BIOGRAPHICAL MEMOIRS

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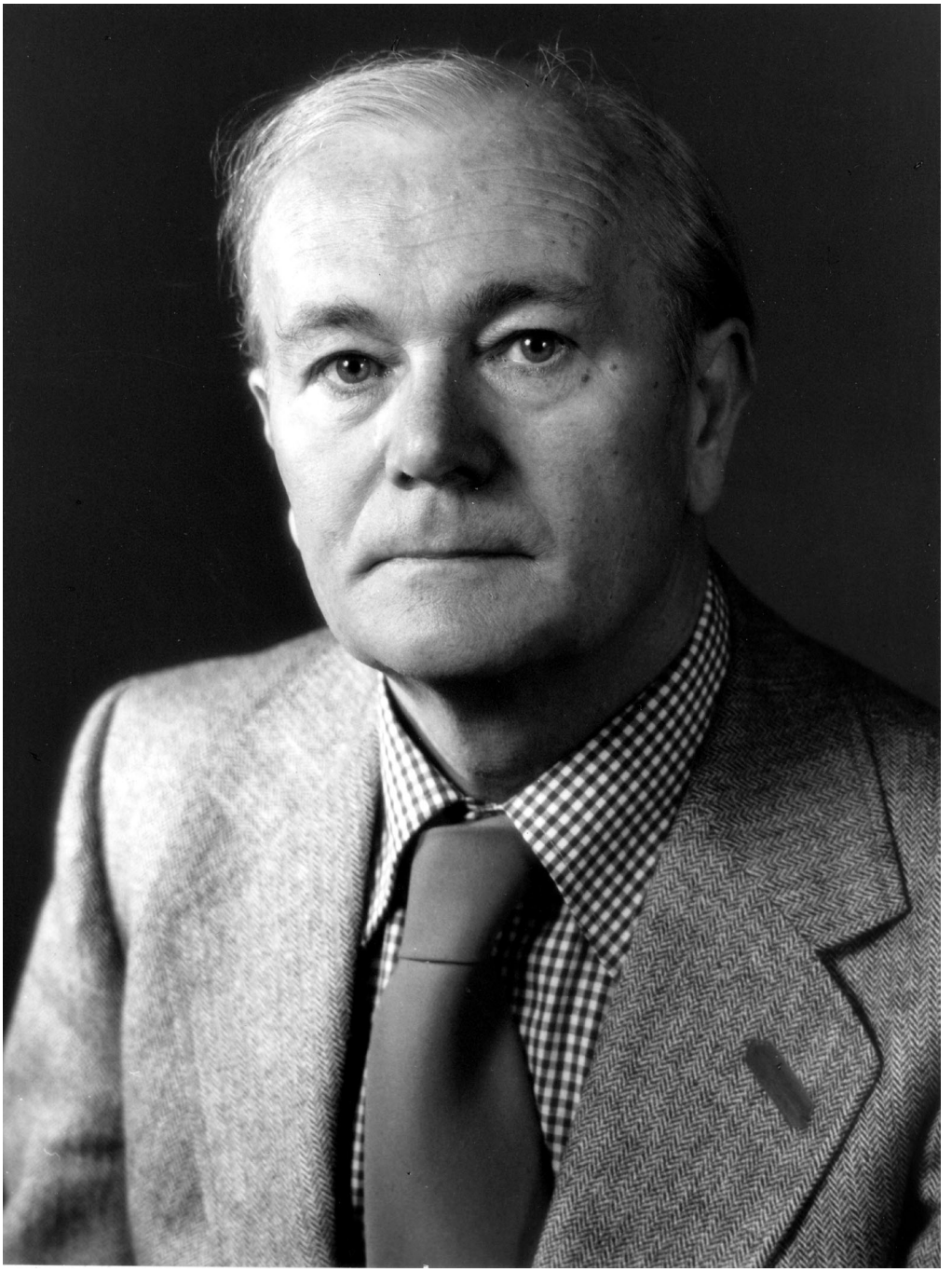

S F Mason

STEPHEN FINNEY MASON

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Elected FRS 1982

By Roger Grinter

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Stephen Mason's professional career comprised three distinct periods. After completing his DPhil on the physicochemical properties of antimalarial drugs in 1947 he first worked in the history of science and wrote a notable book on that subject, *A history of the sciences: main currents of scientific thought*. In 1953 his interest turned again to 'modern' chemical research, and until his retirement in 1988 he was active at the forefront of the application of the spectroscopic and theoretical techniques developed during the middle third of the twentieth century to the elucidation of the structures of organic and inorganic molecules. In the last, post-retirement, phase he returned to the history of science. This pattern reflected his extremely wide interest in and comprehensive knowledge of science, especially chemistry, which was manifest in his approach to university teaching and to all the research problems with which he engaged.

Early life, 1923–41

Stephen Finney Mason was born in the village of Anstey, Leicestershire, on 6 July 1923, the first child of Leonard Stephen Mason and Chrissie Harriette Mason (*née* Finney). A sister, Renelle June Mason, was born on 21 June 1927. The family lived in a house and general store adjoining a commercial garage that had been purchased by his maternal grandfather in 1920 from the proceeds of the sale of a small boot and shoe factory. At first the garage was run by his father. Later, when his parents separated, his maternal grandfather again took over the sales side of the business and let the garage space to a series of lorry owner-drivers. The general store, run by his mother, occupied the front of the house. By 1940 the owner of a small fleet of trucks rented the whole garage space, and he bought out the garage and store a few years later. Stephen lived in the house until the age of 18 years.

The presence in the garage of discarded motor parts of all kinds—gear boxes, magnetos, and so on—stimulated the boy to dismantle and reassemble them with varying degrees of

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success and to discover how they performed their allotted tasks in a vehicle. Old car batteries were used to provide electricity for his electrolysis experiments or, if they were no longer chargeable, as a source of sulphuric acid. One cannot envisage that health and safety considerations would permit a young and enquiring mind to be developed and educated in this way today. A small plot in the garden fostered an interest in plant growth that led to early experiments with the hydroponic technique, with only partial success due, as he realized later, to lack of pH control. Interest in water, common to all small boys, led to the construction of a canoe and a punt, which were tested on the nearby brook and found to be moderately functional. At the same time he began to construct crystal-set radio receivers and recalled first hearing the declaration of World War II through the headphones of such a set.

The family library, which consisted largely of a job lot of volumes purchased by his maternal grandparents, was meagre but it did include W. M. Watts's *Index of spectra* (1872), which contained a colour illustration of the visible spectrum crossed by the dark Fraunhofer lines and the information that the lines became bright if the appropriate elements were heated strongly in a gas flame. This the budding spectroscopist was pleased to confirm on the kitchen gas stove, using samples of copper verdigris and salt. Thus, a very broad interest in all things technical and scientific developed at an early age.

After primary education in the Anstey village schools from 1928 to 1933, he won a scholarship to Wyggeston Grammar School in Leicester from 1933 to 1941. At the time the school had about 1000 boys and was located alongside the campus of Leicester University College. Stephen was placed in the B stream of potential mathematicians, scientists and technologists; the A stream comprised the classicists. The absence of Latin in his school curriculum had later consequences and required an intensive course in that subject during his last year at school to meet the Oxford University entrance requirements. At Wyggeston, Stephen found the science masters, in biology, physics and chemistry—and especially the last, Harold Garside—particularly impressive and influential. The breadth of his interest in all things scientific and technical was shown again in a talk that pupils in their final school year were obliged to give to their sixth-form contemporaries and their teachers. He had read of a geometrical projection by means of which any point outside a circle could be represented by a point within the circle and, although he admitted that he had not fully mastered all the mathematical complexities, he extended the idea to a sphere and proposed that Hubble's law of galactic recession could be transformed in this way to a law of motion towards the centre of a spherical cavity. The headmaster was very impressed by the exposition, and he and the science masters encouraged Stephen to sit for an open scholarship in natural science at Oxford or Cambridge, the headmaster in particular being adamant that he should sit the Oxford scholarship examination of December 1940. His time at Wyggeston ended in 1941 with the award of an open scholarship at Wadham College. There was no tradition of science or the professions in the family, and he was the first to go to university.

Oxford, 1942–47

After a splenectomy to correct a congenital haemoglobin condition, in August 1941 Stephen matriculated at Oxford in 1942 to read chemistry with subsidiary biochemistry. The Oxford experience opened up a new world to him. The modern poets, painters and composers were experienced for the first time, and new subjects such as politics, philosophy and economics were revealed.

The science exhibitioner at Wadham in Stephen's year was an engineer, Ian Hutcheon, and the two became close friends. As students they both joined a volunteer scheme of the Mercantile Marine to crew the transfer of small ships from one port to another; this took up about a month of the summer vacations of 1943 and 1944. The remainder of the time and much of the summer vacation of 1942 was taken up in farm camps organized by the National Union of Students to assist with the harvest. He and Hutcheon attended the meetings of a variety of cultural and political student societies. The Socratic Club, founded by C. S. Lewis, discussed the tenets and beliefs of various political, religious and philosophical systems, and in one meeting of the club P. A. P. Moran (FRS 1975), a staff member at the Oxford Institute of Statistics, presented the case of the 'Old Religion', while Stephen opposed him putting the case for the 'New Science'. The two champions of this 'Science versus Religion' debate confronted each other at several meetings of student societies, and this and Stephen's openly expressed left-wing opinions may have antagonized Moran because in 1955, when he was Professor of Statistics at the Australian National University (ANU) in Canberra, he seems to have been unsympathetic to Stephen's application for a post at the ANU.

Stephen found the lectures of N. V. Sidgwick FRS and C. N. (later Sir Cyril) Hinshelwood FRS (PRS 1955–60) to be the most memorable. Both were polymath-generalists, and their approach to their subjects, clearly laid out in their subsequent books, *The chemical elements and their compounds* (Sidgwick 1950) and *The structure of physical chemistry* (Hinshelwood 1951) based on their lecture courses, made a lasting impression. Stephen felt that, in addition to hearing Sidgwick's lectures, some of the latter's influence also came to him through his tutor, D. L. Hammick (FRS 1952), who had himself been tutored by Sidgwick. In particular, he was impressed by Sidgwick's concern with electronic and molecular structure and his use of physical methods to probe these properties; this was to become a central theme in all his later, non-historical research.

At that time there was no fellow in chemistry at Wadham; tutorials were given by Hammick, who had been a fellow of Oriel College since 1921. Hammick was probably as well known for his irreverent attitude to authority as for his chemistry, but he could also make jokes at his own expense. He would relate with relish the story that, when he was on the point of retirement he remarked to his former tutor, Sidgwick, that he would soon have no future in chemistry, to which Sidgwick replied, 'You never did, Hammick, you never did!' During Stephen's final year Hammick set 'The benzidine transformation' as an essay topic, drawing attention to what he considered to be the 'wholly unphysical' mechanism for the reaction proposed by the then Waynflete Professor of Chemistry at Oxford, Sir Robert Robinson PRS. The result was an alternative mechanism for the transformation, which Stephen and Hammick proposed in two joint publications (1, 2)*.

His Part II research with Hammick, sponsored by the Royal Army Medical Corps, was to determine from urine samples whether Italian prisoners of war were taking the antimalarial tablets they were prescribed. The active ingredient of the tablets was based on an acridine derivative, mepracrine, and the products of its degradation were followed down a chromatographic column by their marked fluorescence. All those involved in the research took the tablets and provided urine samples, and Hammick's product was characterized by a unique, bright yellow fluorescence that appeared in no other sample. Hammick attributed this to the

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

high riboflavin content of his favourite beer, which he consumed in considerable quantities every lunchtime at the Lamb and Flag.

Stephen graduated with first-class honours in July 1945 and continued from September 1945 to work under Hammick's guidance for his DPhil, which was awarded in 1947. The research centred on the physicochemical factors influencing the relative biological activity of two diamine homologous series of the acridine and quinoline antimalarial agents. The available biological data covered the relative inhibitory effect of these homologues on the reproduction of the malaria parasite *in vivo* and *in vitro* and on the activity of diamine oxidase, an enzyme system considered to be important for the growth of the parasite. Correlations of these properties with redox potentials, acid–base dissociation constants, relative protein affinities and lipoid partition coefficients led to the proposal that an acridine with a diamino-acid side chain might prove to be an effective antimalarial agent. The synthesis of such acridine derivatives showed on testing that, although the product with an esterified acid group was an active antimalarial agent, the parent acid was not.

Stephen had hoped that on completion of his DPhil he would be able to find a position in the Chemistry Department at Oxford. Unfortunately, his and Hammick's earlier correction of Robinson's mechanism for the benzidine transformation had not endeared him to the latter and he was advised by colleagues that he would be unlikely to obtain any position related to chemistry in Oxford. This was confirmed when Robinson declined to complement his application for a chemistry fellowship at Jesus College with a departmental demonstratorship, and he was obliged to seek pastures new.

Oxford, 1947–53

A growing interest in the history of science at the time of his DPhil research, particularly the early chemical studies of the seventeenth-century 'experimental philosophers' Wilkins, Boyle, Hooke and Mayow, who had strong connections to Wadham College, led Stephen to submit an essay on the history of proto-chemical ideas for a prize junior research fellowship at Magdalen College. The essay was sent for assessment to Sherwood Taylor, the curator of the Museum for the History of Science at Oxford. The result was the offer of a post as departmental demonstrator in the museum to give lectures of general interest on the history of science. Stephen accepted.

The need to prepare lectures on the history of science expanded his historical knowledge and awakened a lifelong interest in the possible links between the scientific revolution, the Protestant reformation and the global geographic discoveries of the sixteenth and seventeenth centuries, and the bearing of these changes on the agricultural and industrial revolutions from the eighteenth century onwards. At that time the active historians of science engaged solely with the history of science itself, for example the Society for the Study of Alchemy and Early Chemistry, and the idea that developments in science as a whole might be linked to socio-political changes in the wider world was new, even revolutionary; Sherwood Taylor issued a clear warning, 'Don't bring politics into this!' (Mayer 1998). Furthermore, the connection also had religious overtones in that it could be argued that Protestants, although not exactly favourable to science, were less obstructive than Catholics. Such opinions and their open expression were capable of arousing strong opposition in conservative circles, and in Stephen's case they did so. In assessing these feelings one has to recall that the years immediately after World

War II were ones of considerable division in public opinion. The Soviet Union was still widely admired for its sacrifices and achievements during the war while being at the same time feared for its expansionist policies and, by some but by no means all, for its militant atheism. Marxism was very attractive to many idealistic young men and women and was widespread in the universities. At this time Stephen was, by his own admission, 'very Left-wing' (Mayer 1998). This was to have consequences.

A condition of the appointment as demonstrator in the museum was that Stephen became secretary to the Society for the Study of Alchemy and Early Chemistry and helped with the administration; he performed these duties from 1948 to 1952. The members of the Society were a rather odd assortment of serious historians of science and others who still had a residual faith in alchemy. Some of the latter even proposed that the secretary should arrange for a kilogram of lead to be irradiated at Harwell and then analysed for traces of gold formed by nuclear fission, because they thought that alchemists might have used such techniques! Stephen declined their suggestion, pointing out that although the conversion of gold to lead in a nuclear reactor might be possible by a series of neutron captures and β-decays, the converse transmutation, of lead into gold, was wholly impracticable.

At the same time, *ca*. 1947, he also joined the newly formed British Society for the History of Science (BSHS) and also, very soon thereafter—immediately it was formed—the British Society for the Philosophy of Science. He remained a member of both until his death. However, in connection with his membership of the latter, it is interesting to note that he never felt quite at home with the philosopher's view. He felt that they dealt with the post-hoc justification, rather than with the origin and basis, of scientific ideas; the process of discovery seemed to him to be important and significant. 'I wanted to find out what actually happened in history, and why it happened. That was the drive, not what justified it logically or otherwise' (Mayer 1998).

Teachers formed a large proportion of the membership of the BSHS; they found the historical aspects valuable in the teaching of their subject, a view very much shared by Stephen. Later, when he returned to mainstream chemistry teaching and research, this approach was part of his method and informed his successful undergraduate lectures in subjects that most chemistry students find difficult, such as quantum mechanics.

The time at the museum, during which he also held the post of college tutor in chemistry at Wadham, was a period during which Stephen developed the broad and comprehensive view of the history of science, culminating in a book (3), *A history of the sciences*; since its first publication in 1953 it has been reprinted 25 times and translated into seven languages. The immediate impact was considerable and the age of the author a cause of astonishment. A well-known philosopher of science at the time, S. Toulmin, remarked in his favourable review of the new book, 'How can a young man under the age of 30, write a history of the sciences?' (Mayer 1998). Apart from its longevity and translation into several languages, the book is fundamentally important in that it was one of the very first surveys of the history of science as a whole, not confined to individual disciplines, and it reflected the left-wing political views that Stephen held at the time. His account of Chinese science, for example, was strongly influenced by Joseph Needham FRS, who shared many of these views. Had he remained an active historian he would surely have updated the book and, perhaps, modified its standpoint and his conclusions in the light of the socio-political developments in the intervening years. However, he did not do so and it was only after his retirement that he took up the very extensive task of revision. Had he been able to complete and publish a revision, the impact of his work might

well have been greater and more permanent. As it is, the work remains a groundbreaking piece of scholarship that encapsulates the man and his world view at that time. Some eight other historical publications were completed during his time at the museum.

In spite of his success as a historian, the thought that a career in the history of science might forever deny him access to a laboratory and experimental science grew increasingly in Stephen's thoughts, and he came to the conclusion that his natural propensities would be best served if he could find an academic post in chemistry and pursue his historical work as a recreation. This decision received impetus from the problems that he was experiencing in seeking to further his career in the history of science. He gained the impression that his political views and atheistic stance had made him unpopular in historical circles at Oxford, and there was also a growing belief among professionals that historians of science should be historians and not scientists.

The change of direction proved difficult; heads of chemistry departments to which he applied for a post frequently thought that he had been away from the bench for too long, and said so. Accordingly, when Adrien Albert, the head of the Department of Medical Chemistry at the ANU, which was based at that time in the Wellcome Institute in London in laboratories adjacent to University College London (UCL), encouraged him to apply for a fellowship there he did so enthusiastically, having long admired Albert's work in physical-organic chemistry and its relationship to the mode of action of pharmaceuticals.

London, 1953–56

Albert believed strongly that the physicochemical properties of a biologically active agent determined its relative toxicity to parasite and host, a view that lay at the heart of Stephen and Hammick's work on antimalarials, and he had successfully shown that the effective antibacterial aminoacridines are the planar members protonated to cationic forms at physiological pH. At the time at which Stephen joined him, Albert had recently equipped his laboratory with a range of new spectroscopic instruments, and the principal objects of his work were the purines (4, 7) and pteridines (5, 6), which had been shown to have interesting antileukaemia properties. Stephen was in charge of the new instruments, and his project was the characterization of simple purines and pteridine model systems with respect to their predominant tautomeric and ionic forms in the solid state and in solution over a range of pH values. When, in 1955, the Wellcome researchers needed the laboratory that Stephen occupied in the institute, accommodation was found for him in the Biochemistry Department of UCL, which brought him into closer contact with the groundbreaking physical-organic and spectroscopic work of the UCL Chemistry Department. These contacts strengthened his resolve to better his understanding of quantum chemistry and molecular spectroscopy, which he furthered through his own initiatives and by attending the first, and later, Oxford Summer Schools in Theoretical Chemistry instituted in 1955 by C. A. Coulson FRS. Albert ruled that the period of absence on the course was to be regarded as part of his annual leave! A particular interest at this time was the interpretation in terms of the molecular orbital theory of the high-resolution, gas-phase electronic spectra of molecules such as pyrazine (10) and *sym*-tetrazine, which had been recorded with the high-resolution spectrograph constructed by G. King in the UCL chemistry department. By analysing the rotational fine structure of the 0–0 origin band in the visible region of the spectrum of *sym*-tetrazine, Stephen was able to show from its polarization that this was an

n–π* transition, as predicted by the molecular orbital theory, and not a π–π* transition as suggested by the valence-bond analysis (8). This work led to a perturbed-carbocyclic model for the analysis of the π–π* electronic transitions of substituted azines (9).

Albert's department was scheduled to relocate to Canberra in 1956, and originally it was planned that Stephen would apply for, and be offered, a permanent post in Australia and move there also. However, various problems relating to his openly expressed political (left-wing) and religious (atheistic) opinions caused delays in arranging the permanent appointment and although the appointment was finally approved, it was not before he had applied for and been appointed to the post of lecturer in physical-organic chemistry at the University of Exeter, which had just received its Royal Charter and was emerging from beneath the protective wing of the University of London.

Exeter, 1956–64

The period at Exeter was an important one. During those eight years Stephen consolidated his particular grasp of the relationship between macroscopic molecular properties and the theoretical description of their electronic structure; by means of successful grant applications he obtained several ultraviolet–visible and infrared spectrometers that when he arrived had been sadly lacking in the department. The arrival of the new instruments also provided an opportunity for Stephen to reveal his wry sense of humour. The newly appointed head of department, H. N. Rydon, thought that the new acquisitions deserved publicity and suggested to the local press that they publish an article about it. They sent a reporter and photographer. When a picture of the splendid new infrared spectrometer appeared in next day's paper it was seen to have a stoneware alembic in a prominent position above the cell compartment. Rydon, a rather peppery man, was not amused, but he never seemed to discover the origin of the unusual accessory although postgraduate students, who had access to Stephen's office, had often seen the alembic there.

More importantly, during the Exeter days Stephen laid the foundations of much of his best and most original subsequent work: the study of chirality, especially through the measurement and interpretation of optical activity in both organic and inorganic molecules. Although the basic origin of the optical activity of chiral molecules was well known, attempts to study the phenomenon were limited to the recording of optical rotatory dispersion (ORD) spectra, whereas the more informative property, circular dichroism (CD)—the differential absorption of left and right circularly polarized light (lcp and rcp respectively)—had rarely been measured, largely because of the experimental problems that such measurements entailed. But a growing interest in CD, notably by W. Moffitt and his students in the USA, caught Stephen's attention, and his initial step was to modify a Hilger & Watts manual ultraviolet–visible spectrometer to enable it to measure CD spectra. The essentials of the modification consisted of the insertion of a polarizing prism and a quarter-wave plate into the lightpath. By rotating the one through 90° relative to the other, rcp or lcp could be obtained; one measured the spectrum twice, once in rcp and again in lcp (11). By modern standards the instrument was not very sensitive and the results were tedious to obtain, but at that time they were almost unique and it was particularly unfortunate for him that very soon after the completion of his instrument a recording CD spectrometer was placed on the market by Jouan. The Jouan CD instrument was not only much simpler to use but also had the advantage that the circularly polarized

light was generated by a Pockels cell, which enabled the circular purity of the emerging light to be maintained throughout the instrument's spectral range. This was not the case with the home-made instrument. Furthermore, in the commercial instrument the differential absorption was measured directly by means of an amplifier locked into the frequency of the Pockels cell; this gave greatly improved sensitivity. Stephen soon raised the money to acquire a Jouan dichrograph. Notable developments at this time were the start of inorganic work (14, 15) with an increased interest in chiral metal complexes and a further involvement in theory (13, 16).

The second half of Stephen's time at Exeter was one of rapid expansion of the university system in the UK, and in 1962–63 he received offers of chairs at three of the new foundations. Impressed by the vigour with which A. R. Katritzky (FRS 1980) was building up the School of Chemical Sciences at East Anglia he accepted the offer from the University of East Anglia (UEA) and moved to Norwich in September 1964.

UEA, Norwich, 1964–70

The period at Norwich was not an especially productive one; administrative and other non-scientific duties proved to be particularly time-consuming. Essentially it was a time of consolidation and further development of research lines already established. During this time the first steps in what later became the ligand polarization theory were made. There was also a brief flirtation, stimulated by Andrew Thomson (FRS 1993), with magnetic CD.

By this time Stephen was at the forefront of establishing the modern, chemical spectroscopic basis of optical activity, particularly when measured as CD, and increasing worldwide recognition of his work attracted many postdoctoral workers and academics on sabbatical leave to Norwich. He championed the physical picture of a spectroscopic transition requiring non-orthogonal electric and magnetic transition dipole moments to interact differentially with lcp and rcp. Invoking, among other things, the Kuhn *g*-factor (dissymmetry factor: $g = (\varepsilon_l - \varepsilon_r)/\varepsilon$, the ratio of the CD to the absorption), the role of CD in characterizing electronic transitions became apparent in studies of the n–π* transitions of ketones and the d–d spectra of Co^{3+} and Ni^{2+}. His exciton coupling model for the determination of absolute stereochemistry had become accepted and is now considered classical by the chiroptical spectroscopy community. The first secure determination of absolute configuration (calycanthine) was achieved, on the basis of the exciton model of its CD spectrum (12). His early reviews are still worth reading. In addition to those of interpretation, the experimental side of the work posed many problems. The Ni^{2+} work required measurements to wavelengths of 1000 nm, the limit of photomultiplier detection. Work at longer wavelengths much reduced the life of Pockels cells because of the high voltage that had to be applied to them; in the far ultraviolet, limiting light throughput was a serious factor. Later these problems would be largely solved by the introduction of the photoelastic modulator. The consolidation of the exciton coupling model and the extension of the spectroscopic range of CD measurement were central to Stephen's scientific research over the next few years.

But at UEA Stephen was Professor of Inorganic and Theoretical Chemistry, a position that he felt did not accord well with his polymathematical inclinations, and by 1968 the need to move on to a department with no formal subject divisions in an older university became important to him. He was appointed to a chair of chemistry at King's College, London (KCL), in late 1969.

KCL, 1970–88

He arrived at KCL in 1970 with three PhD students and three postdoctoral fellows; Stephen always maintained that a group of approximately six was large enough. The postdoctoral fellows included Robert Peacock, who introduced Stephen to lanthanide chemistry, and Alex Drake, who was in large measure responsible for the subsequent spectrometer developments. Reiko Kuroda, an inorganic crystallographer, joined the group in 1973, having taken her PhD with Saito, the first person to determine the absolute configuration of a metal complex ($Co(en)_3$), in 1953. Drake, Peacock and Kuroda worked with Stephen for more than 10 years and provided important continuity.

In the early 1970s the exciton model (18) was explored more deeply, particularly as computational aids became more readily available. At UEA, Stephen had read Weigang's papers on the origin of optical activity and was much taken with the role of polarizability, which he subsequently developed into the ligand polarization model (21–23). This development provided the basis of regional rules for the CD of chiral coordination compounds (19, 20) and an explanation of a number of anomalies in the spectra of metal complex spectra. The latter was particularly the work of George Tranter, who in the first year of his doctoral studies successfully analysed the ligand-polarization contributions to the intensities of f–f allowed electric 2^n-pole transition moments ($n = 2, 4, 6$) showing that the polarization contribution is dominant for $n = 2$, whereas the crystal-field terms predominate for $n = 6$ (28). The contributions from the two sources are approximately equal for $n = 4$. Polarizability models were also applied to the interpretation of the CD of organic molecules and vibrational CD (VCD).

In the mid 1970s the Mason exciton model of CD was challenged by two young Japanese crystallographers who claimed that there was a sign error in the Bijvoet methodology for analysing X-ray crystallography data. Stephen rose to the challenge and invoked a dipole velocity as opposed to dipole length formalism to describe electronic transition dipole moments; a subsequent reworking of the crystallography algebra showed a double sign error. Stephen's earlier assignments were therefore confirmed and there was a collective sigh of relief with the knowledge that (−)-alanine was still *S*-configuration. A subsequent crystal structure of calycanthine confirmed the CD-based assignment of the absolute configuration of that molecule (12). However, it should be noted that not all the absolute configurations determined by the coupled-oscillator method have been confirmed by later work. An early determination of Tröger's base (17) was not substantiated in a VCD plus *ab initio* study by Aamouche *et al*. (2000), who attributed the problem to the inadequacies of the coupled-oscillator model.

By the late 1970s, developments in computers were leading to great advances in the *ab initio* quantum mechanical calculations. Stephen was never a great devotee of these. Even if they produced the correct answer, in his view they did not provide sufficient insight into the underlying processes and principles. This was certainly true in the early days, and the use of *ab initio* calculations to characterize the excited electronic states of large (real) molecules remains a challenge.

Meanwhile, instrumental developments continued. Initially, the infrared measurements were rather insensitive and only very large *g*-factors could be detected; an example was the CD of cholesteric liquid crystal solvents, which eventually turned out to be a special form of linear dichroism rather than optical activity. By 1976 the photoelastic modulator (PEM) had become commercially available. Unlike the Pockels cell, the PEM was robust and could be easily tuned to provide linearly or circularly polarized light covering the spectral range 170 nm

in the far ultraviolet to 10 000 nm (1000 cm^{-1}) in the infrared. This, coupled with technological developments in electronics, detectors and computers, stimulated a revolution in linear dichroism and CD measurement. In the ultraviolet, linear dichroism measurements of small molecules aligned in liquid crystals and polymer films were used to assign transition polarizations. Far-ultraviolet CD allowed the characterization of the Rydberg and valence transitions of unsaturated organic compounds. The world-leading Chirascan instrument (http://www.photophysics.com) is a tangible outcome of this work.

Infrared CD at KCL was limited to 5000 nm (2000 cm^{-1}) by the dispersive, as opposed to interferometric, methods adopted. Nevertheless, measurements of the near-infrared CD of metal complexes, the Fano resonance between molecular vibrations and isoenergetic d–d electronic transitions and the VCD of the N–H, O–H and C–H fundamental vibrations were made (24, 25). The objective of the last was to use the spectra, in conjunction with a vibrational dynamic coupling theory, to determine absolute configurations; however, they proved very difficult to interpret. Fourier transform measurements of VCD were never attempted at KCL.

Instruments were also built to monitor CD in fluorescence and as an online monitor of optical resolution during enantioselective chromatography (26).

The thalidomide crisis of the mid 1970s stimulated increased regulation of pharmaceutical products. In the 1960s, the racemic form of thalidomide was administered to patients; later, it was shown that teratogenicity lay in the *S*-enantiomer, although both enantiomers racemize *in vivo*. This sparked a worldwide interest in enantioselective analysis and the study of enantiomeric purity and distribution; chiral stationary and mobile phases became the norm for chromatography. This rekindled Stephen's interest in chirality *per se* and his high regard for Pasteur. The remarkable chiral discrimination found in biology was a topic that Stephen took particularly to heart and surveyed in detail in *Molecular optical activity and the chiral discriminations* (27). It also led to his final major scientific research topic, the role of weak nuclear force as the reason for the predominance of L-amino acids and D-sugars in the biochemistry of all known living organisms. His principal collaborator in this endeavour was his PhD student and later postdoctoral fellow, George Tranter. By basing their approach on earlier work by physicists who had shown how the electroweak interaction could be introduced into molecular orbital theory, programs for the *ab initio* calculation of molecular energies using a basis of Gaussian orbitals were modified to include the electroweak force. The resulting calculations (29–31) showed that the L-amino acids and the L-polypeptides are intrinsically more stable, to a minor degree, than the corresponding D-isomers. Analogous calculations showed subsequently that the D-sugars are similarly favoured energetically over the corresponding L-enantiomers.

During his time at KCL, apart from teaching chemistry, Stephen was also active in creating opportunities for students to take courses related to his other great interests, the history and philosophy of science. A joint honours degree in chemistry (taught at KCL) and the history and philosophy of science (taught at the London School of Economics) was started in 1974 but ended when he retired in 1988, as did his course for chemistry students on the growth of chemical science and industry. He also contributed annually to a historical course, 'The making of modern science', for students of theology.

In the early 1980s the Leverhulme Trust provided funding for a PhD studentship to help in archiving the rich KCL history in chemistry.

Cambridge, 1988–2007

On his retirement in 1988, Stephen and his wife Joan moved to Cambridge, where in the years 1988–90 he worked on his book *Chemical evolution: origins of the elements, molecules and living systems*, supported by a Leverhulme Emeritus Fellowship.

Thereafter he took up again the historical work set to one side in 1953, his particular aim at this time being to rewrite completely his 1953 *History of the sciences*. On being asked shortly before his death how that project was progressing he replied that he 'had got about as far as Newton' (Professor N. Sheppard FRS, personal communication 2007), which is where it remains. In view of the significance and wide acceptance of the earlier work, an account in Stephen's style 'as far as Newton' would be an excellent addition to any library, and it is to be hoped that a way can be found of getting it published.

Marriage and family

After an unsuitable early marriage Stephen met Dr Joan Banus, a Cambridge Natural Sciences (chemistry) graduate in late 1953 while she was working at UCL and he at the ANU. She had asked for permission to use one of the new spectrometers in the ANU laboratory to measure the infrared spectra of some of the compounds she had been synthesizing. Professor Albert agreed that she might use the instrument under the supervision of his new research fellow, Dr Stephen Mason. This first meeting led, in due course, to an arrangement whereby Stephen, who had planned a holiday touring Italy alone in his new Morris Minor, would give Joan a lift as far as Milan, where she had friends. However, when they reached Milan the friends were not in town and the two decided to make the tour of Italy a joint venture by the end of which they had decided to marry, which they did in 1955. They were extremely well matched and were the quietly proud parents of three sons, Oliver Neil (1957), Andrew Lawrence (1959) and Lionel Jeremy (1960), who have pursued very successful careers in engineering and computer technology, medicine, and mathematics respectively. They had eight grandchildren.

Apart from her considerable achievements in chemistry teaching and research (she held a readership at the Open University for many years and was particularly active in the field of multinuclear NMR), Joan was a founding member of AWiSE (Association of Women in Science and Engineering) and was chair of the organization until her death. Throughout her married life, and especially in retirement, she was a passionate advocate for the cause of women in the professions and was awarded an MBE for her work in that field. Stephen was devastated by her untimely death in March 2004.

The Masons's was always a very welcoming home, and they regularly invited final-year undergraduates and members of Stephen's research group to supper. When serving her excellent meals Joan showed her practical side. On one occasion when long ribbons of pasta proved problematic she simply produced a large pair of scissors and sliced through the recalcitrant strands. At UEA, where in the early years it was the practice of the three professors each to entertain the whole chemistry undergraduate body, the Masons decided to do this in three tranches on consecutive nights. This found its way into the national press, leading to tabloid headlines such as 'Prof. hosts three-day orgy'. Applications to read chemistry at UEA received a considerable boost!

The Masons's house in London was renowned for its well-stocked back garden and extensive library. A social event of the year was the annual Christmas party at home for Stephen's and Joan's research groups and selected guests. Joan was the cook, and Stephen the waiter. Joan's syllabub was always a feature. At the 1979 party Stephen was surprised by being presented with his team's first VCD spectrum, covering the C–H stretching vibrations of camphor.

In February 2007 Stephen was diagnosed with an incurable, malignant growth in his gullet. He bore this distressing condition with resignation and great fortitude until his death in December.

Awards and honours

1941	Open scholarship, Wadham College, Oxford
1972	Nuffield Lecturer, University of British Columbia, Vancouver
1980	Visiting Research Fellow of the Japan Society for the Promotion of Science
1982	Elected Fellow of the Royal Society
1983	Weldon Spring Visiting Scholar, University of Missouri, St Louis
1983	Visiting Research Fellow of the Italian Chemical Society
1988–90	Leverhulme Emeritus Fellow, Department of the History and Philosophy of Science, Cambridge
1988–90	Extraordinary Fellow of Wolfson College, Cambridge
1991	Wilkins Lecturer of the Royal Society
1991	Piero Pino Gold Medal of the Italian Chemical Society

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The frontispiece photograph was taken in 1982 by Godfrey Argent and is reproduced with permission.

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