

BIOGRAPHICAL MEMOIRS

John Guest Phillips, 13 June 1933 - 14 March 1987

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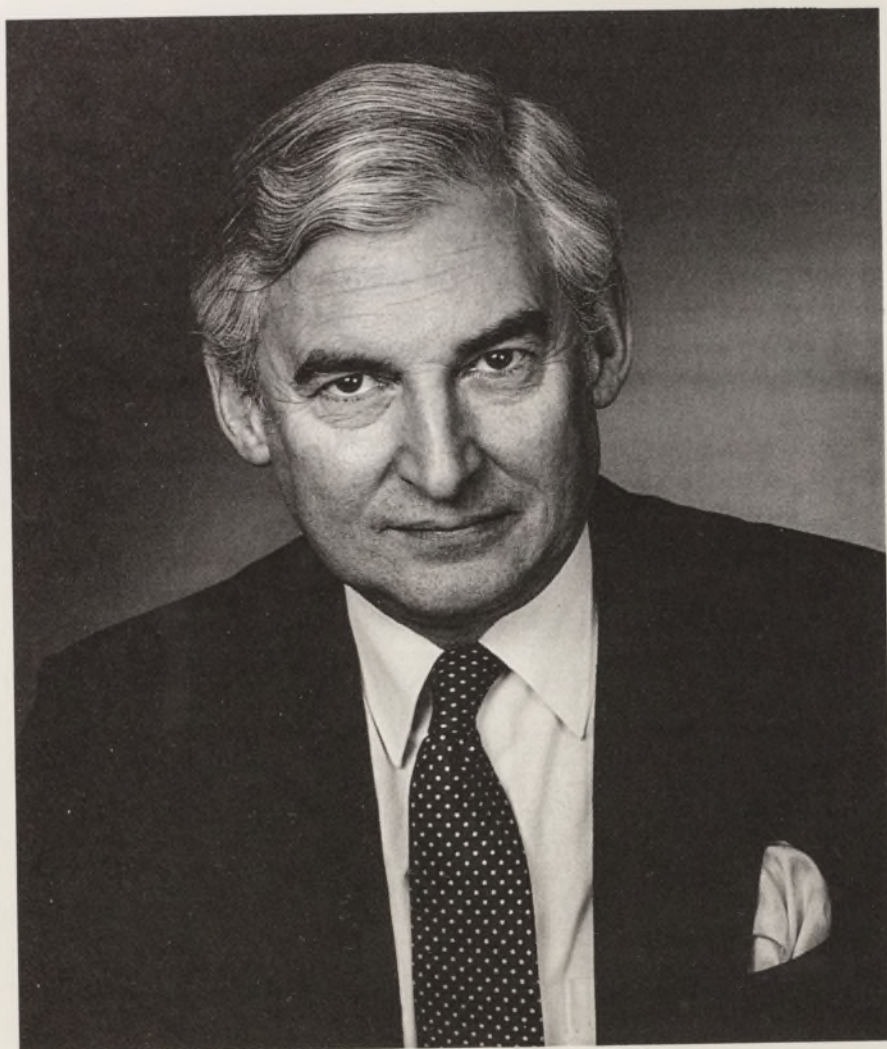
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Early life

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Elected F.R.S. 1981

BY G. P. VINSON AND J. F. TAIT, F.R.S.

INTRODUCTION

JOHN GUEST PHILLIPS, Vice-Chancellor of Loughborough University of Technology, died on 14 March 1987 in Leicester Royal Infirmary of a cerebral haemorrhage. He was 53. From 1961 Jacqueline Ann Myles-White was his loving and inspiring wife. She was also his constant and loyal colleague in his onerous and numerous administrative duties. With this essential backing, even before his Vice-Chancellorship at Loughborough, he had held an amazing number of highly active and responsible positions. He was Head of the Departments of Zoology at Hong Kong and Hull Universities. At Hong Kong University he was also Dean of Science, Pro-Vice-Chancellor and Acting Vice-Chancellor. At Hull University he was Dean of the Faculty of Science and, finally, Director of the Wolfson Institute. He was Chairman of the Humberside Area Health Authority, Secretary of the Zoological Society of London, Treasurer and then Chairman of the Society for Endocrinology. None of these were token positions and, particularly in the earlier days, were held during an active and productive scientific life.

EARLY LIFE

John Phillips was born on 13 June 1933 in Swansea, Wales. He was the third-born of one elder brother and of two sisters. His early childhood was spent in the village of Burry Port, in the Burry Inlet opposite the Gower Peninsular. The whole area is famed for its sea-birds and general marine biology, later the basis for his scientific interests. In *A brief history of the Zoological Department of the University of Hull* (Miles 1988), John Phillips writes: 'I did too have a deep desire to understand more about marine biology because as a boy I used to bicycle to the sea shore near my home and was intrigued and fascinated by inter-tidal life. My love for the

sea from the shore has persisted all my life'. Burry Port now gives an impression of being rather industrialized but the dominating power station on the beach was built in 1953, after John Phillips had left to start university life. On the other hand, nearby Llanelli must have been a very busy steel town in the 30s and 40s, although the mills are now silent and empty.

John Phillips attended the Burry Port Primary School from 1938 to 1944. He also went, twice on Sundays, to St Mary's Church, Burry Port, where, at the age of 11, he joined the choir. Later he sang tenor and enjoyed joining in the singing again when visiting the village. His father was Owen Gwynne Phillips, 'who was a remarkably well read and knowledgeable man although without formal education'. His mother, Dorothy Constance Lucas, 'had an amazing capacity to convey enthusiasm for life and the will to strive and work hard'. John Phillips obviously had a great regard for his parents. The descriptions of them included here, are in his own words (Miles 1988). His father ran a wholesale confectionary business and the family lived in a four bedroom semi-detached house. They were a mostly English-speaking family and only the father spoke Welsh. Nevertheless, in the best Welsh tradition, the children were obviously highly motivated to do well in life.

He also had an uncle, Warren Lucas, who was a keen cricketer and took John to see Glamorgan play whenever possible. This relative gave him 'a love for sports as a balancing influence in his life'. Nevertheless, John Phillips himself only played tennis keenly (with some squash) although he did this very well. Typically, he not only took part, but often also organized, the Llanelli Tennis Tournament. Another uncle was a Commander Engineer, then Captain, in the Royal Navy. The family tradition of naval and public service continued when his brother, David, became a Captain in the Royal Navy and one of his sisters a civil servant.

The Rt Honourable James Griffiths, C.H., M.P., who rose to cabinet rank during John Phillips's childhood, lived next door. Through friendship with the children of this local political celebrity John Phillips, at an early age, met a whole series of distinguished public figures, who regularly visited and discussed local and national politics in the garden. This left John Phillips with a 'lasting impression of a need for compromise, reason and balanced judgement', which must have contributed to his later ability to run committees. There were early signs of this ability in his handling of an irate farmer from whom he had 'borrowed' chestnuts.

At the age of 11 John Phillips won an Entrance Scholarship to Llanelli Grammar School, where he started as a pupil in 1944. Unfortunately, when 14, he failed his Junior Matriculation but passed Senior Matriculation at the age of 16, although with relatively poor grades. He promptly left school and for a few months trained as a chemist at the

Royal Ordnance Factory at Pembrey (later to be part of the Pembrey Country Park). At the same time he tried to take an external B.Sc. at the Swansea Technical College. However, he soon realized the difficulty of doing this and with the encouragement of his parents (perhaps also spurred on by his brother obtaining a lower deck cadetship at Dartmouth), he returned to the sixth form of Llanelli Grammar School. He took A-levels in botany, zoology and geology and, as a result of this examination, won a County Major Scholarship to Liverpool University. A major reason for this success was the influence of his 'characteristic and enthusiastic' biology teacher at Llanelli Grammar School, Mr Leslie Southern, whom he greatly admired. John Phillips has stated that, in the space of less than 10 years, this grammar school teacher initially trained nine eventual holders of chairs of biology within the Commonwealth. Perhaps John Phillips's improved academic success at this point in his school career was due also to his concentration on the more biological subjects, which were clearly his favourites.

LIVERPOOL UNIVERSITY

He has mentioned that, in his later days at school, he wished to make a career in medicine, preferably as a surgeon, but was advised against it. Therefore, in 1951, John Phillips entered Liverpool University with an original intention to read marine biology; probably because of his early interests at Burry Port. He writes (Miles 1988) that his choice of Liverpool was partly because of the easy access to Port Erin (Isle of Man), which was noted for its sea life and its marine biological laboratory, affiliated to the University. However, the focus of his interests again changed when he attended the lectures, first on sponges and sea-urchins but later on general endocrinology, given by Ian Chester Jones who was, at that time, senior lecturer in the Zoology Department. Thus began the productive professional association between the two men, based on considerable mutual respect and affection that was to last until John died. Chester Jones recalls the impression made on him by this unusual man who, as an undergraduate, asked penetrating questions about a whole variety of biological problems—Aristotle's lantern of *Echinus* is one such subject still vividly remembered although a long way from endocrinology—in an accent that was clear received English, unexpected in view of John Phillips's origin in South Wales.

It followed naturally that John Phillips should, on graduation in 1954 with upper second-class honours, be recruited into Chester Jones's research group, supported initially by a State Scholarship, a Liverpool University studentship and, later, an Agricultural Research Council (A.R.C.) studentship. His youth and charm contrasted with his ex-service hardened peer group, and Chester Jones made sure that during the course of his postgraduate career he visited the major European

centres, talking steroids with R. Neher, birds with J. Benoit and making many other similar visits in addition to highly influential scientists in the U.K., such as Ian Bush. No matter that he was no linguist he was, as throughout his career, an excellent ambassador, so clearly a sympathetic and interested listener. He was also proud to have played an active part in the organization of Chester Jones's Symposium on Comparative Endocrinology, which was to be the first of a series of these International meetings. As W. Neil Holmes, another contemporary Ph.D. student of Chester Jones has stated, there was a tremendous feeling of comradeship in the laboratory at that time, and the friendships that John Phillips made then were cherished throughout his life. An outstanding example was the association with W. N. Holmes himself, with whom he was to collaborate at British Columbia, Santa Barbara, California and the Marine Laboratories, Florida, on many projects in comparative endocrinology. This is a subject that does require extensive travelling and this was certainly a feature of the subsequent productive period of the scientific life of John Phillips.

RESEARCH AT LIVERPOOL

I. Chester Jones and his associates had been interested in the comparison of adrenal function between vertebrate species for many years. At first the investigations were mainly morphological and John Phillips also took part in such studies, for example on the histology of the adrenal gland of the Prototheria. However, the period of John Phillips's research studentship coincided with the application of the methods of Zaffaroni and, particularly in the U.K., of Ian Bush, to the direct analysis of adrenal effluent in the mammalian field. Bush's classical studies with *in situ* adrenal preparations established that corticosterone and/or cortisol were stoichiometrically the major adrenal steroids secreted by mammalian species, e.g. man, monkey, sheep, dog and cat produced cortisol, and rats and rabbits, corticosterone, as the major adrenal steroid; ox and ferret secreted nearly equal amounts of both of these steroids. Although technically a much more difficult task, the time was ripe for the extension of these studies to non-mammalian species and John Phillips adopted this as his main doctoral subject (1)*. A feature of these studies was the ingenuity to devise surgical apparatus and the necessary dexterity to collect adrenal blood from these animals.

He presented a paper at the Society for Endocrinology in 1957 on the analysis of adrenal (or adrenal homologous) tissue or blood in the ray, dog fish, cod and lung-fish (*Protopterus annectens*), *Xenopus laevis* (mixture of renal and adrenal blood), grass snake and capon (3). A series of tables of concentrations of adrenal steroids in birds, reptiles, amphibians, lungfish,

* Numbers given in this form refer to entries in the bibliography at the end of the text.

bony and cartilaginous fish was published in a paper by W. N. Holmes, John Phillips and I. Chester Jones (22), which also includes the results of later studies by John Phillips and his associates and other groups. These results indicated that corticosterone was the major adrenal steroid (stoichiometrically) secreted by birds and it was produced to a certain extent by all species studied. Cortisol could also be produced in significant amounts by certain reptiles, amphibia and fish.

John Phillips was therefore, one of the leading pioneers in the field of the nature of adrenal secretion in non-mammalian species, which, as will be described in the next section, eventually included studies of aldosterone production. He or his associates continued to contribute to the overall subject, which was his first major scientific interest, until he was appointed Vice-Chancellor at Loughborough.

YALE UNIVERSITY

After taking his Ph.D. at Liverpool University in 1957 John Phillips was awarded a Fellowship of the Commonwealth Fund of New York (now the Harkness Fellowship). He held this prestigious Fellowship at the Bingham Oceanographic Laboratory at Yale University with the late Grace E. Pickford. John Phillips continued to study the adrenal secretion of different species at Yale. Because the laboratory of Grace Pickford did not have the necessary equipment for steroid analysis he did this work in the laboratories of Phil Bondy and Patrick Mulrow. As a result he published, with these Yale scientists, and W. N. Holmes, then based at the University of British Columbia (5, 6), two papers on the production of corticosteroids in fish. Later he published a review, with Ian Chester Jones, on the same subject (10). Phil Bondy states

We had recently worked out a quantitative method for cortisol and corticosterone in reasonable (50 ml) amounts of blood and were happy to have him [J.G.P.] join us. He introduced a somewhat unusual flair to the lab, since he frequently came in with an arm full of Connecticut river salmon, usually around 2 feet long and pretty strong, with which he wrestled while he got blood by cutting off the tail and letting it drip. His work was not without danger especially when he tangled with lampreys. I remember a nasty-looking disk of missing skin on his forearm after one of those beasts grabbed him. My interest in his work was concerned with whether cortisol was a more mature steroid (in evolutionary terms) than corticosterone, but that idea died a quick death when it became apparent from John's work that fish, including lampreys, had a great deal of cortisol in their plasma, whereas, of course, rats and rabbits normally had almost none. Another matter of interest was the question of whether salmon died after spawning because of excessive secretion of corticosteroids. We were puzzled because reports from the west coast indicated that Columbia River salmon died of Cushing's disease, but our measurements showed only levels of steroids about the same as normal human beings [5]. I think it was later demonstrated

that the east and west coast salmon behave differently in this respect. John was a pleasure to have around. He always seemed cheerful and his sense of humour was sufficiently different from ours (more British perhaps) so that he often caught us off balance in his way of speech and the jokes he made. In spite of this, though, he was a tough person to fool and his science was first-rate.

The disappointment of Phil Bondy in the lack of significance of the choice of cortisol and/or corticosterone as the major stoichiometric adrenal steroids was shared by many scientists in the field, probably including John Phillips. The nature of the secretion does not correlate with the biological activity of the steroids, at least in mammalian bioassays, and their suspected function in the various species. Cortisol is stronger in glucocorticoid but weaker in mineralocorticoid assays than corticosterone but this does not seem to correlate with the characteristic metabolic requirements of the various species. There was also, as P. Bondy remarks, 'with our present knowledge no obvious evolutionary pattern to the nature of the adrenal secretion'. Perhaps greater knowledge arising from developments in molecular genetics will throw some light on this fascinating subject.

Aldosterone became a factor to be considered at about this time. In 1952 it was shown to be secreted by the mammalian adrenal cortex and physico-chemical methods of analysis became available from about 1954. However, its very low concentration in adrenal and peripheral fluid meant that meaningful analysis of this hormone was uncertain in most non-mammalian species. For many years in this field analyses for this hormone had to be made after incubation of adrenal or homologous tissue, but the physiological significance of these measurements was less directly clear. Nevertheless, partly due to the studies of John Phillips and associates at various centres, including one with I. Chester Jones (3) at Liverpool, with P. Mulrow (6) and W. N. Holmes and P. K. Bondy (5) at Yale, and with D. Bellamy and I. Chester Jones (16) at Sheffield, it was established, with reasonable certainty, that aldosterone was secreted by nearly all the non-mammalian animals investigated (see also the more recent review by Vinson, Whitehouse, Goddard & Sibley 1979). Even with the low concentration of aldosterone in circulating fluids, its high potency indicated that with other adrenal steroids, as with mammalian species, it probably had a significant effect in controlling the electrolyte metabolism of organs such as the kidney or homologous tissue. However, as will be described later in the next section, owing mainly to the studies of Phillips and associates, the situation is probably different for certain specialized electrolyte controlling organs of birds and reptiles.

Patrick Mulrow writes that Grace Pickford encouraged John Phillips and himself to work together and after incubating killifish tissue with radioactive progesterone they were probably the first to demonstrate that aldosterone was produced by fish (6). They also demonstrated that the

corpuscles of Stannius did not produce steroids, so settling a controversy of the time. Mulrow mentions the infectious enthusiasm of the British visitor in these and his other investigations at Yale (7).

Probably his most significant work at Yale was, with Grace Pickford, on the metabolic effects of prolactin in fish (9). He has stated, 'Perhaps my most vivid moment of scientific excitement was the discovery with Grace Pickford of the osmoregulatory activity of prolactin. The observation remained a scientific oddity for a brief period and then was fully substantiated by various workers throughout the world'. It seems that this was a proper judgement as the paper, although short, has had a very significant influence.

The problems of osmoregulation and salt-water homeostasis had already provided a fruitful and productive area of research in comparative endocrinology. It was clearly understood that different mechanisms existed among the various groups of vertebrates and that, for example, the human species is not particularly well suited to adapt to environmental extremes. In illustration of this point, humans cannot tolerate prolonged periods of high temperature without water as can, for example, the desert rat. This species never drinks, and it survives on metabolic water, eliminating only minute volumes of highly concentrated urine. The human being has only a limited ability to excrete a concentrated urine. It is for this reason that a castaway cannot survive by drinking seawater. Clearly, though, some species, including obviously fish but also some birds, reptiles and mammals, can survive well in such adverse conditions maintaining for the most part blood concentrations hypotonic to that of the environment. Some remarkable species of teleosts (bony fish) can survive equally well in fresh or seawater; these are termed euryhaline species. The best known of these are perhaps the European eel and the salmon, both of which have seawater and freshwater phases during their life cycles.

The main euryhaline species studied in Grace Pickford's Yale laboratory was the killifish, *Fundulus heteroclitus*, which, as previously indicated, was used for many studies. As an estuarine species the intact animal can survive well a transfer to fresh water. However, removal of the pituitary gland eliminates its capacity to adapt and, although it remains viable in seawater, the hypophysectomized animals dies within days on transfer to freshwater. Before the arrival of John Phillips in the laboratory it had already been shown that, although a pituitary extract could sustain the animals, administration of adrenocorticotrophic hormone (ACTH, corticotrophin), growth hormone (GH), thyroid stimulating hormone (TSH, thyrotrophin) and posterior lobe extracts were ineffective, as was thyroxine. Furthermore, treatment with the aldosterone-like steroid, deoxycorticosterone acetate, was also ineffective. These results were baffling. Mammalian studies had already quite clearly shown the importance of the adrenal cortex to salt metabolism as previously

discussed. The work of Mulrow and Phillips had also shown that the head kidney of *Fundulus*, which contains the adrenocortical homologue, had the capacity to produce mammalian-type corticosteroids. However, could it be that they had only a minor role in controlling sodium balance in the fish?

To test this *Fundulus* were hypophysectomized and treated with cortisol or aldosterone. In addition extracts of the mysterious corpuscles of Stannius, which some evidence suggested were involved in osmoregulation, were also administered. Another group was given renin. None of these treatments produced any useful effect. Pickford and Phillips discounted the gonadotrophins and sex steroids on the grounds that sex and maturity had no bearing on the adaptive response. Almost as an afterthought, it seems, they tried prolactin and were delighted with the result. All four hypophysectomized recipients of this hormone survived well in freshwater and were still lively after 20 days, though eating little.

The importance of this serendipitous finding is much greater than simply to account for the survival, under highly artificial conditions, of an obscure species of tropical fish (in certain other species, for example the eel, euryhalinity is not even affected by hypophysectomy). It is rather that it helped change the perceptions of comparative endocrinologists about the nature of their subject, for the evolutionary plasticity of the endocrine system was exposed. The Darwinist mechanisms that are held to account for the adaptation of anatomical structure to different ends in various species, it now seemed, could also operate on molecules. It released a new wave of interest in the comparative physiology of prolactin itself. Always something of an enigma, although its mammalian role in milk production was clear, it had already been identified as the pituitary hormone responsible for the 'water drive' behaviour in the newt *Triturus*. It was now even more certain that there was a good deal more to this hormone than first met the eye. P. Mulrow writes that at one time he and John wondered whether prolactin could be the aldosterone-stimulating hormone, then a subject of great interest at Yale, but this did not turn out to be the case. However, as is now well recognized, prolactin does have a wide range of biological activities.

In 1958 John Phillips attended the International Symposium on Comparative Endocrinology at Cold Spring Harbor, U.S.A., organized by Professor Aubrey Gorbman, where he stayed in a motel with I. Chester Jones and W. N. Holmes. No doubt arrangements for the subsequent productive collaborations were made then. The Congress was the second in a series of international congresses on the subject, the Symposium in Sheffield in 1954 now being regarded as the first.

When based at Yale he also undertook a North American tour, as required by the conditions of the Harkness Fellowship. Nevertheless, he also took an active part, as Resident Fellow, in the life of Devonport College, Yale.

SHEFFIELD UNIVERSITY

Although powerfully influenced and fascinated by North America (and although lasting only about two years, it was certainly one of his most scientifically productive periods) John Phillips was contractually bound to return to the United Kingdom, which he did in 1959. He first took the position of A.R.C. funded Research Officer and then became Assistant Lecturer in the Department of Zoology, to the Chair of which Ian Chester Jones had been appointed in the preceding year. Accordingly he played an important part in the planning and supervision of the research of the whole comparative endocrinology group. At this time he also delivered his first lectures to an undergraduate class. These are recalled by Gavin Vinson as being quite unlike anything else that happened in the Zoology Lecture Theatre at that time. Mostly this was because of John Phillips's youth, enthusiasm and success, with all of which we were eager to identify, but it was also because of his fluency and confidence within the essentially multidisciplinary field of endocrinology. Perhaps more than in most subjects, endocrinology requires that some of the traditional boundaries between subjects are transcended. Knowledge of structure and physiological function and biochemistry must all be used with equal facility. Among many other subjects John Phillips lectured with familiarity and point about the molecular structure of hormones with which he worked, a perhaps unusual skill in zoologists of that time.

Studies on the nasal gland of birds

In Sheffield his work was initially concerned with rounding off projects initiated with Ian Chester Jones at Liverpool. However, in 1960, he returned to North America to spend five months as Visiting Assistant Professor at the University of British Columbia with W. N. Holmes. This period introduced John Phillips to a subject that was to fascinate him throughout his career, osmoregulation in marine birds. This was obviously an extension of his work on osmoregulation in fish.

Like some of the species of fish, which he studied at Yale, marine birds can take in either freshwater or seawater. Birds and reptiles possess paired glands above the eyes, the nasal glands, which enable them to do so. It is through the secretion of a very hypertonic salt solution by the nasal gland that excess sodium, absorbed after drinking salt water, is eliminated. Much of the original work on the function of this gland, including its sympathetic control, had been done by K. Schmidt-Neilsen and his co-workers. By 1960 John Phillips and others had shown that the adrenocortical secretion of birds consisted largely of corticosterone and aldosterone, and Neil Holmes had developed methods for adrenalectomizing ducks. In view of the largely understood role of the adrenal cortex in the control of sodium balance in mammals, the moment was appropriate to investigate the adrenal role in avian nasal gland function.

It was quickly established that adrenalectomy completely abolished the nasal gland secretory response to a sodium load and that this could be re-established with administration of adrenal steroids (11, 12). In intact animals there was little correlation between the known effects of steroids on the mammalian kidney and their actions on the avian nasal gland; both steroids with strong activity in mammalian mineralocorticoid assays (aldosterone and deoxycorticosterone) and cortisol, which has high mammalian glucocorticoid activity, stimulated nasal gland secretion. Corticosterone, which has both glucocorticoid and mineralocorticoid activity and 18-hydroxycorticosterone (weak mineralocorticoid activity), another major product of the duck adrenal, were later added to the list of effective steroids. The presence of specific receptors for corticosterone in cytosol and nuclear fractions of nasal gland cells was later shown by other workers. Hypophysectomy also abolished nasal gland secretion and restoration was achieved by treatment with ACTH (24, 32). However, later in Hull, John Phillips and co-workers found that, unlike the killifish, there was no clear cut effect of prolactin in ducks (106).

If the avian adrenal has a central role in controlling nasal gland secretion, it is essential that the adrenal secretion should be sensitive to alterations in sodium intake. Unfortunately, the studies of Phillips and Holmes and their co-workers were less certain in their conclusions on this question. Circulating levels of corticosterone are increased only transiently as birds are transferred from freshwater to seawater, and in saline adapted animals they are no higher than in animals raised or maintained on freshwater (95). Nevertheless, in these circumstances, the apparent volume of distribution is increased suggesting the possibility of increased steroid secretion rates despite unchanged plasma concentrations. However, the concentration at the site of action would have to be related to the secretion rate of the steroid rather than to the circulating concentration. This is possible but has not yet been demonstrated. Returning the animals from seawater to freshwater also had no effect on circulating corticosterone. In view of the expected relative circulating concentrations of aldosterone and corticosterone, the activity of aldosterone in promoting the salt excretion of the nasal gland was not high enough to make this hormone a likely important factor, even in a permissive role. Clearly the system is complex: if nasal gland secretion is under neural control, as other workers have shown, then the role of adrenal steroids may be no more than permissive. Perhaps because of the difficulties inherent in the experiments, clear dose-response relationships and circulating concentrations for all the possibly relevant steroids, which would have helped to clarify the issue, are still not available.

Once again, however, the endocrinology of non-mammalian vertebrates was shown to be by no means another version of the mammalian condition but instead, in many ways, a more complex affair with special adaptations to the specific requirements of the species. In mammals the

kidney is the main site of electrolyte control. In birds, additionally, there are the nasal gland and the cloaca (later also studied by John Phillips and his associates (80)). Consequently, in hindsight, it should not be surprising that the studies of John Phillips and W. N. Holmes established that the concepts of the adrenal control of electrolytes by secretion of aldosterone (and possibly other steroids with mineralocorticoid activity), which stems from the mammalian model, do not necessarily apply, at least for the whole animal, in other species (84). However, at the time, as was evident by the invitation to Holmes, Phillips and Chester Jones to present a paper, 'Adrenocortical factors associated with adaptation of vertebrates to marine environments', at the 1962 Laurentian Hormone Conference, it elicited much interest (22). Unfortunately, owing to the illness of his wife on the way to the Conference, John Phillips was unable to attend. However, his answers to the Discussion were recorded *in absentia*. This is, we believe, the only time that this has been done at this leading International Endocrinology Conference and indicates the importance of the subject and his crucial role in the work.

The appointment in Sheffield was obviously productive, both in his research and teaching activities. However, it is never easy to be a staff member in a department whose head was your active Ph.D. supervisor, no matter how great the extent of the mutual personal affection and regard. It was obviously time for a change in his career, and when it came it was a spectacular movement.

UNIVERSITY OF HONG KONG

In 1962 the Chair of Zoology at the University of Hong Kong fell vacant and John Phillips was appointed to it at the extraordinarily youthful age of 29. Neil Holmes states that the invitation arrived when he and John were working together in Florida. This was a courageous appointment, which was amply repaid to the university in the strengthening of the department and in the administrative skill he brought to bear in other offices. It now seems almost incredible, but this young man was acting Dean of Science for periods in 1963–64, Pro-Vice-Chancellor 1966–67 and acting Vice-Chancellor, for three months in 1967 at the age of 34! Nevertheless, it was in many ways an idyllic and comparatively stress-free period during which the Phillipses' two sons were born. It may be speculated that the problems facing the acting V.C. in Hong Kong, while complicated by the political unrest in the Colony at that period, in no degree presaged the severity of the burden of this office in Loughborough in 1987.

In the department the first problem was to find support for setting up a laboratory suitable for comparative endocrinology. This he was quickly able to establish with a grant from the Nuffield Foundation. The Nuffield Unit, comprising laboratories and animal facilities, was established in a

building apart from the main body of department and was well equipped with a gas chromatograph and scintillation counter as the *sine qua non* of the period. Graduates were supported by university studentships to study for the Ph.D degree and before long there was a flourishing group.

The research of this period is characterized by a flowering into previously unapproached areas. Partly, of course, this is due to the imaginative and successful exploitation of locally available species, each bringing its own complement of problems in endocrinology to be solved. These included the endocrinology of sex reversal in the rice field eel, *Monopterus albus* (39, 40, 41, 47), the embryology of the rectal gland (another site for electrolyte exchange) in *Squalus acanthias* and *Hemiscyllium plagiosum* (35, 36, 37), the endocrinology, with particular reference to the thyroid, of skin sloughing in the gecko (44, 59–61, 65) and, most startlingly, a whole range of studies on the cobra, *Naja naja* (34, 43, 47, 50, 51, 57, 64). It is difficult to describe with sufficient forcefulness the tense atmosphere of concentration in the laboratory when a major experiment with the latter was in progress. Of the Hong Kong University Graduates who studied in the Nuffield Unit, two (D. K. O. Chan and S. T. H. Chan) are now on the academic Staff of the department, D. P. Huang and K. W. Chui are elsewhere in Hong Kong, and P. K. T. Pang, S. W. C. Chan and W. O. Tam are in North America. All are still actively engaged in research, despite the great problems some have met in maintaining this activity. Few would deny that their original inspiration in following research as a career with such keenness is due originally to the enthusiasm of John Phillips.

Hong Kong and the Nuffield Unit were also something of a magnet for visiting researchers from other countries at this time. These include B. Lofts, I. Chester Jones, J. Dodd, F.R.S., and G. Vinson from the U.K., R. I. Dorfman and K. B. Eik-Nes from the United States and virtually the entire staff of the Howard Florey Institute, Melbourne, Australia.

HULL UNIVERSITY

Although John Phillips was happy in Hong Kong it was remote for scientific contacts, even for a dedicated international traveller. He was therefore advised by many senior colleagues, such as Sir Peter Medawar, F.R.S., I. Chester Jones, Lord Swann, F.R.S., J. M. Dodd, F.R.S., and most significantly, N. Robertson, Professor of Botany, Hull University, that he must again return to the U.K. John Phillips was now convinced that he could hold a disparate research group together and Hull University, at a time before British universities developed serious financial problems, was keen to develop its research activities. One also suspects that the recruitment of a man of the general qualities of John

Phillips was important at a time when Hull was keenly interested in having a medical school. He knew and liked the maritime town of Hull and the flat, but interesting, surrounding countryside. He had a good friend on the staff of the Department of Zoology, Norman Nowell, and there was already an establishment of technical and academic staff with promises, later fulfilled in the early years, of considerable further additions. Therefore, in 1967, he accepted the Chair of Zoology at Hull University. Nevertheless, he delayed taking up the appointment to help the department in Hong Kong and represented that university in the U.K. for many years. He then developed the department in Hull with active leadership but in a democratic manner, which clearly pleased the staff already in post. He adjusted the teaching to give it a research-based flavour and this greatly influenced the successful Honours School. At first he obtained extensive extra research support, in addition to U.G.C. funds, from both public and private sources such as the Medical Research Council, the Royal Society, the Science Research Council (S.R.C.), the Wellcome Trust, the Nuffield Foundation, Reckitts and I.C.I. Two additional lectureships in Zoology were created during his headship of the department (1967–79) and several internal promotions were made to senior lectureships, readerships and a Personal Chair.

Research activities in the Zoology Department

In Hull John Phillips continued, as best as he could, many of the research activities that he had developed in Liverpool, Yale, Sheffield and Hong Kong (106, 112, 113, 118). His overall research work was now recognized by several honours; a D.Sc. of Hong Kong University (1967), the Scientific Medal of the Zoological Society (1970), Medal of the Society of Endocrinology (1971) and Fellowship of the Royal Society (1981). Undoubtedly he would have received many other honours but for his early death.

Nevertheless, in a large department, the encouragement of independent zoological research by staff members had to be supported with equal priority to his own particular interests. Although there was some general bias towards comparative physiology, this he did with unstinting unselfishness, perhaps to the detriment of his own particular research. The general range of interests in the department was remarkable. The following is a selection from a list provided by another former student of I. Chester Jones's, N. Nowell, who was interested in neuroendocrinology and animal behavioural studies. John Sudd was involved in mainly field studies and ant and spider behaviour, and Ivor Williams studied helminths of birds, fish and molluscs. Margaret Manning carried out immunological studies, mainly on *Xenopus laevis*. These were particularly expedited by the improvement in resources owing to the new Head of Department. Professor G. Goldspink made the Hull Department a

notable centre of muscle research using mammals, birds and fish. Many members of the staff of the Muscle Research Unit took up senior research positions throughout the world. John Riggott studied the pathology of cancer tissues in a number of different organisms including mice, birds and man. Neville Jones made aquatic fauna his interest. Later, this involved a number of studies of freshwater fish and the status of local waterways from a conservation point of view. This eventually led to the formation of the multidisciplinary Institute of Estuarine and Coastal Studies. R. Uglow studied certain aspects of the biochemistry of littoral crustacea. D. V. Holbertson was concerned with the motility and organelles involved in movement in the Protozoa. Graham Goldsworthy studied the physiology of flight in locusts including the characterization and synthesis of adipokinetic hormone. John Robinson was involved in reproductive endocrinology, particularly ovarian function with its implications for human infertility.

Obviously this list is incomplete and nearly all the investigators had associates, who cannot be mentioned here. A fuller account of these research activities in the department, when John Phillips was the head, is to be found in the *Brief history of the Zoology Department of the University of Hull* (Miles 1988). Although much of this research was done without the direct participation of John Phillips, except as a most important energizer, the consequent administrative load must have been considerable. Most of the research members of staff greatly appreciated the extra support and facilities that John Phillips provided for their work. They felt that they had a head who would fight for them.

Wolfson Institute

In addition to these activities in the Zoology Department the Wolfson Institute with its research on gerontology was established. This research was started at Grimston with a colony of ageing rats supplied by his collaborator, D. Bellamy, and it became the first laboratory for gerontological research in the U.K. Due mainly to the efforts of John Phillips and funding by the Wolfson Foundation in 1974, these activities were transferred in January 1977 to a purpose-built Institute on the University campus, adjacent to the Biology building, where it provided joint animal facilities for the Zoology Department. In this Institute a whole animal model system was developed in which the role of ageing and the possibilities for reducing its deleterious effects were clearly defined. After running both the Wolfson Institute and the Department of Zoology for some time, John Phillips thought it vital to concentrate on research by vacating the Chair of Zoology. In 1979 the Wolfson Foundation made a grant to support partly a Chair to which he was appointed, and the S.R.C. initially awarded him a Senior Fellowship; these two grants together enabled John Phillips to become Wolfson Professor and Director of the

Wolfson Institute. After some rather complicated rearrangements in the University I. M. L. Donaldson, a medical graduate of Edinburgh, then occupied the Zoology Chair with its associated administrative duties. These complications, in which an established Chair in Zoology was lost, reflected the University's response to pressure from the U.G.C. on all universities in the summer of 1979 to reduce their commitments. Even before the severe reduction in university funding that began in 1981, Hull University was particularly hard hit by the introduction, in 1980, of full-cost fees for overseas students, of which it had a high proportion. Ironically, this probably arose from the tradition of the activities of the famous Wilberforce family. In consequence, a series of three Vice-Chancellors had to impose severe financial cuts, which inevitably affected the Wolfson Institute. John Phillips had a remarkable capacity for work and he responded generously to all the demands made for his expertise, as will be evident in the list of his activities recorded here, until eventually, in 1984, even he became too extended and he had to curtail external activities significantly in the interests of the Wolfson Institute. Nevertheless, during his directorship there were many papers published on the effect of stress (94, 97, 103, 107, 108), the environment (109, 111, 114), including the effects of oil on seabirds (99, 101, 104), ageing in various species (92, 100, 115) and on several other subjects, as listed in the bibliography section of this memoir. However, the Wolfson Institute, according to D. Bellamy (currently Head of the Zoology Department of Cardiff University), now 'stands as an empty monument to Britain's withdrawal from international science, and to the decline of the provincial universities'.

Other Hull University activities

Extending his experience at Hong Kong University John Phillips served as Dean of the Faculty of Science of Hull University from 1978 to 1980. One of his most important innovations was to compile a register of all research activities in the Faculty. He then used this firm information to encourage certain members to be more active in this direction. Apart from the advantage of this for increasing intellectual activity in the University, it was essential in view of the searching examination that was to come to British universities. John Phillips also extended his contacts, which he had made for the Department, for the benefit of the Faculty as a whole.

Just as beneficial to the University were the general social activities of John Phillips and his wife, Jacqui. These were particularly involved in the visits of many British academics and generally influential personalities, such as Mr Kingman Brewster, the former American Ambassador, when receiving honorary degrees. The Phillipses made sure that not only were these guests well entertained but they were made aware of all activities connected with Hull University. This made many

informed friends for the University, which was particularly important for an area that is not geographically central (even in Yorkshire).

Health Authorities

From 1981 to 1984 John Phillips was Chairman of the Hull Health Authority, which in 1984 had a budget of about £60 M per annum, including acute community and ambulance services. Before the 1982 reorganization of the National Health Service he was Vice-Chairman of the Humberside Area Health Authority (1979–81) and, as Chairman-designate of the redefined area, served as Shadow Chairman for six months until 31 March 1982; he played a big part in the setting up of the new organization. In his role as official head of such a medical administration his regrets at not becoming a medical student must surely have been assuaged.

Hull University had made a bid for the establishment of an undergraduate Medical School before John Phillips's arrival in 1967. It was a cause he espoused and he became deeply involved in the University's second and third unsuccessful attempts to secure approval. After the final outcome was known in 1974 the decision was taken to concentrate henceforth on postgraduate medical education, and Phillips redirected his efforts. Later, as Chairman of the Hull District Authority, he was involved in the setting up of a centre for postgraduate medical education and obtained £0.75 M from the Yorkshire Regional Authority for that purpose. The building, now a Postgraduate Education Centre, will be completed next year.

Again, his colleagues reported on his skill and dedication as a Chairman of the Health Authority at a difficult time of reorganization and limited resources for the potential of modern medical education and treatment.

Other extramural activities

John Phillips had many other extramural activities, mostly started and conducted when he was at Hull. The following list contains those not mentioned elsewhere in this memoir.

Probably arising from his connection with Hong Kong University, he was a keen member of the Commonwealth Scholarship Commission. He was active in the Institute of Biology, both in the Yorkshire Branch (President) and nationally (member of Council and Vice-President), the British Association (President, Zoological Section) and the Marine Biological Association of the U.K. (Council Member). He was on the Commonwealth Human Ecology Council and the Executive Committee of the British Society for Research into Ageing.

In addition to his involvement in the *Journal of Endocrinology*, he was a member of the editorial board of *Age and Ageing* and associate editor of the *Proceedings of the Royal Society*.

A particular interest of John Phillips's was in special schools. He was Governor of St Anne's (Vice-Chairman), Wold and Bridgeview special schools. He was also Governor of the Endsleigh College of Education and Trustee of the Hull and East Riding Cardiac Trust and the Ferrens Education Trust. He was Chairman of the Humberside Area Nurse Education Advisory Centre.

He held numerous visiting research fellowships, lectureships and professorships, mostly while he was based in Hull, including at the University of British Columbia; University of California, Santa Barbara; Harvard University (Milton Research Fellow); Sheffield University; University of Texas, Lubbock; Ben Gurion University; La Trobe University; University of Manchester and McKenzie University. He was assessor and examiner for first and higher degrees in the U.K. and overseas in many universities, too numerous to detail here.

THE SOCIETY FOR ENDOCRINOLOGY AND THE ZOOLOGICAL SOCIETY OF LONDON

Society for Endocrinology

Perhaps the major continuing interest of John Phillips outside Hull University was his long and dedicated service to the Society for Endocrinology. He served as a committee member of the Society between 1971 and 1984, Treasurer 1975–81 and Chairman 1981–84, with corresponding duties on the Council of the Journal of Endocrinology. According to Professor Lesley Rees, his successor as Chairman of the Society:

At the International Society for Endocrinology (ISE) Congress in Melbourne in 1980 in the bar one evening he formulated the concept of a confederation of British Endocrinology and improving the qualities of our meetings. His vision in this regard led to the formation of the British Endocrine Society (BES) and the first meeting was held in London at the Institute of Education in May 1982. He played a key role in drafting the constitution of the BES and ensuring the spectacular success of the first meeting. It is true to say that this changed the face of British Endocrinology.

The idea of a combined society, on the lines of the successful (and much older) Endocrine Society in the United States, had been discussed before this famous meeting in a Melbourne bar. However, there was already a well entrenched demarcation in the U.K. between the various societies for endocrinology and between clinical and non-clinical endocrinologists. The diplomatic skills and practical committee sense of John Phillips were therefore essential for the successful formation of the combined Society. It was therefore only appropriate that he was its first Chairman.

John Phillips also used his experience as Treasurer to make many financial changes in the administration of the Society for Endocrinology

when he became Chairman, and therefore his dominating influence in this area extended over ten years. Perhaps it is for this reason that the financial health of the Society has been evident. This has resulted in moderate subscription and *Journal* charges, and generous travel grants to meetings, including those for junior members of the Society.

As Lesley Rees continues, 'On the international scene he was equally effective. He served on the Central Committee on the ISE, where he was an effective promotor of the U.K. and outspokenly critical when he perceived that political decisions were interfering with the progress of science'. He was also on the International Committee of Comparative Endocrinology and so, bearing in mind also his extensive overseas travelling for research and lecturing, his influence in international endocrinology was considerable.

Zoological Society of London

Lord Zuckerman, F.R.S., writes:

Following the retirement of Dr Erasmus Barlow, then secretary of the Zoological Society of London, John Phillips was elected in his place at the Annual General Meeting of the Society in May 1982, thus becoming the 16th Secretary since the Society's Foundation in 1829. He took over at a difficult time, in a period of increasing annual deficits between income and expenditure. The Government stepped in to save the Society on condition that it prepared an Operational Plan in order to see whether the Society could become self-sufficient, at the same time as it was the custodian of a major national institution, the London Zoo. This involved much work within a short period by the Officers and Executive Staff. Phillips devoted great energy to the Secretary's part in this task, while at the same time becoming familiar with the many scientific activities of the Society.

John Phillips's experience as a professional zoologist, and his contacts with the heads of other zoological departments encouraged him to try and organise a closer relationship between University Departments and the Society through the medium of a Zoology Liaison Group. On his retirement from the Secretaryship, others took up the task of making a reality of this imaginative move.

During the early 1980s in addition to the Secretary of the Zoological Society of London, Phillips had taken on an increasing number of other diverse projects. Among his other commitments was that of Chairman of the Humberside Health Authority. The realization that his research programme in Hull was suffering and that his students were being deprived of his leadership with consequential effects on their careers, led him to resign from the Secretaryship prior to the Society's Annual General Meeting in 1984.

Professor J. P. Hearn adds:

John Phillips was a valued member of the Council of the Society when he was invited to serve as Secretary, a post he held for just under two years. During this time, with all his other commitments, he was at the Society

at least two days a week, contributing to all the activities of the Society during a very difficult time. He promoted the close team function of the Society, with its specific institute and its zoos, encouraging a broad international role as well as insisting on high scientific standards. As Director of Science of the Society during that time, I found it a joy to work with John, who was always accessible and entirely supportive. He found time to know junior staff and to involve himself in social events to the extent all staff still comment on the open, vital and supportive role that he played. He was full of ideas and always provided constructive suggestion, leading the management team by his action and optimistic approach.

It seems likely that there was incompatibility of personalities at the top level during John Phillips's Secretaryship. Nevertheless, a major factor in his resigning was undoubtedly the pressure of his other commitments and the effect on the Wolfson Institute, as previously discussed.

LOUGHBOROUGH UNIVERSITY OF TECHNOLOGY

On 1 January 1986 John Phillips became Vice-Chancellor of the Loughborough University of Technology. Leaving Hull University must have involved many regrets in spite of his later disappointments there. Unfortunately, his early death meant that he has not left any direct personal account of his motivation for the move. Even with the invaluable help that we have received from his colleagues such as Professor Gordon Wray, F. Eng., F.R.S., Professor of Mechanical Engineering at Loughborough, one can only speculate, without complete supporting evidence, that realizing the pressures that any British university was about to experience he preferred to be in complete charge of such an institution, whatever the consequences. It seemed that he realized that Loughborough University, being particularly concerned with engineering, was a vital institution for Britain and that it could become a Massachusetts Institute of Technology or a Stanford University. According to Professor Wray he may also have been influenced, to some extent, in his view of the importance of engineering by his brother, who was a senior engineering officer in the Royal Navy and by his eldest son, then a mechanical engineering student at Bristol University. He must have realized at Hull University that his personal research work was nearing its end and that his main contribution in the future was to be in creative administration at the highest university level. He must have felt justifiably confident, with his broad administrative experience, that he could make a success of it.

As a zoologist and endocrinologist, his appointment as administrative head of a major engineering institution must have caused some surprise in certain Loughborough circles. Nevertheless, it is clear that his personal qualities became immediately appreciated and his general experience must have been obvious. He also quickly instituted a positive programme of reviewing departmental and general university activities, including a

series of extensive visits. This was an extension of his policy as Dean of the Faculty of Science at Hull. He also formed a Planning Team of mainly senior academics. This was urgently necessary to consider courses of action in view of communications being received by Loughborough University, as by all other British Universities, from the University Grants Commission (U.G.C.), acting under pressure from the Secretary of State for Education and Science. It became clear that real U.G.C. income for Loughborough would be cut immediately by 2–4 % and there would be considerable further reductions in the future; surprising decisions to be applied to a technological university. This necessitated closure and merger of certain departments, and termination of some courses with consequent difficulties for staff and students. There was then natural opposition, as in many other similarly placed universities, to the action of internal administrators, who had to take the necessary remedial steps. Although a deeply caring person, typically, John Phillips did not show much outward emotion in the difficult situation. However, his early morning phone calls at the time to his old mentor, Ian Chester Jones, indicated the stress involved. After a final five weeks of intense activity by the Planning Committee, at one meeting on 9 March John Phillips had a cerebral haemorrhage and died on 14 March 1987. Personal trauma occurred in the staff of many British Universities at that time and probably resulted in similar casualties. In the postwar period staff in British universities had been quite unaccustomed to such attrition. In many cases neither the academic community nor the administrative structures of the institutions were sufficiently rugged for the hard decisions that had to be taken. This period of sudden examination and curtailment was undoubtedly very stressful to the staff generally and hence to the responsible administrators. Although John Phillips had experienced the early effects of financial cuts in Hull, their full impact occurred in the first year of his assuming the greatest responsibility at Loughborough. Unfortunately, he did not have time to adjust to the pressures. Perhaps this is not ever possible, in the circumstances, for such a caring, although outwardly calm, person.

The impression he must have made at Loughborough is demonstrated by the many honours and quality of the tributes shown to him by the University after his death, even though he had been in office for a relatively short period. Particularly in view of his love of music, probably starting with his days as a choirboy in Burry Port, it was appropriate that the programme on 12 May 1987 for the Gala Concert with the Hallé Orchestra on the 21st anniversary of the establishment of Loughborough University was left, as a final tribute exactly as he planned and designed it.

Some extramural activities, which he had undertaken in Hull were continued at Loughborough, although some of the most onerous, such as administration in the Health Authority, the Zoological Society and the

Society for Endocrinology, had ceased. One of his later interests was in the University of Buckingham. He obviously considered the establishment of this institution to be a useful innovation and became a Patron. The last honour he received, only a few weeks before his death, was an honorary D.Sc. degree from this University.

PERSONAL MATTERS

John Phillips left a widow, Jacqueline, and two sons, Adrian Myles Guest and Justin Guest Phillips. The essence of the success of the family life, in spite of his many responsibilities outside the home, must have been the interest of his wife, Jacqui, in most of those activities and her active participation in the informed entertainment of visitors, a most important function in the University and in outside organizations such as the Society for Endocrinology. However, in spite of the successful formal social life of the Phillipses, there is little doubt that they preserved the common touch and he loved to meet old school and choir friends from Burry Port and Llanelli.

He had an excellent relationship with his sons, who have themselves steadily developed their academic careers. They were both at Oundle School. Adrian obtained an upper second-class honours engineering degree (Ford Prize) at Bristol University in 1987. He is currently in the XIII/XVIII Royal Hussars Queen Mary's Own. Justin obtained a degree while at Magdalene College, Cambridge, and in September 1987 started clinical studies at Charing Cross and Westminster Hospitals.

After he left Hull University and relinquished many of his extramural responsibilities, John Phillips was additionally a member of the Royal Commission for the Exhibition of 1851, Governor of Loughborough Endowed Schools and Vice-President of the Society for Wildlife Art of the Nation, but these are not posts with strenuous duties. He also abandoned all the usually demanding personal research ambitions when he moved to Loughborough and he was certainly not aware that the administrative stresses were to be great enough to deprive the family of husband and father.

Fellow scientists gave tribute to his research efforts at the British Association's Zoological Section Meeting in Belfast in 1987. At the Presidential Session, initially organized by John Phillips himself, the appropriate theme was the ecophysiology of vertebrates.

ACKNOWLEDGEMENTS

We are clearly grateful to his family, Mrs Jacqueline Phillips, Captain David L. Phillips, R.N., and Mr F. Myles-White (father-in-law) who, in spite of their grief, helped us greatly. Although one of us (G.P.V.) was a student at Sheffield University, when John Phillips was there, we were

only fleetingly colleagues on the staff in the same university or fellow officers in organizations, in which he was active. We have, therefore, been very dependent on assistance from such colleagues. For their help we are particularly grateful to Professor D. Bellamy, Professor P. K. Bondy, Mr M. Bray, Professor I. Chester Jones, Professor E. A. Dawes, Dr S. Harvey, Professor J. P. Hearn, Dr W. N. Holmes, Mr A. E. John, Professor B. Lofts, Professor D. R. London, Dr H. B. Miles, Dr B. J. Merry, Professor P. J. Mulrow, Dr N. W. Nowell, Professor A. Pollard, Professor L. Rees, Miss B. Roscoe, Professor R. V. Short, F.R.S., Dr S. A. S. Tait, F.R.S., Professor G. Wray, F. Eng., F.R.S., and Lord Zuckerman, F.R.S.

The photograph reproduced was taken in about 1985 by Godfrey Argent.

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