to take up new lines of research. As a designer of instruments he saw the essential functional requirements and found the most direct way of solving the problems. In his contacts with people Siegbahn was a man of few words, but what he said was always to the point and his quiet manner was not to be taken as a sign of timidity. On the contrary, he possessed the large amount of contagious self-confidence needed for bold enterprises. Siegbahn took little interest in formal teaching and he gave his research students a great deal of freedom in their work, at the same time keeping them aware of his generous encouragement.

Bengt Edlén

E. A. Moelwyn-Hughes

WITH the death, on 10 September 1978, of Emyr Alun Moelwyn-Hughes, Fellow of Darwin College and for many years Lecturer in the University of Cambridge, the world of chemistry has lost one of its luminaries.

He was born in Cardigan in 1905 one of the six children of the Rev. Dr J. G. Moelwyn-Hughes, a well known Welsh Presbyterian minister and hymnologist. After a remarkable career as a student in the University of Liverpool, who awarded him a DSc at the age of 28, and where his interest in kinetics was first aroused by Prof. W. C. McC. Lewis, he went to Magdalen College, Oxford as 1851 Exhibitioner.

It was there, alongside C. N. Hinshelwood with whom he collaborated, that his work on solution chemistry and the comparison of the rates of change in the gaseous and liquid state first flourished. His interests soon encompassed ionic reactions, enzyme catalysis, the isotope effect and the general theory of solutions. The first of his classical texts *The Kinetics of Reactions in Solutions*, which greatly influenced the subsequent development of the subject, was published in 1933, at about the time when he embarked on a year's collaboration with K. F. Bonhoeffer at the Institut für physikalische Chemie, Frankfurt.

In 1934 he moved to the University of Cambridge where, apart from the war years when he was associated with the Ministry of Supply, he remained for the rest of his life, except for short visits abroad. He held the Messel Fellowship of the Royal Society from 1936 to 1940, and later became a Vice President of the Chemical Society.

As a teacher in Cambridge, and as an extraordinarily successful author of several standard texts, he influenced the careers of countless young scientists. One of his own research associates (J. C. Kendrew) became a Nobel laureate, and many others reached distinguished heights. They were taught at the time when his own experimental contribution was at its apogee: at a time when he wrote the often-quoted 'the complete physical chemist blows his own apparatus and solves his own equations.'

But he will be remembered best for his scholarly authorship of texts which were widely acclaimed. Moelwyn-Hughes wrote about his chemistry with the consummate skill of the accomplished creative artist. His dignified fluency, together with his wit, percipience and perspective, was altogether refreshing in its originality and impact. Molecules, and other inanimate entities of the physical world, were frequently endowed with human qualities; and he contemplated the beauty, magic and mystery of their behaviour in the best traditions of the natural philosopher and poet. He had the innate feeling for the right turn of phrase. On listening to him, or reading his work, one was impressed by the freshness of his metaphors, which were invariably newly minted. And he obviously relished the act of regulating the rhythm of his sentences. His physical chemistry was described with the right words in the right order. Some of the gems that constitute part of his legacy trip off the tongue: 'Energy among molecules is like money among men; the rich are few, the poor numerous.' 'Belief in the essential simplicity of things is one of the chemist's articles of faith.' And consider his discussion of the self-evident fact that the liquid state of matter is intermediate between the solid and gaseous states. 'Like a central party in politics or a moderate denomination in religion, the liquid state is less rigorously defined and more difficult to understand than either of the extremes that flank it.'

His introduction to the Everyman Edition of *The Sceptical Chemist* (1963) is a model of succinct historical exposition. In asking when the discovery of the inverse relationship between pressure and volume was made and who was Robert Boyle, he wrote: 'He flourished in the seventeenth century, that turbulent time of pestilence and fire so amply described by Evelyn and Pepys, when Bunyan wrote in Bedford jail and Penn left England's shores, when Milton sang his *Paradise Lost* and Wren built London's churches, when Britain's monarch was overthrown and Cromwell made Protector.' His book-reviews were also delightfully composed.

Moelwyn-Hughes was greatly admired by many. He was appreciated as a significant figure in twentieth century physical chemistry. His coruscating, if sometimes caustic, wit was much enjoyed (and occasionally feared) as was his superb storytelling gift; and very many including those Welshmen who got to know him at the University of Cambridge Welsh Society (Cymdeithas y Mabinogi), valued his warm-hearted friendship.

His illness was prolonged: for many years he was struck with immobility and incapacity. During that time he uttered not a syllable of complaint; and throughout it all he was nursed with profound affection and care by his devoted wife Mair who, along with his twin sons Edmwnd and Rolant, survive him.

J. M. Thomas

F. C. Fraser

DR FRANCIS CHARLES FRASER, CBE, FRS, Polar Medal 1942, a cetologist of international distinction and Keeper of the Department of Zoology at the British Museum (Natural History) from 1957 to 1964, died on 21 October 1978 at the age of 75. A graduate of Glasgow University, where his interests had been in both zoology and geology, his love of the sea and an appropriate opportunity sent him to the Antarctic and South Georgia from 1925–1933. His early work with the 'Discovery Investigations' was on the development and distribution of the young stages of *Euphausia* (*Discovery Rep.* 1936, **14**, 1).

From the time of his appointment to the museum in 1933 as an Assistant Keeper, Fraser devoted his research to various aspects of cetology. He took over the *Reports on Cetacea, stranded on the British Coasts* which had been initiated in 1913 by Sir Sidney Harmer. This involved the development of communications between coastguards and other authorities and the museum, and then recovery, identification, measurement, and preparation of specimens to ensure the fullest scientific use of each stranded cetacean. Successive *Reports* were published in 1934, 1946, 1953 and 1974. Each contained analyses of strandings by species, site and distribution, number per month, estimated age, time of birth and summaries of many other findings useful in building up facts about the life histories of cetaceans. Altogether (from 1913–1966) 1,550 cetaceans were identified by Harmer and Fraser. These reports have been so valuable that other countries have begun to publish similar records.

During the Second World War, Fraser worked at the Admiralty. Afterwards he joined the 'Atlantide' expedition (1945–1946) and studied cetaceans off the coasts of West Africa. He soon confirmed his reputation as a leading

cetologist, especially on the often difficult decisions of identification: people from all parts of the world came for his help. His numerous taxonomical notes, mostly on rarer species, provided clarification where there was usually utter confusion.

In 1956 he described a species of dolphin *Lagenodelphis hosei* from a single skeleton collected before 1895 on a beach in Sarawak. From 1971 onwards sightings and captures have been made in widely scattered parts of the world to 're-discover' what is now known as Fraser's dolphin.

He contributed original observations on the anatomy, especially cranial osteology, and morphology of many cetacean species and made use of stranded animals brought to the museum both for research and display. The Whale Hall's present existence and its popularity owe much to Fraser's desire to educate the public about whales and dolphins. He also supported many of the early enterprises to exhibit live dolphins. His informative museum guides to British cetaceans and his splendid book with J. R. Norman, *Giant Fishes, Whales and Dolphins* are meticulously accurate.

A substantial work was that with P. E. Purves on Hearing in Cetaceans (*Bull. Brit. Mus. (Nat. Hist.) Zool.* 1960, **7**, 1). This dealt with anatomical and experimental evidence to demonstrate that hearing was by way of the external auditory meatus, it was precisely discriminative and directional and the cetacean ear was sensitive to a wide range of frequencies. The elaborate sinus system was shown to be an extension of the middle ear cavity and could be a guide to the systematic arrangement of the Order Cetacea.

Fraser had a deep interest in the history of cetology and wrote about Peter Mundy's Greenwich Whale of 1568, early Japanese whaling, William Scoresby Junior and on the Grey Whale in Icelandic waters. His last contribution (1977) was on 'Royal Fishes: The Importance of the Dolphin'. This paper contained a lifetime's research and reflection on the Royal Prerogative in Britain which he had traced back as far as the 13th century.

Fraser was proud of his Dingwall stock and delighted in being a pawky Scot of the dry, humorous kind: yet there was nothing but solicitude and generosity about him, consideration for anyone deserving of it and an unrelenting determination to see justice done. It could well have been of him that Herman Melville wrote: 'But I have swam through libraries and sailed through oceans; I have had to do with whales with these visible hands; I am in earnest; and I will try.'

R. J. Harrison

A. S. McFarlane

ARTHUR SPROUL MCFARLANE, Head of the Biophysics Division at the National Institute for Medical Research from 1945 to 1970 died on 4 October 1978.

He was born in Glasgow on 18 April 1905. He took 1st class honours in biochemistry at Glasgow University in 1928, and qualified in medicine in 1931. From 1931–33 he was biochemist at the Glasgow Royal Cancer Hospital, and was elected to a Beit Memorial Fellowship in 1933 to work in Uppsala under Professor The Svedberg on the use of the recently developed oil-turbine ultracentrifuge. The studies which he made of a wide range of serum proteins illustrated the potential of this new technique for the characterisation of normal and pathological proteins in mixtures.

When the Rockefeller Foundation, anxious to make the instrument available to other laboratories, offered one to the Lister Institute, McFarlane joined the Institute to continue his Beit Fellowship and to supervise the installation of the Svedberg machine in a specially constructed building. The installation was completed in 1937, by which time he had become a member of the Lister Institute staff and had been joined by R. A. Kekwick. They also acquired the newly developed Tiselius electrophoresis apparatus—both instruments being the first of their kind in the UK—and in 1938 published the first paper arising from their use on the "Physical properties of bushy stunt virus" recently crystallised by F. C. Bawden and N. W. Pirie.

Further work on vaccinia virus was interrupted by the war, when his attention changed to devising a means for preparing stable human plasma for transfusion. He invented a novel means of removing unstable lipids by freezing below −25 °C with ether, and went on to design large scale freeze drying plant. This was done at the L.C.C. Serum Institute, Carshalton, where the laboratory had been transferred in 1941.

In 1943 McFarlane's services were requested by the National Institute for Medical Research to supervise the design and installation of special services, including one of the early electron microscopes, in the new building at Mill Hill (built in 1938 but used meanwhile by units of the Women's Royal Naval Service and finally occupied in 1950).

When in 1945 the US Atomic Energy Commission announced that radioisotopes produced in uranium chain-reactors would be available for peaceful uses to scientists all over the world, McFarlane was sent by the Medical Research Council to negotiate the supply of radioisotopes for the UK. Hopes were rudely shattered by the passage in 1946 of the McMahon Act forbidding exportation from the US of all radioactive materials produced in atomic piles, but McFarlane through his friendship with Robley Evans, in charge of the cyclotron at the Massachussetts Institute of Technology, managed to obtain sufficient ^{32}P to allow research workers here to get the feel of radioisotopes and experience in design of counting instruments.

In 1947 he was again sent to the US and to Canada to negotiate purchase of other radioisotopes and this mission was entirely successful. (A fuller account appears in an article by Professor George Popjak in *Trends in Biochemical Sciences,* October 1976.)

By the time that the N.I.M.R. finally moved to Mill Hill in 1950 McFarlane had been responsible for making it the best equipped medical research laboratory in England in respect of biophysical instrumentation. By designing an elaborate but efficient apparatus for counting ^{14}C after combustion to $^{14}CO_2$ and installing a mass spectrometer he also gave his colleagues a headstart in the use of the radioactive and stable isotopes then available.

His own interests became concentrated on studying the metabolism of plasma proteins, using ^{14}C and radioiodine as trace labels. He devised a method for labelling proteins with radioiodine, which avoided denaturation and by studies on antibodies in collaboration with J. H. Humphrey showed that biological activity and ^{14}C internal and ^{131}I external labels were catabolised at identical rates. This validated radioiodine labelling and led to a series of definitive measurements on the turnover of several plasma proteins in normal and sick subjects, in which McFarlane collaborated with workers in Britain, the USA and elsewhere. He also developed an ingenious method for measuring plasma protein synthesis *in vivo* involving simultaneous measurement of incorporation of ^{13}C from labelled urea and ^{14}C from bicarbonate.

By temperament he was a shrewd Scotsman, with what might nowadays be considered an old fashioned outlook on life, but certainly capable of enjoying it. He was at his best when devising apparatus or techniques, and would have made his mark in industry had he chosen this career. Although his own approach to biological problems was simple (sometimes over-simple) and mathematical, he greatly helped many biological colleagues by providing them with technological back-up at a time when the array of sophisticated equipment nowadays provided by scientific instrument manufacturers was not available.

J. H. Humphrey