught as a discipline particularly to provide the food industry (which was rapidly expanding and moving from a craft based to a scientifically oriented industry) with its scientific manpower. The Borough Polytechnic was one such teaching institution that recognised this need, and under Francis's able and progressive leadership the food technology element of his department grew and flourished.

Though still retaining his interest in lipids he began to take a greater interest in the role of food technology in relation to nutrition and food supplies. This led naturally to his appointment in 1960 to serve for two years as FAO Adviser on Food and Nutrition to the Government of Ghana, and for the period 1961-62 as Head of the newly created Department of Biochemistry, Nutrition and Food Science at the University of Ghana. From that time he developed a major interest in nutrition in relation to national and international food problems. From Ghana he moved to Poland and during 1962-65 he was Director of the Polish Food and Nutrition Project supported by the UN special fund.

In 1965 he returned to Britain as Director of the Fruit and Vegetable Preservation Research Association, Chipping Campden. Then in 1968, following the retirement of Professor Crossley as Professor of Dairying and the decision of Reading University to broaden the interests of the department to cover food science, Francis was appointed its first professor. In many ways this was an apt and fortunate appointment. Francis believed that institutes of higher education have a duty to assist developing countries, and this view agreed well with the tradition of Reading's Faculty of Agriculture. He obtained a substantial grant from the Leverhulme Foundation which permitted him to support two Senior Fellows and with their help he built up a large postgraduate school of food science—the largest in Europe—drawing most of its students from developing countries.

While at Reading he continued to act as consultant on behalf of organisations of the UN. This work was complementary to his service as Chairman of the University's Overseas Service Committee. Within the UK he was an active member of the Food Group of the Society of Chemical Industry. He was a member of the Food Additives and Contaminants Committee of the Ministry of Agriculture, Fisheries and Food. After retiring from his University post he continued to put great effort into helping with nutrition programmes overseas. He was appointed a member of the UN Advisory Group on Nutrition and was engaged in co-operating with UNEDO in regional services of food industries in the developing countries.

They heavy demands his career made on his time were not allowed to prevent him from playing an active role in the Roman Catholic Church, and recognition was given in 1951 when he was appointed a Knight of St Gergory.

With the untimely death of Francis Aylward, we in food science and technology have lost not only a highly respected colleague, but a friend of great warmth and personal kindness.

*E. Rolfe*