Obituaries

Professor C. Lovatt Evans

SIR CHARLES LOVATT EVANS, emeritus professor of physiology in the University of London and a former vice-president of the Royal Society, who died on August 29 at the age of 84, was the foremost pupil and a lifelong associate of E. H. Starling. The latter, when Jodrell professor of physiology at University College London, examined Lovatt Evans in 1910 for the external BSc in physiology of the University of London, and offered him the post of Sharpey Scholar in the department.

Here Lovatt Evans found the opportunity to develop his great promise in a department then entering a period of intense and fruitful research, which originated in the invention by Knowlton and Starling (1912) of the dog heart–lung preparation. In this the artificially ventilated lungs and heart were isolated from the rest of the body so as to pump defibrinated blood round a closed circuit which embodied devices representing the features of the normal circulation; with this Starling made his classical studies on the mechanical action of cardiac muscle, epitomized as the "law of the heart". During the next five years, Lovatt Evans, with Ogawa, Matsuoka and Starling, studied the gaseous and carbohydrate metabolism of the isolated heart and lungs in normal and diabetic animals, and the features of the coronary blood flow. With Bainbridge, Lovatt Evans evolved the heart–lung–kidney preparation, in which the heart–lung unit was used to maintain an isolated kidney. This was the first isolated kidney preparation which could be regarded as a success; it formed the basis of the later classical studies of Starling and Verney on the mechanism of urine formation.

After qualifying in medicine at University College Hospital in 1916, Lovatt Evans joined the Royal Army Medical Corps and served under Starling in anti-gas work; this experience was to be called upon again during the Second World War. After demobilization in 1918 and a brief period as professor of physiology and pharmacology in Leeds, he joined the staff of the National Institute for Medical Research in 1919; there under Dr H. H. Dale (later Sir Henry) he worked on the circulatory effects of carbon dioxide and the regulation of the reaction of the blood. These studies were included in his first book *Recent Advances in Physiology* published in 1925, three years after he had moved to the chair of physiology at St Bartholomew's Hospital Medical College. The book was an immediate and enduring success. In 1930 he took over the editing of Starling's *Principles of Human Physiology* and carried this ever increasing labour through eight editions until 1956. This book, started by Starling in 1912, became a world famous text for students of physiology, distinguished for its exposition of the fundamental principles of the subject.

In 1926 he succeeded A. V. Hill in the Jodrell chair at University College (Hill had followed Starling in 1923). In a series of papers, first with Grace Eggleton and then with Tsai, F. G. Young and others, he examined and clarified the problems of the relation between blood glucose and lactate and liver and muscle glycogen; and from this was led, as described in a paper published in 1933 with seven co-authors (he usually referred to it as "Uncle Tom Cobley and all"), to the study of blood sugar and lactate levels in the dog heart–lung preparation and the explanation for their variation in relation to cardiac metabolism. That the working heart used both substances had been shown by him and others on the basis of arterial/coronary venous differences; but it was also known from the earlier work of Anrep and Cannan (1923) that in a heart–lung preparation the blood lactate might rise if the lungs were ventilated with air instead of oxygen/CO_2. With Grace Eggleton (1930) he had discovered a similar phenomenon in hind-limb preparations perfused with blood, but no final explanation had been offered as to the origin of the lactic acid. The key to the problem was now seen to lie in the conditions governing blood glycolysis—the transformation of blood glucose into lactic acid; and in a paper the next year (1934), with Hsu and Kosaka, he described how the isolated dog's lung was perfused with blood pumped round a closed circuit, the extent of blood glycolysis in different conditions of ventilation was accurately measured and the lungs themselves were revealed as an important site of lactate formation from blood glucose. Patterson and Starling in 1913 had come to the conclusion that a good deal of the sugar used by the heart–lung preparation was accounted for by the lungs alone; but they had supposed that the sugar was oxidized.

These results clarified the complex situation governing blood glucose and lactate levels in the heart–lung preparation; but they also indicated that, if the carbohydrate metabolism of the isolated working heart was to be measured directly, the lungs must be removed and replaced by an oxygenator. Control determinations of blood glycolysis *in vitro*—a simple matter—would then make it possible to calculate the use by the heart of blood glucose and lactate using determinations of the change in blood levels and the circulating blood volume. In the same year (1934) Lovatt Evans, Grande and Hsu evolved two simple heart-oxygenator circuits for blood-fed dog hearts (the design was later improved by other pupils) in which the heart would work at high rates in excellent condition for several hours. With this preparation a series of pioneer studies were made of the carbohydrate metabolism of the dog's heart. With Grande and Hsu it was shown that the heart used two or three times more lactate than glucose, with a certain degree of reciprocity depending on blood levels; with Lee (Australia) and Mulder (USA) added to the team, the diabetic dog's heart was shown to use almost as much lactate as the normal, but much less glucose; insulin considerably increased the glucose usage and reduced the lactate consumption. When the normal heart was driven at a high rate of work in the presence of adrenaline, lactate was used preferentially to glucose; and high levels of the former, though not the latter, were markedly beneficial in impending failure. Pyruvate and beta-hydroxybutyric acid were shown to be used in large amounts when added to the circuit, although usage of the former did not spare that of blood glucose or lactate. Finally, the place of heart glycogen in the metabolic scheme was defined as a store which could be called upon as blood lactate and glucose declined, or during anoxia, and was replenished (from blood glucose, but not lactate) when conditions were reversed.

When these remarkable studies were interrupted by the war a totally enclosed oxygenator had been devised which would have made possible continuous determinations of the respiratory gas exchanges.

In 1945 when he was released from his service at the Chemical Defence Establishment at Porton Down, and returned to University College, Lovatt Evans devoted himself with characteristic unselfishness to building up the department and preparing the way for his successor. On retirement from the chair in 1949, he found opportunity for continuing work in experimental physiology by rejoining the staff at Porton and becoming consultant first to the Ministry of Supply and later to the War Office.

Lovatt Evans had no great liking for the formal occasion, whether scientific or social; and although he gave a number of eponymous discourses, he was perhaps at his best as a lecturer with his junior undergraduate students. Here (believing such teaching to be his special responsibility) he was probably unsurpassed in his generation. The long bench in the physiology lecture theatre at University College would be crowded with apparatus, upon which he demonstrated, as he spoke, many of the experiments he was describing; and woven into each account was the historical background of the subject, enlivened by anecdotal illustrations often drawn from his own recollections and experience.

His great services to every aspect of British physiology are indicated by the many bodies of national importance on which he served with devotion of much time and effort, among them perhaps most notably the Medical Research Council. He was elected FRS in 1925, FRCP in 1929, was knighted in 1951, received honorary degrees from the Universities of Birmingham (his birthplace) and London, was a fellow of University College London, and of the Royal Veterinary College, London, and an honorary member of many learned societies, including the Physiological Society, which gave him especial pleasure.

Correspondence

Is Botany Dead ?

SIR,—I have followed the article by Sir Frank Engledow and other correspondence on "Is Botany Dead ?" with great interest (*Nature*, 220, 521, 541 and 834; 1968). It seemed to be generally agreed that the main contributory factor to the present disinterest in the subject was its bad image to the public at large.

Various ways of solving the problem have been put forward, but none of these seem to attack the root cause. This, in my opinion, is the fact that botany has now split up into many varied branches, each of which is now considered as a separate science. Thus all the major research done on plants, and the exciting discoveries resulting from this, come under the heading of molecular biology, genetics, biochemistry, etc. This relegates botany to the pursuit of nature fanatics, flower pickers, amateur gardeners and the like, which takes it out of the realms of modern science.

The solution to this is either to drop the word botany from scientific usage—maybe to be replaced by "plant sciences"—or else to make a concerted effort to re-establish the link between it and its many subsidiaries in the eyes of the ordinary man.

Yours faithfully,
PETER G. THOMSON

Department of Botany,
University of Southampton.

Scientists Informed

SIR,—During this year, we have had the International Federation for Information Processing Conference and many official reports on the subject of information retrieval and associated computer science topics, all of which have portrayed an unsatisfactory state of affairs strangely at variance with claims made for specific projects in the mass communication media. The report of the Parliamentary and Scientific Committee on the subject revealed a deplorable lack of communication between the specialized groups involved and concluded that the scientific and technological information network of the country was as good an example of a non-system as it was possible to find. More recently (*Nature*, 220, 320; 1968) the Royal Society conference on the subject called attention to the inadequate progress made since its last deliberations in 1948 and concluded that the remaining problems of computer based information retrieval would not be solved until machines expressly designed for the purpose were evolved. If investment and volume of activity in the field had been small, this state of affairs would be understandable, but in fact vast sums of money have been spent, particularly in the United States, and the volume of literature in the field almost constitutes a mini-information explosion in its own right. Clearly, the causes of failure cannot be attributed solely to the scientific difficulty of the problem, for a great many able minds have considered it from many specialized points of view.

Having recently brought my own work in the field to the point of implementation, I have been taking a strategic look at official and academic attitudes to present and future information retrieval problems. Not only are the conclusions of the bodies mentioned here supported, but there is abundant evidence that there is little interest in seeking solutions outside conventional hardware and software philosophy. Few, if any, computer scientists recognize that the information handling as distinct from the numerical processing aspects of computer design are at the present moment theoretically inadequate. There is certainly no enthusiasm for a specific information handling machine, despite the fact that such a project would represent a better investment in both academic and commercial terms than many of the projects currently being funded, some of which are undoubtedly doomed to obsolescence in the prototype phase. Computer scientists seem to be more motivated by professional chauvinism and the politics of fund raising than concern for extending the theoretical base of computer science and there is abundant evidence of over-specialization. Few, if any, think beyond the confines of numerical mathematics and conventional boolian logic.

Other professional groups involved, information scientists, statisticians and librarians, likewise tend to be unable to see beyond the narrow confines of their own art. Many statisticians seem unable to grasp the fact that the real information retrieval environment is statistically inhomogeneous and librarians tend to look on the computer merely as a way of mechanizing their traditional approach to subject matter. In all groups there is a curious dichotomy between privately expressed interest and enthusiasm and official conservatism and complacency.

What then is the answer to this problem which affects almost every branch of scientific endeavour ? Firstly, some of the massive new funding of projects needs to be directed to areas where there is a possibility of fundamental long term advance, rather than merely rehashing of existing technology to produce short term political and commercial gains. Secondly, experts in the various fields have got to be prepared to extend their knowledge to the point where they can see realistic generalized solutions related to other people's disciplines. And, finally, there must be official implementation, not just lip service, to the idea that original and adventurous thinking in science is worth supporting. Competition in the field of ideas is, in the long term, a sounder investment for a country of limited productive capacity than financial jiggery-pokery.

To conclude on the specific topic of this letter, it is my contention, based on my own work, that the development of an information retrieval computer could be brought to prototype phase within one year for a cost in the region of £100,000. The device would be based on an autocoded internal metalanguage structure for associative memory and learning functions. Input, output and most programming operations would be in natural language, from a VDU keyboard. The metalanguage processor could be built from standard logic elements and any commercial computer with variable word length and multi-programming facilities could be used as a basis for design. In addition to commercial opportunities in one of the few computer markets which is not overcrowded, the device would have applications in linguistics, pattern recognition, computerization of medical records and mathematics of higher finite group spaces.

Yours faithfully,
GORDON HYDE

Datatrac Ltd,
6 Collingham Place,
Earls Court, SW5.