RICHARD NEWLAND DIXON
25 December 1930 — 25 May 2021
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Elected FRS 1986

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Richard Newland Dixon began his independent scientific career as a molecular spectroscopist in Sheffield, where he demonstrated new ways to measure, analyse and interpret the electronic spectra of small gas phase species. He later moved to the chair of theoretical chemistry at the University of Bristol, where he embraced new experimental methods, particularly techniques enabled by continuous wave and pulsed lasers, and honed his theoretical skills in angular momentum algebra and time-dependent quantum mechanics. This blend of experimental and theoretical expertise allowed him to make pioneering contributions in the field of gas phase molecular photodissociation dynamics. Richard will be remembered as a polite and modest man, and a very sharp scientist. Among his many lasting scientific achievements, he will be remembered for developing strategies for determining state-resolved correlations between the vectorial properties of the products of molecular photofragmentation processes, and for being one of the first to recognize the near ubiquitous importance of non-adiabatic couplings between potential energy surfaces in rationalizing the dynamics of such dissociations.

EARLY YEARS

Richard Dixon was born in Borough Green, Kent, on Christmas Day 1930. His parents, Robert Thomas Dixon (1906–1985) and Lilian Dixon (née Newland, 1904–1973), were both school teachers. Richard was the eldest of their five children and their only son; the children’s paternal grandfather (Richard Dixon, 1860–1953) was a hereditary freeman of the City of Dover.

Richard attended the local infant and junior schools in Borough Green, then won an entrance scholarship to the Judd School in Tonbridge, where he was a pupil throughout the period 1941–1948. He was well placed to witness moments of the Battle of Britain, but I

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only know of two of his wartime experiences, both of which involved explosions. In one, an aircraft collided with a local barrage balloon at night and crashed near the family home. The ensuing explosion brought down the ceiling onto the bed in which Richard was sleeping, but the debris was held up by the iron headboard and Richard was spared serious harm. For the other, many children at that time had chemistry sets, and ‘interesting’ chemicals were much more easily sourced than is the case nowadays. Richard was no exception, and one of his escapades involving home-made explosives and a dustbin lid resulted in a rather loud bang and a small crater in the road. Memories of this incident lived on mainly because Richard’s father was a member of the Home Guard charged with locating the source of the explosion.

Borough Green and Tonbridge are almost 10 miles apart and, for all but the first few months, ‘going to school’ involved cycling there and back every day. Fortunately, Richard was an enthusiastic cyclist and happy to use this mode of transport, not just to get to and from school but also to explore much of Kent—and beyond—with friends and family during vacations. He was a diligent and successful pupil, recognized by the receipt of several school prizes and appointment as deputy head boy. This was the time that his enthusiasm for science came to the fore: he took Higher School Certificates in both pure and applied mathematics, in physics and in chemistry, and was always keen to stress the influence of (and encouragement provided by) his teachers in these subjects. As noted above, Richard supplemented school science with home-based experiments, not just in chemistry, but also constructing radio sets and playing with photography and the processing of photographs. He also made time for non-scientific pursuits. He represented the Judd School at rugby (second XV), excelled at cross-country running (a stamina-sapping activity honed by all the cycling?) and was a member of a school choir and of a Borough Green church choir. During vacations, he worked for a local builder, thereby gaining more carpentry and woodworking skills and a head for heights from roofing work.

Richard entered his third year of sixth form in September 1948 with the intention of taking the entrance examination for natural sciences at Emmanuel College, Cambridge, but then learned that he had been awarded a state scholarship and could choose between offers of places to read physics at King’s College London, or chemistry at University College London. Either choice would mean deferment of National Service, which was obligatory at the time. Richard chose the former—a decision that had a significant role in defining his future life. As at the Judd School, Richard was an outstanding student and duly graduated with a first class BSc (honours) degree in physics in the summer of 1951. The course included much advanced mathematics and courses in quantum theory taught by Charles Coulson (FRS 1950), all of which proved invaluable in his later career. But the biggest formative influence during his time at King’s College London was William Charles (Bill) Price (FRS 1959), who had recently joined the physics department from the Department of Physical Chemistry in Cambridge and who inspired Richard to become a chemical spectroscopist. Again, Richard managed to balance success in his academic studies with significant extra-curricular activities, most notably rowing—for which he gained full colours (for two years) as a member of the King’s College First Boat, winning events at several regattas.

Bill Price pointed Richard in the direction of Norman Sheppard (FRS 1967) at Cambridge, under whose supervision Richard undertook PhD research while a student at St Catharine’s College. His research centred around a high-resolution infrared (IR) spectrometer built by a predecessor in the group, but within a few months of starting his research all the optical elements and the electronics in this spectrometer were severely damaged by a flood emanating
from a laboratory on a higher floor of the building. Richard had to rebuild the instrument from scratch—a steep learning experience, intensely frustrating at the time, but educational in the longer run. The target systems were small polyatomic molecules. The largest was boron trimethyl, B(CH$_3$)$_3$, the IR spectrum of which was investigated in collaboration with L. A. Woodward at Oxford (who had recorded its Raman spectrum) (3)*. The most challenging molecule was silyl iodide, SiH$_3$I, for which analysis of the measured spectra required Richard to go beyond the theory then available in standard textbooks (2). And, lest one forgets, the ‘analysis’ methods available at that time were all based on graphical reductions and mechanical calculators—a very far cry from modern computational analysis methods. These studies formed the basis of Richard’s thesis, entitled ‘High resolution infrared spectroscopy’, which led to the award of his PhD in 1955 (1).

Beyond the lab, Richard remained committed to rowing and was captain of boats for St Catharine’s College for the year 1952–1953. But this was the time for another key event in Richard’s life: meeting Alison Mary Birks at a dance in the autumn of 1951. Alison was a mathematics undergraduate at Newnham College, the younger daughter of Gilbert Arnold Birks (1897–1966), schoolmaster, and Millicent Mary Birks (née Painter, 1907–1997). Gilbert Birks published several papers on philosophy, and was a Unitarian lay preacher and the son and grandson of Unitarian ministers. Romance blossomed, and Richard and Alison duly married in Leeds in September 1954 (figure 1). Their marriage was subsequently blessed with three children, Paul (1959, MA (Cantab.), PhD (London), now a biomedical engineer), Joan (1961, BA (Sheffield Hallam), now an IT project manager) and Sheila (1962, BSc (Reading), now a statistician with the Department of Health and Social Care). Alison provided unstinting encouragement and support throughout Richard’s career and beyond, most especially in the challenging last few years of his life.

Upon leaving Cambridge, Richard’s deferment of National Service lapsed, thus requiring that he either spent time in the armed forces or took a reserved occupation until his twenty-sixth birthday. Richard chose the latter, before embarking on further academic activities. Thus it was that Richard and Alison started married life in Reading, acquired their first car (a baby Austin dating from 1929) and began a two-year spell at the Atomic Weapons Research Establishment, Aldermaston. Richard was an analytical chemist, in his own words ‘devising and implementing spectroscopic based quality control methods for materials of strategic interest’, while Alison worked as a mathematical programmer. Richard’s interest in (and the time he committed to) woodworking grew while in Reading, and Alison persuaded a friend to teach her chess to help pass the times when Richard was otherwise engrossed!

**Canada, 1956–1959**

In late 1956, Richard and Alison boarded the *Queen Mary* in Southampton, bound for New York. The trans-Atlantic crossing was memorable for an unscheduled course diversion to allow the transfer of a poorly crewman from a passing freighter by breeches buoy. Once through immigration in New York (a stressful experience), they travelled on to London, Ontario, by train. The three years Richard spent as a postdoctoral researcher in Canada, first with Ralph Nicholls at the University of Western Ontario, and then in the group at the

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* Numbers in this form refer to the bibliography at the end of the text.
National Research Council (NRC) in Ottawa led by Gerhard Herzberg FRS (Nobel Laureate 1971), laid the foundations for his career in electronic spectroscopy and the study of free radicals and photochemistry. Alison also found gainful employment in Canada, first working in the actuarial department of London Life Insurance, then with Computing Devices Canada—where she enjoyed being able to claim Richard as a dependent when claiming tax relief on her income!

The NRC in Ottawa was a Mecca for aspiring spectroscopists at that time; the postdoctoral fellows held weekly meetings/seminars and studied together the advanced quantum mechanics
necessary for advancing the research field. These experiences sparked Richard’s interest in developing new theories to interpret new experiments and new experimental data, which were a feature of much of his subsequent research. One scientific highlight from his time at NRC was the first detailed analyses of spectra of a linear polyatomic system, the NCO radical, subject to the effects of vibronic interaction (the Renner–Teller effect) (4). This effect arises in the spectra of molecules with electronic states for which vibrational (bending) motion can carry the system through linear geometries. Any electronic states in such molecules that are doubly degenerate at linear geometries (e.g. $\Pi$, $\Delta$ states) must split into two near-lying but non-degenerate states upon bending away from linearity, and the individual rovibronic levels associated with these pairs of states will be coupled by the rotational kinetic energy operator. This manifests as a breakdown of the Born–Oppenheimer approximation and can greatly complicate spectra relative to those predicted using any zero-order picture that neglects coupling of the nuclear and electronic motions.

This time in Canada also provided many opportunities for Richard and Alison to travel and to start exploring parts of North America. They drove to Yellowstone National Park in summer 1957, visiting the Tetons and the Badlands on the way back, with Richard learning to water-ski in Minocqua, Illinois. Subsequent trips allowed them to sample the Maritime provinces, to travel south to Williamsburg and Washington, and to visit relatives of Alison’s in New England.

Life was moving on, however. Richard interviewed successfully for a job at the University of Sheffield in early 1959—the interview was conducted in Ottawa by a passing representative of George Porter, the then professor of physical chemistry at Sheffield (FRS 1960, Nobel Laureate 1967, PRS 1985)—and Paul was born a couple of months later. It was time to say goodbye to Canada and for them (now three in number) to start the journey from Quebec back to the UK.

**Sheffield, 1959–1969**

Richard was initially appointed as an ICI fellow in chemistry at the University of Sheffield. This appointment translated into a lectureship the following year and a Sorby research fellowship of the Royal Society* during the period 1964–1969. The earlier recruitment of George Porter (in 1955) to the newly established chair of physical chemistry had helped to ensure that Sheffield was then one of the most attractive and exciting host institutions for aspiring physical and theoretical chemists. Other appointees around that time included John Murrell (FRS 1991), Neil Atherton and Brian Brocklehurst. Upon arrival, Richard set about designing and constructing a 21-ft Eagle-mounted diffraction grating spectrograph, which could be coupled to a flash-photolysis source of free radicals. This spectrograph not just served as the work-horse for the research of his own postgraduates but was also used (under Richard’s watchful guidance and direction) by various Porter-group members. Building on his Ottawa experiences, Richard extended the theory of vibronic interaction

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* Henry Clifton Sorby (1826–1908, FRS 1857), born into an old Sheffield family, devoted his life to scientific research and enhancing opportunities for education. He was president of Firth College (1882–1897), vice-president of the new University College in Sheffield (1897–1905) and, following the inauguration of the University of Sheffield in 1905, served as a member of its council until the time of his death.
to molecules undergoing large amplitude motion, thereby proving that the amino NH$_2$ radical is non-linear in its first excited state and accounting for its strikingly irregular fine structure (8). Analysis of the spectra of other systems exhibiting the Renner–Teller effect included the triatomic species NCS, PH$_2$, AsH$_2$ and SiH$_2$. Richard’s analyses of the latter spectra afforded a detailed explanation of the striking reversal of anharmonicity within the manifolds of bending vibrational levels in these dihydrides (the minimum in a plot of bending energy level separation versus vibrational quantum number is sometimes termed the ‘Dixon-dip’) (7).

The much-enhanced dispersive power of the 21-ft spectrograph also enabled ‘known’ spectra to be recorded at much higher resolution and, consequently, analysed with greater certainty and precision. One such study involved the CBr radical, the low-resolution spectrum of which had been obtained previously in the group of John Simons (FRS 1989) at the University of Birmingham. Richard’s high-resolution study confirmed the symmetry ($^2\Delta$) of the excited electronic state responsible for the absorption band at ca 300 nm and, by recognizing the relative diffuseness of spectral features associated with the upper spin–orbit component of this state, established an upper bound for the C–F bond strength in the ground state of the radical (5). Arguably the most significant feature of this study, however, was the identity of the PhD student involved in the work: Harry Kroto (FRS 1990). In Kroto’s own words (Kroto2022), at the end of his PhD, Richard ‘inveigled an attractive offer of a postdoctoral position for me from Don Ramsay (FRS 1978) at the National Research Council in Ottawa’, which paved the way for Kroto’s independent career at Sussex, his later collaborations with Rice University in Houston and his eventual receipt of the Nobel Prize for chemistry (together with Rick Smalley and Robert Curl) in 1996 for ‘the discovery of fullerenes’.

Richard also devised sources of two complex emission spectra prevalent in flames that had long resisted analysis: the so-called ‘carbon monoxide flame bands’ and the ‘hydrocarbon flame bands’ (6). In both cases, the new sources permitted the first high-resolution recordings of the relevant spectra. Richard succeeded in assigning the former bands, with the aid of extensive model calculations, to the carbon dioxide (CO$_2$) molecule—specifically, to transitions from a strongly bent excited state to high levels of the linear ground state that were subject to extensive anharmonic perturbations (6). The carrier of the latter bands was identified as the HCO radical, undergoing transitions from a bent excited electronic state to a broad range of vibrational levels of its ground state (10).

Richard’s decade at Sheffield was not solely devoted to laboratory spectroscopy and associated theory. He found time to write an acclaimed textbook, *Spectroscopy and structure* (9), first published in 1965 (second edition 1972, Spanish edition 1967) (figure 2). Richard and Alison bought their first family home and (re)discovered the joys of home maintenance and gardening. Joan and then Sheila were born, and the growing family moved to a larger house. Alison had the opportunity to teach maths to sixth formers at Abbeydale Girls Grammar School, and then statistics at (what was then) Sheffield Polytechnic. Sailing was a major weekend pastime. Richard and Shirley Murrell, John Murrell’s wife, were both in demand as crew members when George Porter entered his Enterprise class dinghy in various races at the Dukeries. Richard was grateful that his reputation was not tarnished by the occasion when over-exuberance on his part led to the dinghy capsizing and George Porter being tipped into the lake.
Richard’s scientific achievements were becoming ever more widely recognized. In 1966 he was awarded the Corday–Morgan Medal and Prize of the then Chemical Society—now the Royal Society of Chemistry (RSC)—and in early 1969 he interviewed successfully for the then recently established chair of theoretical chemistry at the University of Bristol.

**BRISTOL 1969–1996 AND BEYOND**

The Dixon family moved to a large, detached house in Coombe Dingle, some four miles northwest of the University of Bristol, in summer 1969. Essential components of the 21-ft spectrograph also moved to Bristol, but narrow-bandwidth laser sources were also starting to become more readily available. Richard’s arrival posed a challenge. The newly appointed professor of theoretical chemistry needed laboratory space, preferably with a stable and rigid floor capable of supporting high-resolution laser spectroscopy experiments. Gordon Stone (FRS 1976), the then professor of inorganic chemistry at Bristol, long maintained that Richard had ‘got’ the job under false pretences. As a theoretical chemist, he would surely only need pen and paper! Nonetheless, space was found, in the extreme basement of the department, and refashioned to be fit for purpose. Access was via an external fire exit (normally locked, but essential when it came to installing lasers with heavy power supplies) or, for everyday use, via a steep open-tread metal staircase.
Two early appointments helped Richard to establish Bristol’s reputation as a centre for molecular spectroscopy and photophysics. One was Keith Rosser, who provided first-class technical support for the experimental activities of Richard’s group (and, in due course, the groups of later appointees). The second was Geoffrey Duxbury, who had undertaken PhD research with Richard in Sheffield and then won a junior research fellowship at the National Physical Laboratory. Graham Fleming (FRS 1994) undertook his final year undergraduate project with Geoff and Richard before starting PhD studies with George Porter (by now at the Royal Institution). Richard used high-resolution tuneable visible lasers to record not just the rovibronic structure within the electronic spectra of small gas phase species, but also fine structures such as hyperfine splittings (in NH$_2$), Stark splittings (in H$_2$CS, HNO and HCF) and Zeeman splittings (in H$_2$CS)—all of which, after thorough analysis, provided many new insights into the respective electronic states and structures. The HNO radical (and its isotopologue DNO)—the spectra of which show clear evidence of Renner–Teller coupling—was a particular favourite. Many series of spectra for this radical were recorded, leading to an unusually full and detailed knowledge of the excited states and the thermochemistry of the radical (15). Tuneable lasers were also used to study state-to-state changes in inelastic collisions involving NH$_2$, HNO and CH radicals, and the theory developed to interpret these observed state changes applied to the spectra of interstellar OH and CH maser sources (11).

Geoff Duxbury accepted a senior lectureship in physics at the University of Strathclyde in late 1980 and Richard succeeded in persuading Bristol to fund a junior replacement position. Here I must declare a personal interest: I interviewed successfully for this vacancy, thereby starting my independent research career in autumn 1981 and triggering a series of collaborative endeavours that challenged and rewarded us both for the next three decades. My appointment boosted Richard’s interest in molecular photodissociation processes—processes wherein photon absorption not just promotes the species of interest to a higher excited state but also induces chemical change (bond breaking). My first experiments were designed to explore the photophysics of high-lying (Rydberg) electronic states of small polyatomic molecules by observing resonance enhancements in their multiphoton ionization (MPI) spectra. Many of the initial systems chosen for study were light hydrides like water vapour (H$_2$O), hydrogen sulfide (H$_2$S) ammonia (NH$_3$), etc.—molecules that had been investigated previously by one-photon absorption spectroscopy (and at much lower spectral resolution) by Richard’s early mentor, Bill Price. The resonance-enhanced MPI spectra displayed resolvable rotational structure. Richard was uniquely placed to develop the necessary multiphoton linestrength theory required to interpret these spectra in detail. Since the final photon-driven ionization step occurs in competition with any non-radiative decay from the resonance-enhancing excited state of interest, systematic deviations between observed and predicted line intensities provided many new insights into the importance of Coriolis (i.e. rotationally induced) coupling in the predissociation of such molecules (12, 13).

A period of sabbatical leave in the autumn of 1982 and early 1983 with Dick Zare (ForMemRS 1999) at Stanford University further stimulated Richard’s interests in molecular photodissociation (figure 3). It also provided an opportunity for Alison, Joan and Sheila to make a ‘road trip’ from New Orleans via the Grand Canyon and Los Angeles before joining up with Richard in Stanford, and for the whole family to later visit Yosemite and Death Valley. While at Stanford, Richard used Doppler and polarized laser excitation spectroscopy methods to determine the translational energy, angular, rotational alignment and internal state distributions (i.e. vibration, rotation, spin–orbit and $\Lambda$-doubling components)
of the nascent OH products formed in the near-ultraviolet (UV) photodissociation of nitrous acid, HONO (14). John Simons (then at Nottingham) was developing a similar approach at the time, and Richard and he collaborated on similarly detailed characterizations of the electronically excited OH(OD) fragments from photolysis of H$_2$O(D$_2$O) (16). Richard then showed, using a time-dependent theory, how Renner–Teller coupling can have dynamic consequences for excited states (of, for example, H$_2$O) that are subject to predissociation (17). Building on ideas that emerged during his sabbatical period, Richard also developed a separate theory concerning the determination of state-resolved vector correlations in the products of photodissociation. This ‘Dixon bipolar moment formalism’ (18) has found very widespread application within the photofragmentation dynamics community and was subsequently extended by others to treat stereochemical aspects of bimolecular collisions.

This was a particularly exciting period for the gas phase reaction dynamics community, within which Richard quickly became recognized as a substantial international player. His achievements were recognized by election to the Fellowship of the Royal Society in 1986. He was increasingly in demand as an invited/keynote speaker in key molecular dynamics conferences (figure 4) and chaired the Faraday Discussion 82, held in Bristol in 1986, on the topic of molecular photofragmentation dynamics. This discussion was notable in many regards: at a personal level, Richard was delighted that his PhD supervisor, Norman Sheppard,
was presiding, in his capacity as president of the Faraday Division of the RSC. Scientifically, the discussion provided the first illustration of the power of the H atom photofragment translational spectroscopy (PTS) method pioneered in Karl Welge’s group in Bielefeld, and a suitably conducive atmosphere for two of the participants—Dave Chandler (Sandia) and Paul Houston (Cornell)—to come up with the concept of photofragment ion imaging, which they successfully demonstrated the following year (Chandler & Houston 1987; Chandler et al. 2017). Paul Houston later contacted Richard seeking his help in rationalizing the (at the time) very surprising observation of a parallel distribution of H atom recoil velocities following photodissociation of formyl, HCO, radicals when excited via the (perpendicular) visible band system. Again, Richard was able to show that this was an inevitable dynamical consequence of Renner–Teller coupling (19).

I spent the summers of 1985 and 1987 working in Welge’s group in Bielefeld, observing and assisting with the development of the H atom PTS technique, and later established a similar capability in Bristol. The resolution achievable with the ‘Rydberg tagging’ variant of this method meant that the kinetic energy distribution of the H atoms arising...
in the photodissociation of any hydride (XH) molecule carried a detailed fingerprint of the population distribution within the internal energy states of the X partner fragment. These distributions are determined by the dynamics of the fragmentation process, and their determination and analysis provide exquisite insights into the forces acting on the constituent nuclei during the fragmentation process (i.e. on the topography of the potential energy surfaces on which the dissociation occurs). Such experiments yielded a wealth of new information and resulted in joint publications reporting unprecedented insights into the primary photochemistry of many prototypical hydride molecules, including methane (CH₄), H₂O, H₂S and NH₃ (20) in the period up to Richard’s official retirement in 1996 (figure 5).

Twenty-seven postgraduate students received higher degrees for research carried out under Richard’s direct supervision, and numerous others—in Bristol and beyond—benefitted hugely from being able to work with and learn from him. The continuing excellence of Richard’s scientific achievements was recognized by the Liversidge Award from the RSC in 1993/4.

In addition to his research and his undergraduate teaching commitments, Richard carried major administrative responsibilities during his time in Bristol. He was head of the Department of Theoretical Chemistry throughout 1969 to 1989, at the end of which period (in no small measure through his efforts) the separate departments were disbanded to form a single School of Chemistry. He held the Alfred Capper Pass chair of chemistry from 1989 up to the time of his retirement. He served as dean of the Faculty of Science (1979–1982) and as pro-vice-chancellor of the university (1989–1992), during which time the University Senate accepted his proposals for radical revisions of its composition and of the procedures for considering academic staff promotion. He was also heavily involved in devising an objective scheme for apportioning the academic budget among departments, and enjoyed and learned much from chairing committees of the medical faculty, the computing service, the university library and

Figure 5. Richard with Keith Rosser (left) in one of the laser laboratories in Bristol at the time of his ‘retirement’ in September 1996. Photograph by the author. (Online version in colour.)
the university administration. He was also in demand externally, serving on (and chairing) committees of, for example, the Science and Engineering Research Council, the Institute of Physics, the European Physical Society and the CNRS (France). Alison was a steadfast source of support and encouragement throughout these busy times, juggling family life (particularly in the earlier years) with work as a maths teacher at St Ursula’s School.

‘Retirement’ allowed Richard to shed most of his remaining university responsibilities and devote more time to research, although he was delighted to accept an invitation to chair the University Alumni Foundation. He also maintained external roles such as chair of the board of the Bristol Institute of Child Health (1992–2002) and non-executive director and vice-chair of the United Bristol Healthcare NHS Trust (1994–2003), both of which positions followed from his demonstrable success chairing committees within the medical faculty during his time as pro-vice-chancellor. As emeritus professor and a senior research fellow of the University of Bristol, he continued to work very closely with my students, bringing depth and rigour to interpretations of the photodissociation dynamics of molecules like hydrogen cyanide (HCN), formaldehyde (H₂CO) and a range of small heteroatom-containing aromatic molecules such as pyrroles, phenols and thiophenols (22, 23). The group of Xueming Yang, at the Dalian Institute of Chemical Physics in China, had established a similar H atom PTS experiment that allowed investigations of molecular photofragmentations induced by much shorter wavelength, vacuum-UV radiation, and obtained spectacularly detailed kinetic energy distributions for the H atoms formed when photolysing jet-cooled H₂O molecules at the H Lyman-α wavelength (the key wavelength for most photochemistry driven by the interstellar radiation field). Data of this quality demanded similarly high-level interpretation, which Richard was uniquely equipped to provide. His analysis demonstrated that the OH product state population distributions are strongly influenced by quantum interference between two dissociation pathways, involving non-adiabatic coupling between potential energy surfaces at linear H...OH and H...HO configurations—a chemical analogue of Young’s double slit experiment in optics (21, 24). In 2004, Richard was awarded the Rumford Medal of the Royal Society in recognition of ‘his many contributions to molecular spectroscopy and to the dynamics of molecular photodissociation’. He continued to publish original research and to attend scientific conferences until well into his ninth decade (figure 6).

Walking had long been a favoured pastime for both Richard and Alison, particularly in mountains and in wild places. Several family holidays when the children were young were shared with the family of John Murrell—a practice that the parents continued long after their children had left home; but Alison and Richard also undertook many more ambitious walking ‘holidays’, including trekking in Peru, the Himalayas, Kenya, Patagonia, Australia and New Zealand (figure 7). Richard’s retirement allowed more opportunities for travel, both for pleasure and professionally, and his collaboration with the group in Dalian enabled him and Alison to revisit China in 1999. Richard and Alison maintained fitness and friendships via the University Senior Common Room walking group, participating in (and leading) numerous walks, and were still enjoying walking holidays well into their eighties.

**Concluding remarks**

I conclude by reproducing a few very apposite words from a congratulatory note that John Simons (my PhD supervisor) sent me at the time I was appointed at University of Bristol in
1981, John wrote ‘I think you will find him [Richard] a most kindly and inspiring chap to work with’ and went on to describe him as ‘an effortless theoretician’. Some 40 years later, I (and many others) can fully confirm the first of these statements. As for the latter description, Richard certainly made original, significant and enduring contributions in several areas of molecular spectroscopy and reaction dynamics, but, having shared a corridor with him in the
early 1980s and watched him agonize for well over a week about a missing factor of $-1$ in a part of the angular momentum algebra that underpinned his formalism for determining state-resolved vector correlations in the products of a molecular photodissociation process, I can attest that these achievements were often very far from ‘effortless’. Richard’s success was built on great natural talent, but also called on a great deal of hard work, study and determination.

### Honours and Appointments

| Year       | Position                                                                 |
|------------|--------------------------------------------------------------------------|
| 1951       | BSc Physics (first class), King’s College London                          |
| 1955       | PhD, University of Cambridge (supervisor: N. Sheppard)                   |
| 1954–1956  | Scientific officer, AWRE Aldermaston                                     |
| 1956–1957  | Senior Research Associate, University of Western Ontario                 |
| 1957–1959  | Postdoctoral Fellow, NRC, Ottawa, Canada                                 |
| 1959–1960  | ICI Fellow, University of Sheffield                                      |
| 1960–1969  | Lecturer in Chemistry, University of Sheffield                           |
| 1964–1969  | Sorby Research Fellow of the Royal Society, University of Sheffield      |
| 1966       | Corday–Morgan Medal and Prize (Chemical Society)                         |
| 1969–1989  | Professor and head of Department of Theoretical Chemistry, University of Bristol |
| 1972–1975  | Chairman, School of Chemistry, University of Bristol                     |
| 1973–1976  | Chairman, Theoretical Chemistry Group, Royal Society of Chemistry        |
| 1976       | ScD, University of Cambridge (for published works)                      |
| 1976       | Fellow and Chartered Chemist, Royal Society of Chemistry                |
| 1978–1979  | Dean of Graduate Studies, Faculty of Science, University of Bristol     |
| 1979–1982  | Dean, Faculty of Science, University of Bristol                          |
| 1981–1985  | Chairman, High Resolution Spectroscopy Group, Royal Society of Chemistry |
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1982–1983  Visiting Research Scholar, Stanford University, USA
1984–1986  Chairman, School of Chemistry, University of Bristol
1985      Spectroscopy Medal, Royal Society of Chemistry
1985–1989  Member, Faraday Division Council, Royal Society of Chemistry
1986      Fellow, the Royal Society
1986–1990  Chairman, Senior Common Room, University of Bristol
1987–1990  Member, Sectional Committee 3 Chemistry, the Royal Society
1988      Hallam Lecturer, University of Wales
1989–1992  Pro-vice-chancellor, University of Bristol
1989–1996  Alfred Capper Pass Professor of Chemistry, University of Bristol
1989–1998  Vice President, Faraday Division Council, Royal Society of Chemistry
1992–2002  Chairman, Board of the Bristol Institute of Child Health
1993–1994  Liversidge Lecturer, Royal Society of Chemistry
1993–1994  Harkins Lecturer, University of Chicago
1994–2003  Non-executive director, United Bristol Healthcare NHS Trust
1995–2003  Vice-chairman, United Bristol Healthcare NHS Trust
1996–1999  Emeritus Fellowship, Leverhulme Trust
1996–2008  Emeritus Professor and Senior Research Fellow, University of Bristol
2003–2006  Trustee, The Charitable Trusts for the United Bristol Hospitals
2004      Rumford Medal, Royal Society

ACKNOWLEDGEMENTS

The author is very grateful to Alison Dixon and the family for providing information, the opening portrait and the photographs reproduced in figures 1 and 7, which enrich this biographical memoir.

AUTHOR PROFILE

Mike Ashfold

Mike Ashfold gained his BSc and PhD degrees at the University of Birmingham, then enjoyed three years as a Guy Newton junior research fellow at Jesus College, Oxford, undertaking postdoctoral research with Gus Hancock, before appointment in the School of Chemistry at the University of Bristol in 1981. His research interests span (multiphoton) molecular spectroscopy, molecular photodissociation dynamics and diagnosing thin film deposition by pulsed laser ablation, and, particularly, chemical vapour deposition. He was promoted to professor of physical chemistry in 1992 and became an emeritus professor at the end of 2020. His research achievements have been recognized by several Royal Society of Chemistry awards—including the Tilden (1996) and Liversidge (2014) prizes—and the Herbert P. Broida Prize of the American Physical Society (2015). He was elected to the Fellowship of the Royal Society in 2009, has just completed a three-year term as a member of Royal Society Council and served as chair of the Chemistry sub-panel in REF2021.


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