RSC | Advancing the Chemical Sciences

Historical Group

NEWSLETTER and SUMMARY OF PAPERS

No. 64 Summer 2013

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RSC Historical Group Newsletter No. 64 Summer 2013

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From the Editor

Welcome to the summer 2013 RSCHG Newsletter. If you have received the newsletter by post and wish to look at the electronic version it can be found at:

http://www.rsc.org/historical or http://www.chem.qmul.ac.uk/rschg/

The summer issue begins with the obituaries of two men who played a crucial part in the founding and early years of the Historical Group, Colin Russell and John Shorter. As the newsletter was being completed, I learnt that Frank Greenaway, former Keeper of Chemistry at the Science Museum and a committee member of the Historical Group in its early days, had passed away - an appreciation of his life is also included. A note on the life of David C. Goodman, who worked on early-nineteenth century crystallography at the beginning of his career also appears. They will all be much missed by those who knew them. Following a message from our outgoing Chairman, Alan Dronsfield, and other news from the RSCHG, there is feedback from the winter 2013 issue along with various notices and news items. In this issue there are two short essays: the first by Alan Dronsfield and Margaret Hill entitled "Whatever Happened to Alabamium and Virginium" and the second by Michael Jewess entitled "Faraday's 'Blue' Plaque – Commemorating a Remarkable Master as well as a Remarkable Servant". There are three book reviews: Gerald Hayes, *The Catalyst Triangle: Mathieson, McKechnie and Wigg*; Michael Freemantle, *Gas! Gas! Quick, Boys! How Chemistry Changed the First World War*; and Carl Djerassi, *Chemistry in Theatre: Insufficiency, Phallacy or Both*. Reports also appear on three RSCHG meetings: "The History of the Chemical Industry in the Runcorn - Widnes Area"; "History of Fluorine - Some Historical Aspects of the Chemistry of Fluorine" and "Robert Woodward - Chemist Extraordinary". Details of the autumn meeting on “Chemistry and Medicine: Some Historical Aspects” on Wednesday 23 October are also included.

Finally I would like to thank everyone who has sent material for this newsletter, with particular thanks to the newsletter production team of Bill Griffith and Gerry Moss. I would also like to thank the RSCHG’s outgoing chairman, Alan Dronsfield, for his many contributions to the newsletter and his support to me as editor. If you would like to contribute items such as articles, book reviews, news items and reports to future newsletters please do contact me. The guidelines for contributors can be found in the summer 2012 edition or online at:

http://www.chem.qmul.ac.uk/rschg/Guidelines.html

The deadline for the winter 2014 issue will be Friday 14 December 2013. Please send your contributions to (a.simmons@ucl.ac.uk) as an attachment in Word or rich text format, or on CD-ROM (post to Epsom Lodge, La Grande Route de St Jean, St John, Jersey, JE3 4FL). All contributions must be in electronic form.

Anna Simmons
University College, London

Obituaries

Professor Colin Russell (1928-2013)

Professor Colin Russell died at home on 17 May 2013 after a long illness. The RSC Historical Group had been founded in 1975, but Russell laid the foundations for the Group as we know it today in his period as Chairman between 1977 and 1982. As Alec Campbell remarked in an appreciation in the January 1983 newsletter, Russell “immediately addressed himself to enlarging the Group’s sphere of influence. The fact that the Group now has an established place in the programme of the Annual Congress, alongside the large Divisions of the R.S.C., is due to Colin’s detailed knowledge of the interplay of forces within the history of science in this country, and his personal commitment to the notion of the history of chemistry as an integral part of living chemistry”. I would add that his close links with the RSC and, in particular his rapport with its conference organisers (John Gibson, Angela Fish and Stanley Langer), were also crucial. The historical sessions and the ever-popular public lecture at the RSC Annual Congresses were the main focus of the group’s activity for many years. I recall the Annual Congress in Bristol in April 1979, when Russell identified a house in Hotwells as Beddoes’s home, probably with the help of a local informant. One evening, we all crowded into a bemused middle-aged couple’s narrow kitchen as Russell and David Knight held forth on the history of the Pneumatic Institute and Humphry Davy. Through his good relationship with J.W. Barrett, Russell enabled the inclusion of a historical session in the triennial Priestley conferences sponsored by the BOC Gases Division Trust. These sessions, often organised by Russell, led to some excellent conferences; for example, the one on the history of ozone at Bucknell University in Pennsylvania in June 1994. These conferences had the advantage that they were always published as RSC special publications and hence taken by most university libraries. The Group Newsletter was also established during his chairmanship, initially in an A4 format. Russell handed over the Chairmanship to Campbell at the end of 1982, but he remained a loyal committee member for several years. He delivered the Historical Group’s Wheeler Memorial Lecture on “The Origins of Organometallic Chemistry” in 2009.

Colin Archibald Russell was born in Streatham, London, on 9 July 1928. His father was a branch manager for an insurance company and his mother had been a teacher before her marriage. For several generations there had been a chemist or pharmacist on the Russell side of the family. Colin, his son and his grandson have maintained this tradition. He was taught by Frank Greenaway (later Keeper of Chemistry at the Science Museum) at Epsom Grammar School for Boys. He took an external London B.Sc. in chemistry at University College, Hull (now the University of Hull). He was an organic chemistry lecturer at Kingston Technical College (now Kingston University) between 1950 and 1959, and at Harris College, Preston (now the University of Central Lancashire) in 1959-1970. His field of specialisation as an organic chemist was heterocyclic chemistry and he always considered himself to be a chemist first and foremost. While at Kingston, Colin became interested in the history of chemistry, and took a M.Sc. (1958) and Ph.D. (1962) in the history and philosophy of science at University College London. His monograph on the history of valency published in 1971, based on his Ph.D., remains a classic in the field. As a result, he was asked by Sir Harold Hartley to take over his uncompleted biography of Berzelius, but this never came to pass, a lacuna which all historians of chemistry must regret. Russell also developed his writing skills in the 1960s, co-authoring *An Introduction to the Physics and Chemistry of Baking* (1963) - which sold well and went into a third edition in 1980 - and revised F.W. Gibbs' *Organic Chemistry Today* for Penguin (1970). He was then called to the newly-founded Open University (OU) in Milton Keynes in 1970 as a Senior Lecturer to establish the history of science and technology within the Arts Faculty. Such was his success in entrenching the subject within the university, that it soon became a separate discipline and then a department within the faculty and Russell became a Reader. He also set up a History of Chemistry Research Group, thus making the OU one of the world's leading centres for the history of chemistry in the 1980s, perhaps second only to the Center for the History of Chemistry (CHOC, now the Chemical Heritage Foundation) in Philadelphia. In retirement, he became a research scholar in the History and Philosophy of Science Department at Cambridge University and a visiting fellow at Wolfson College, Cambridge.

Almost as soon as he joined the Open University, Russell began to develop a two pronged strategy for the promotion of the history of science and technology. To show its value for the arts as a whole, the group would contribute to interdisciplinary courses, such as his unit on Humphry Davy for the "Age of Revolutions" course (A202) and his unit on the Copernican revolution for the "Renaissance and Reformation" course (A201). To reach across the whole university, they would develop a social history of science and technology course and a cultural history of scientific ideas course. The first social history course was "Science and the Rise of Technology" (AST281) in 1973. He fought hard, against considerable resistance, for the cross-faculty designation as he wanted to show that the history of science and technology was not just an "arts" subject, but central to modern science and technology as well. He was fortunate in receiving the full support of the first Dean of Arts, Professor John Ferguson. He greatly respected Ferguson, a renowned classicist, for his educational work in Africa, his willingness to support innovation and his Christian faith. Being able to show films on television to a large audience for perhaps the first time in a history of science and technology course, Russell filmed several obsolescent industrial processes, including the last lead chamber plant in Britain just before it was demolished. He was assisted by Archibald Clow, the co-author of *The Chemical Revolution*, who had become a producer of OU programmes for the BBC and revealed himself to be a natural television presenter. For this course, he also wrote a course unit, *The New Chemical Industry*, with his old teacher, Greenaway. He became increasingly concerned about the loss of material about the chemical industry and set up a project to record the archives of the industry. He obtained internal funding for a research fellowship and with the research fellow (Peter Morris) he published *Archives of the British Chemical Industry, 1750-1914* (1988). This project confirmed his belief that the history of the chemical industry has been excessively influenced by the ultimate winners, usually large firms, when in fact the bulk of the industry historically consisted of small, often short-lived, firms. He wrote thumbnail sketches of many of these small firms in *Archives*.

As a staunch Christian, Russell had an abiding interest in the relationship between science and religion, with a strong contempt for the so-called "conflict thesis" which he regarded as completely unhistorical. With David Goodman (an observant Jew), he was instrumental in the development of the new cultural history of scientific ideas course, "Science and Belief: From Copernicus to Darwin" (AMST283) in 1973, which may have been one of the first undergraduate courses in the subject. This course brought him into contact with the Dutch historian of science Reijer Hooykaas whom he held in high regard as a historian and as a person. Russell felt that Christianity had been unfairly neglected in the social history of science, an oversight which he tried to put right in *Science and Social Change in Britain and Europe 1700-1900* (1984). He gave the Templeton Lectures at Cambridge in 1993, which were published as *The Earth, Humanity and God* (1994). He was a president of Christians in Science and he sat on the advisory board of the Faraday Institute in Cambridge. He also published *Cross-currents: Interactions between Science and Faith* in 1985 and *Michael Faraday: Physics and Faith* in 2000. His concern with the Christian stewardship of the environment as a chemist led him to be one of the founders of the John Ray Initiative in 1997, and to write *Saving Planet Earth: A Christian Response* (2008).

Russell was eager to forge close links with the chemistry department at the OU and he once told me that he would have been happy for the History of Chemistry Research Group to have been located within that department, but the chemists were less keen. However he persuaded them to include a historical component to a third-level course on "The Nature of Chemistry" (S304) and he contributed three units based on his thesis entitled "The Structure of Chemistry", described by W.H. Brock as "a very useful study of the development of structural ideas". Significantly this course was launched in 1976 and by the 1980s all links with the chemistry department had practically ceased.

To mark the centenary of the Royal Institute of Chemistry (soon to become the Royal Society of Chemistry), Russell was commissioned by the Institute to write *Chemists by Profession: The Origins and Rise of the Royal Institute of Chemistry* with his OU colleagues, Gerrylynn K. Roberts and Noel G. Coley, which was published in 1977. One of his proudest moments was presenting a leather-bound copy of the book to the Prime Minister James Callaghan. Through the Historical Group, he became a close friend and admirer of Campbell at the University of Newcastle. Russell then studied the short-lived but influential Newcastle Chemical Society (and its leading light, Algernon Freire-Marreco), and the industrial activities of Frank Clarke Hills. In the course of this research he decided to carry out a computer-based prosopographical study of the members of the Newcastle Chemical Society using a mainframe computer. Sadly this project never fulfilled its ambitious objective, partly because the database format used quickly became obsolete, but it laid the ground for the later successful database project, “Studies of the “British Chemical Community, 1881-1972”, led by Roberts. Russell then played a leading role in the late 1980s in the development of AS283 “The Rise of Scientific Europe” and he was enthusiastic about the opportunity to show the history of science in different European countries on television. With his course team colleague, David Goodman (also recently deceased), he edited the still valuable textbook *The Rise of Scientific Europe, 1500-1800* in 1991.

While Russell was living in Preston, he discovered that Edward Frankland had been born in the nearby village of Catterall. Russell approached Frankland’s biography initially as a local history project and made the astounding discovery that he was the illegitimate son of a local landowner Edward Gorst (and hence a relative of the then well-known right-wing MP Sir John Gorst). This line of research led ultimately to the publication of *Lancastrian Chemist: The Early Years of Sir Edward Frankland* in 1986, which was published under his name, but was very much a joint effort with his wife Shirley, a trained historian. He then published a full biography entitled *Edward Frankland: Chemistry, Controversy and Conspiracy in Victorian England* ten years later. During the research for these books, he discovered an important and hitherto unknown collection of Frankland correspondence still in the hands of the Frankland family, which he, together with his wife, microfilmed and indexed for the benefit of other scholars. They published “The Archives of Sir Edward Frankland: Resources, Problems and Methods” in the *British Journal for the History of Science* in 1990. He then had the idea of creating a computerised index to the microfilms which would then drive the microfilm reader. This entailed the installation of one of the first PCs at the Arts Faculty of the OU in 1982, the futuristic-looking Superbrain II. After two decades of negotiation between Russell and the family, this archive was deposited in the John Rylands Library in 2009, an event which he regarded as one of his major achievements. In the 1980s, Russell became increasingly concerned about the relationship between the chemical industry and the environment. He obtained the funding for one of the first research fellowships in the history of the chemical industry and the environment (held by Sarah Wilmot), and with Coley, Campbell and Wilmot, he published *Chemistry, Society and Environment: A New History of the British Chemical Industry* in 2000. Ashgate published a collection of his articles in its Variorum series in 2010, including an important paper on the history of organic synthesis which first appeared in *Ambix* in 1987 and the paper on the Frankland archive. A long-standing interest in the history of railways finally resulted in *Early Railway Chemistry and its Legacy* (2011), co-authored with John Hudson.

Unusually for a professional historian of chemistry, Russell was a Fellow of the RSC and a member of Council between 1999 and 2002. Russell became increasingly concerned in the 1980s about the future of the history of chemistry among chemists and at large. He encouraged RSC Publications to take a stronger role in the promotion of the history of chemistry. One result was the *Recent Developments in the History of Chemistry*, based on the model of the Specialist Periodical Reports of the RSC, which appeared in 1985. It was not repeated as regularly as Russell initially hoped, partly because of the difficulty of finding suitable authors, but he edited a follow-up volume *Chemical History: Reviews of the Recent Literature* with Roberts in 2005. For several years it seemed that the history of science would be included in the new National Curriculum and Russell worked hard to ensure that the history of chemistry would be given a suitably prominent position. One result of this drive to promote history of chemistry in schools was the series of coloured wall-charts launched by the RSC in 1992, which sadly petered out after the first wave of charts on organic chemistry (Russell), industrial chemistry (Campbell), chemical atomic and molecular theory (Coley), and analytical chemistry (Morris).

In the late 1980s, Russell obtained “seed money” from the Wellcome Trust to set up a centre for the history of chemistry. He had hoped that Unilever would offer him accommodation at the eighteenth century mansion Colworth House, Sharnbrook, near his home in Bedford as the firm was dropping the house as their research centre. However it became a science centre instead and Russell did not think the house in Port Sunlight offered by Unilever as an alternative was large enough. The centre was very nearly established at the Open University’s base in Cambridge until it transpired at the last moment that the floor loading was inadequate for the library that Russell had planned. He then rejected alternatives that he felt were not suitable for the kind of centre he had in mind, including a proposed site at the Open University, and returned the money to the Wellcome Trust. It has to be regretted that Russell’s efforts to promote academic history of chemistry have left no permanent mark, as the History of Chemistry Research Group at the Open University has ceased to exist and the History of Science, Technology and Medicine Department was absorbed into the History Department in 2008.

Russell became the Professor of the History of Science at the Open University in 1981 and retired in 1993, becoming a Visiting Research Professor. He was made an Emeritus Professor in 1995. He was president of the British Society for the History of Science from 1986 to 1988 and gave his Presidential Address on “‘Rude and Disgraceful Beginnings’: A View of History of Chemistry from the Nineteenth Century”. He received a D.Sc. from the University of London in 1978. He was presented with the Dexter Award for lifetime achievement in the history of chemistry by the American Chemical Society in 1990 and the David W. Mellor Medal for Chemical Education from the University of New South Wales in 1995.

He first met his wife Shirley in 1948, when they were both at University College, Hull, and they married in 1954. They had four children, Caroline, Jeremy, Kate and Helena. As Milton Keynes hardly existed in 1970, the family settled in Bedford, where a Service of Thanksgiving was held at the Bunyan Meeting on 30 May 2013.

I worked with Russell at the Open University between 1982 and 1991, with a two and a half year gap in the mid-1980s when I worked at CHOC. His hallmark was his modesty, despite his many achievements, and he was always genuinely surprised when his work was recognised in some way. I remember his astonishment when I told him the theologian and physicist Fr. Stanley Jaki regarded his work on science and religion very highly. A man of deep faith, he had a strong sense of fairness and justice. Russell was the enemy of error wherever it was found and he was anxious for all historians of chemistry to achieve the highest professional standards. He was always generous in his help to any scholar or chemist-historian who approached him for assistance. Having struggled in his earlier years as a historian, he was devoted to supporting younger scholars such as myself and he was particularly saddened by the early death in a car accident of Christine King, in whose career he had invested great hopes. Russell had a gentle sense of humour and loved to tell stories, usually with a quizzical look to gauge the listener's reaction. Many of these stories revealed his enthusiasm for chemistry and the history of chemistry which he regarded as indivisible. He was immensely energetic in everything he did from promoting parliamentary links for the RSC, preserving archives or preaching sermons. He was a keen badminton player in his 50s and a dedicated hill-walker; it was sad to witness his growing physical frailty in his later years. The Historical Group has lost a great supporter and the history of chemistry will be the poorer for his passing.

John Hudson writes of Russell as follows: "Colin retained a boyish enthusiasm for railways, especially steam locomotives. At the Service of Thanksgiving held for Colin, two of his children described how at a tender age they had been roused from their beds late at night to watch a steam special pass close to their house. But he also knew that chemists had played a vital role in the railway industry from the earliest days, although no detailed study of their activities had as yet been undertaken. When I approached Colin with the proposal to research the topic in depth, he readily agreed to supervise me as a Ph.D. student. I found that his comments and criticisms were always helpful and constructive. After I moved to the Lake District, supervisions often took place after a convivial lunch either at his holiday home at Oxenholme or at my house at Loweswater. It was an honour to be his last Ph.D. student and to collaborate with him on his final book. With his passing I have lost both a mentor and a friend."

Peter J.T. Morris

Dr John Shorter (1926-2013)

John Shorter, former Secretary (1982-1988) and Chairman of the Historical Group (1989-1993), has died. John was born in Redhill, Surrey, and in 1926 read chemistry at Exeter College, Oxford, where he obtained his B.A. in 1947 and his B.Sc. in 1949. He undertook his doctorate under the supervision of Sir Cyril Hinshelwood, graduating with a D.Phil. in 1950. Later that year he joined the staff of the Chemistry Department at University College, Hull, which in 1954 became the University of Hull. John spent the rest of his career at Hull, retiring after thirty-two years and becoming Emeritus Reader. In the academic year 1966-67 he was R.T. French Visiting Professor at the University of Rochester, New York, staying there with his wife and three children (two sons and a daughter).

Professionally, John was a physical organic chemist with an international reputation for his work in correlation analysis. He was Secretary of the International Group for Correlation Analysis in Chemistry for over twenty years from 1982, and was a member of the IUPAC Commission on Physical Organic Chemistry from 1990 to 1997. John wrote numerous research papers on physical organic chemistry, particularly in the field of linear free energy relationships and also wrote several books on this field, including *Correlation Analysis in Organic Chemistry: An Introduction to Linear Free Energy Relationships* (Oxford: Clarendon Press, 1973), and *Correlation Analysis of Organic Reactivity*, (Chichester: Research Studies Press, 1982).

John was an enthusiastic historian of chemistry, with broad interests in many aspects of the relatively recent past, which he pursued keenly in retirement. One memorable paper was that on the difficult relationship between Sir Christopher Ingold and Sir Robert Robinson over the electronic theory of organic chemistry, presented at the RSC Annual Congress at Warwick University in 1986, and subsequently published (J. Shorter, "Electronic Theories of Organic Chemistry: Robinson and Ingold", *Nat. Prod. Rep.*, 1987, 4, 61-66). He was also a speaker at the conference at Cambridge University held in 2002 to celebrate three hundred years of the Chair of Chemistry, where he spoke on the contribution of George Downing Living, published as a chapter in *The 1702 Chair of Chemistry at Cambridge*, eds. M. Archer and C. Halay, (Cambridge: Cambridge University Press, 2005). Other notable historical papers were "The Centenary of the Birth of Louis Hammett", (*Pure & Appl. Chem.*, 1995, 67, 835-840) and "Humphrey Owen Jones, F.R.S. (1878–1912), Chemist and Mountaineer", (*Notes and Records of the Royal Society of London,* 1979, 33, 261-277).

John was an outstanding servant of the Historical Group at a critical time in our development, as well as a self-effacing and kindly man. He will be much missed by all who knew him.

John Nicholson

Dr Frank Greenaway (1917-2013)

Frank Greenaway, Keeper of Chemistry at the Science Museum between 1967 and 1980, passed away at the age of 95 on Sunday 16 June. Born in Cardiff in 1917, he studied chemistry at Jesus College, Oxford, before serving in the Second World War as a bomb disposal officer. He then taught in Bournemouth and Epsom Grammar School for Boys before working at Kodak in Harrow. Greenaway joined the Science Museum as an Assistant Keeper in 1949 and became a Deputy Keeper ten years later. His major achievement at the museum was the development of new Chemistry Galleries in 1964 and their refurbishment in 1977. He was also one of the first curators at the museum who could be described as a professional historian of science. He was awarded a Ph.D. in the history of science from UCL. His own research was on John Dalton and the atomic theory which was published as *John Dalton and the Atom* (1966). Robert Bud remarks that "He was the most distinguished scholar at the Science Museum for many years keeping alive the flame of research singlehandedly". After his retirement in 1980, he continued to work in the Science Museum Library as a Research Fellow until 1991, which resulted in a major publication, *Science International: The History of the International Council of Scientific Unions* (1996).

Frank was active in many ways outside of his main employment, involving himself not only in the history of science and museum organisations, but also in a broader cultural world. He was keenly interested in music and served on the Council of Management of the Royal Philharmonic Society for much of the 1980s. He was made Reader of the History of Science at the Royal Institution in 1970 following his successful development of a series of lunchtime meetings on the History of Science and Technology from 1967, in which he was joined by Roy MacLeod (then a professor of science education at London's Institute of Education). Frank was directly responsible for the formal development of history of science and technology at the Royal Institution. He led the Leverhulme funded project on the history of the nineteenth-century Royal Institution, which produced influential doctoral theses and facsimiles of the Managers' Minutes. The lunchtime meetings led to the formation of the Royal Institution Centre for the History of Science and Technology (RICHST) under the benevolent eye of the RI's Director, George Porter. Frank was the Chair of the RICHST until 1984 when William Brock succeeded him. Frank James took over this appointment in 1990 and this eventually led to the establishment of a fulltime chair in the history of science at the Royal Institution. Frank Greenaway was also an early committee member of the Royal Society of Chemistry Historical Group and Honorary Secretary of the Society for the History of Alchemy and Chemistry from 1966 to 1974. He also served on SHAC's Council from 1966 to 1987.

On hearing that Frank was compiling a personal memoir, some of his friends considered that it deserved to be published. At the same time, they felt that they, and others, would wish to offer written pieces related to his life's work. The result was an autobiographical memoir *Chymica Acta*, published on his ninetieth birthday in 2007. The publication of the book was celebrated by family, colleagues and friends with a special meeting of the Society for the History of Alchemy and Chemistry, held at the Museum of the History of Science, Oxford, in December 2007. Frank will be much missed by all those who knew him.

Peter J.T. Morris

With additional information provided by William Brock and Frank James and also taken from the preface of *Chymica Acta*, an autobiographical memoir by Frank Greenaway, with essays presented to him by his friends, edited by R.G.W. Anderson, Peter J.T. Morris and D.A. Robinson, (Jeremy Mills Publishing Ltd., 2007).

An obituary by R.G.W. Anderson has been published online by *The Guardian*: http://www.guardian.co.uk/culture/2013/jul/16/frank-greenaway

Professor David C. Goodman

David C. Goodman, Professor of the History of Science at the Open University has also died recently. While he became better known as a historian of early modern science in Spain and Portugal, David began his career in the late 1960s as a historian of chemistry and published papers on early-nineteenth century crystallography. He was a colleague of Colin Russell and they collaborated on an Open University course on the rise of scientific Europe, and published the still valuable *The Rise of Scientific Europe, 1500-1800* in 1991.

Peter J.T. Morris

ROYAL SOCIETY OF CHEMISTRY HISTORICAL GROUP NEWS

Changes at the Top

This will be the last Newsletter that will be headed by my name as Chairman. As indicated by our Secretary below, nominations will be invited at our AGM for my replacement. This has come about because by the end of December I will have served two four year terms as Chair and, apart from any RSC rules and recommendations, I feel it is time that someone else should hold the tiller.

I have had eight enjoyable years chairing the Group and this has come about by working with a very supportive committee and some very helpful co-officers: Bill Griffith and John Nicholson as Secretaries, Peter Reed and John Hudson as Treasurers, and Anna Simmons and Viviane Quirke as Newsletter editors. Nor must I forget Bill and Gerry Moss who form the newsletter production team. Gerry, of course, also maintains our "alternative" RSCHG website.

I think that under my stewardship the Group has remained in good shape. Our membership has increased significantly, thanks to the new RSC policy of offering it at zero cost as part of the overall Society membership package. We have remained in good financial order thanks to the good work of our treasurers, but also because the majority of our membership is now happy to receive their Newsletters electronically, rather than in the paper form. This saving has enabled us to continue our tradition of putting on our conferences at low or zero cost. Here I must pay tribute to committee members who offer to organise these events and quietly get on with the job thus making my work as Chair so much easier.
Finally, I must report that we are seen by the RSC as being one of the more active, and certainly, more helpful, of the subject Groups. With respect to the latter I have to thank those members, and particularly committee members, who respond to "historical" enquiries, either arising from within Burlington House, or (from the public) channelled through it.

So, in wishing every success to my replacement as chair, whoever he or she is, I bid you farewell.

Alan Dronsfield

Election of RSC Historical Group Chair

As reported above, Alan Dronsfield will be retiring as Chair at the end of the year and the Group is seeking a replacement. Nominations (which may be self-nominations) will be invited at the AGM, in addition to any nomination made by the Committee. In the event of more than one nomination being received at the AGM, then an election of the membership will be conducted by email.

John Nicholson

Royal Society of Chemistry Historical Group AGM

The thirty-eighth Annual General Meeting of the Group will be held in the Council Chamber, Burlington House at 14.10 on Wednesday 23 October 2013.

Agenda

1. Apologies for Absence.
2. Minutes of AGM at Burlington House, 28 September 2012.
3. Matters arising from the Minutes.
4. Reports:

   Chairman's Report

   Secretary's Report

   Treasurer's Report.
5. Future Meetings.
6. Election of Officers and other Members of the Committee.
7. Any Other Business.
8. Date, time and place of next meeting.

Minutes of the Thirty-Seventh Annual General Meeting of the RSC Historical Group

Held in the Chemistry Centre, Burlington House at 13.45 on Friday 28 September 2012.

1. Apologies for Absence: from Jack Betteridge, John Hudson, Peter Reed and Henry Rzepa.

2. Minutes of the AGM: at Burlington House, Wednesday 26 October 2011. These were published in the August 2012 issue of the *Newsletter,* pp. 6-9.

3. Matters arising from the Minutes: None.

4. Reports:

Chairman's Report: Alan reported another satisfactory year, with four well-attended and well-appreciated conferences. We have continued to keep attendance costs as low as possible and indeed this present meeting has cost nothing to attendees. Next year we intend to mount four meetings, three in London and one in Widnes. This past year has seen the majority of members electing to receive our Newsletter electronically, rather than by paper copy and this has resulting in a significant saving (and hence the maintenance of our free, or low cost, conferences. The transition has gone smoothly, and I pay tribute to Anna Simmons our Editor, and Bill and Gerry who oversee the production and distribution of the hard copy and electronic versions of the Newsletter.

We have continued to assist the RSC in its various activities such as helping out with its "Open House" venture and responding to enquiries which have an historical underpinning. In particular we continue to liaise with Pauline Meakins over the award of Chemical Landmark plaques.

Alan paid tribute to the officers of the Group and members of the committee who assisted him in his efforts and made the role of chairman both enjoyable and productive.

Secretary's Report: Bill Griffith distributed his report for the year October 2011 – September 2012:

Meetings: There were four, all well-attended and well-received by their audiences.

Environmental Chemistry – An Historical Perspective: A joint meeting with the Environmental Chemistry group on Wednesday 26 October 2011, organised by Rupert Purchase and Peter Reed. A well-attended, successful meeting, reported in the Winter 2012 *Newsletter*, pp. 36-41.

Dyes in History and Archaeology (DHA) 30: A joint meeting of the DHA and RSCHG, Derby, 12-15 October 2011. This was a successful meeting, reported in the Winter 2012 *Newsletter*, pp. 15-16.

Where There's Muck There's Brass! – The Decontamination of Chemical Sites: Burlington House, Friday 23 March 2012, organised by Peter Reed and David Leaback. Peter Reed reported that this had been a very successful and well-attended meeting. The meeting is reported in the Summer 2012 *Newsletter,* pp. 44-49.

Under the Influence – Famous Textbooks and Their Authors: organised by Peter Morris and Bill Griffith (today's meeting, Chemistry Centre, Friday 28 September 2012).

RSC Landmark plaques: The Group had been represented at all of these. John Hudson represented us at an award to commemorate James "Paraffin" Young at Bathgate on 27 April 2012 (Summer 2012 *Newsletter* pp. 42-4); Bill Griffith at the Glucose Sensor plaque, Inorganic Chemistry Laboratory, Oxford, on Monday 16 July 2012 (a report will appear in the Winter 2013 *Newsletter*). The RSC Plan to hold at least three others in the near future but no details are available as yet.

Treasurer's report: John Hudson writes: We ended the year in a very healthy financial position. We had a surplus of £1901.71 for the year, ending with £5374.17 in the current account and £4295.65 in the Wheeler account. Nevertheless, the Committee predicted that we might soon run into difficulties. This fear arose from the fact that our membership numbers are soaring (an extra 300 members in the last 18 months), and we now get only get £1 per annum from the RSC for each additional new member. It was clear that our reserves would be very quickly eroded if numbers continued to rise and we continued to print and post hard-copy Newsletters twice each year to all members. We therefore took the decision to distribute our Newsletter electronically, but to continue to offer a hard-copy version to those who specifically requested it. This policy has been introduced during the current year, and early indications are that it has been very successful.

5. Future Meetings

Four are planned:

i) *The History of the Chemical Industry in the Runcorn-Widnes Area.* On Saturday 2 March 2013 at the Catalyst Science Discovery Centre, Widnes. There will be a charge. Speakers will include John Hudson on the origins of the chemical industry in the area; Peter Reed on pollution problems and their solution; Diana Leitch on the people who worked there, plus others to be announced. Details in the Winter 2013 *Newsletter.*

ii) *The History and Chemistry of Fluorine.* On Thursday 21 March 2013 at 10.30 in the Council Chamber, Burlington House, organised by Alan Dronsfield and Bill Griffith. More details and a registration form in the Winter 2013 *Newsletter.*

iii) *Robert Woodward – Chemist Extraordinary.* On Friday 17 May 2013 at 13.30 in the Council Chamber, Burlington House. An afternoon meeting with talks by Bill Brock, Henry Rzepa and Peter Morris; the latter will deliver the RSCHG Wheeler lecture on *Robert Woodward.* More details and a registration form will be found in the Winter 2013 *Newsletter.*

iv) *Chemistry and Medicine.* A full-day meeting at the Chemistry Centre, Burlington House, on Wednesday 23 October 2013, to be organised by Alan Dronsfield. Details will be announced in our Summer 2013 *Newsletter.*

We have plans for other meetings in 2014 and 2015.

6. Election of Officers and other Members of the Committee

Alan reported that, after ten years as HG Secretary, Bill decided that it was time for someone else to take over the job. Recognising, and appreciating, Bill's role, he had tried to dissuade him, but this time to no avail. That the Group had had ten years smooth running, and had continue to forge strong relationships with senior RSC staff was in no small part due to Bill's enthusiasm and diplomacy. Bill will still be involved with the administration of the Group, however. The role of Membership Secretary is closely connected with Newsletter distribution and Bill will take over this job from John Hudson. He will liaise closely with John as Treasurer, of course, in this connection. The Committee has asked Professor John Nicholson to take over the role of Secretary from the end of this month and John has accepted.

Alan proposed that John Nicholson take over the role of Historical Group Secretary. Seconded by Chris Cooksey and carried *nem con*.

At our last Committee meeting it was established that the present members and officers (other than that of Bill as Secretary and the transfer of the role of Membership Secretary from John to Bill) were happy to continue in their present roles.

Duncan Thorburn Burns proposed that the present members and officers (other than that of Bill as Secretary) should continue in their present roles. Seconded by Gordon Woods and carried *nem con*.

7. Any Other Business

Rupert Purchase commented that a forthcoming meeting of the Environmental Group had been advertised on the Historical Group's webpage, but had been removed after a few days. Alan said that the notification appeared under the heading "Future meetings of the (Historical) Group". This was incorrect information. However he agreed to explore with the RSC if an alternative "home" for such notifications could be constructed on a Group's webpage – "Other Group meetings likely to be of interest" might be an appropriate heading.

8 Date of Next AGM

It will form part of our Autumn 2013 meeting on Wednesday 23 October 2013.

Free Access to the RSC's On-line Archives

Members of the Historical Group who are also RSC members have had free access to the pre-1939 Archives for the past few years. From time to time I have pressed the RSC to bring forward the cut-off date, but I felt that there was only a slight chance of success.

However, the RSC has now decided to widen significantly all access to its archives, as reported in *RSC News,* March 2013, p. 6. The window for free access is now much wider and applies not just to (RSC) Historical Group members but to all RSC members.

We now have free and unlimited access to all the on-line pre-2007 journal archives and limited free access to the post-2007 journal runs. For the post-2007 material we are restricted to ten free downloads per year.

This is how it works. Supposing you are researching the history of organic reaction mechanisms and wish to read what Arthur Lapworth had to say about his theory of "alternating polarities". Go to the Library's web-page at http://www.rsc.org/library/ and type in a few key words in the search box, labelled "site search", at the top. "Lapworth" and "polarities" will suffice. This gives about 900 hits, with the more promising ones listed first, the top one being "*L.—A theoretical derivation of the principle of induced alternate polarities; Arthur Lapworth, J. Chem. Soc., Trans., 1922, 121, 416-427*" Double click the link and this will take you to the first page of his paper. Access the whole paper by typing in the username (your RSC membership number) and your password (your birth-date, written as yyyymmdd) and click the login box. Don't attempt to login using the Athens facility. You will be taken to a new page. Single click the "PDF" icon located approximately in the centre of the page, and the whole paper will be displayed.

You can access all Lapworth's papers in the archives by putting a tick in the "Articles by Arthur Lapworth" box and clicking "Go". The titles of 104 papers will be displayed, but apparently in random date order.

Simply click on any you think will aid your research and when the new page is displayed, click on "PDF" again. The selected paper should be displayed without the necessity of logging in a second time.

If you want simply to browse the archives, you will need to know which journals the RSC now provides on line. There are two choices. Firstly, the RSC has its own lists of archived journals at:

http://pubs.rsc.org/en/Journals?key=Title&value=Current%23%20. Click on this page and then access the archives by clicking on "Journal Archives" in the "Browse by" box. However these pages do not immediately list the date range of the listed journals. Their advantage, though, is that you can click through to any particular serial run and start your research from there. Alternatively, have a look at the RSC's other list at http://www.rsc.org/pdf/journals/archive/journals.pdf of archived journals

This gives journal titles, name changes and usefully, date ranges. Its disadvantage (but this will not usually affect Historical Group members) is that the listings appear to cease at around 1996. Also, it is not possible to click from this link directly to the journal.

Suppose by way of example, we were intrigued by the now-defunct journal *Proceedings of the Institute of Chemistry of Great Britain and Ireland* listed in the above "dated" pdf publication list. Access the journal run from "Journal Archives" in the "Browse by" box mentioned above, select a particular issue by filling in the "Browse by issue box" and follow the above instructions about entering your username and password. Click on the "+" adjacent to the serial run and you obtain an expanded list including:

Proceedings of the Institute of Chemistry of Great Britain and Ireland (1877-1919).

Clicking the title brings up a list of ten-year periods.

Clicking on the dates brings up a list of volumes in that period.

Clicking on one volume (e.g., vol. 22, 1898) brings up a list of four sections:

The Institute of Chemistry of Great Britain and Ireland. Proceedings. Part I. 1898

The Institute of Chemistry of Great Britain and Ireland. Regulations for admission to membership, and register of fellows, associates and students. 1898-1899

The Institute of Chemistry of Great Britain and Ireland. Proceedings. Part II. 1898

The Institute of Chemistry of Great Britain and Ireland. Catalogue of the Library

Clicking on the section leads you there.

Please direct any enquiries to the Library at library@rsc.org. Or have a look at http://www.rsc.org/virtuallibrary.

I thank Chris Cooksey for helpful comments on this article.

Alan Dronsfield

RSC Annual Reports

Stephen Robinson, a former RSCHG Committee member, has a complete set of RSC Annual Reports from the first issue in 1904 to the mid-1980s, with the inorganic volume continuing to the late 1990s. These are all in very good condition and are free to anyone who is prepared to collect them. Please contact Stephen on 020 8546 7940 or stephenrobinson3@hotmail.com

WINTER 2013 NEWSLETTER FEEDBACK

The Great Stink (2)

Since the last report [1], new data has come to light which suggests that some corrections and further comments are in order.

Tyrian Purple

The fragrance associated with the purple shellfish industry, memorably described as smelly shelly studies [2], was supposed to be due to dimethyl disulfide. But that might not be true. While investigations suggest that, in Japanese molluscs, at least, the culprits are methanethiol and dimethyl disulphide [3], it seems that dimethyl disulfide is not too bad after all. A clue as to what might be the real culprit may be found in another legendary fragrance – that of the titan arum (*Amorphophallus titanum*). This plant rarely flowers, but when it does, people flock to botanic gardens to savour the aroma of a rotting animal. The culprit was found, using gas chromatography-mass spectrometry-olfactometry (GC-MS-O), to be dimethyl trisulfide, which was a hundred times smellier than the disulfide, which was also present, but which did not make a significant contribution to the fragrance [4].

***tert*-Butyl isocyanide**

I mentioned that replacing ^{12}C with ^{13}C did not change the indescribable odour of *tert*-butyl isocyanide. However, writing in *Chemistry World*, Phillip Ball [5] reports that isotopic substitution can change the aroma of some compounds. In 1996, Luca Turin suggested that smell receptors sense the vibrations of molecules and found that acetophenone and acetophenone-d_8 had distinctly different odours. Deuteration profoundly affects the vibrational frequencies in the infra-red spectrum. Later, other researchers reported that they could detect no difference between the aromas of the two acetophenones and Turin recently confirmed this, but found that fruit flies could distinguish between them. Eight out of ten fruit flies said that they preferred the non-deuterated acetophenone. OK, I made that up, but using electric shocks, the fruit flies could be trained to selectively avoid one or the other acetophenone. In the most recent experiments, the Turin team tested cyclopentadecanone, the sweet musky perfume Exaltone, using GC-MS-O and found that if it was more than half deuterated, then even naive, *i.e.*, not professional, human testers could detect a burnt note. No need for electric shock training.

References

1. *RSCHG Newsletter*, 2013, No. 63, p. 12.
2. by Prof D. S. Reese, Peabody Museum of Natural History, Yale University.
3. K. Shiomi, K. Sasaki, H. Yamanaka and T. Kikuchi, “Volatile Sulfur Compounds Responsible for a Fetid Odor of the Hypobranchial Gland of Muricid Gastropods *Reishia* (Thais) *clavigera* and *R.* (T.) *bronni*”, *Bull. Jpn. Soc. Sci. Fish.*, 1982, **48**(9), 1353–1356.
4. M. Shirasu, K. Fujioka, S. Kakishima, S. Nagai, Y. Tomizawa, H. Tsukaya, J. Murata, Y. Manome and K. Touhara, “Chemical Identity of a Rotting Animal-like Odor Emitted from the Inflorescence of the Titan Arum (*Amorphophallus titanum*)”, *Biosci. Biotechnol. Biochem.*, 2010, **74**(12), 2550–2554.
5. P. Ball, “Boost for Controversial Smell Theory”, *Chemistry World*, March 2013, 22.

Chris Cooksey

MEMBERS’ PUBLICATIONS

If you would like to contribute anything to this section please send details of your publications to the editor. Anything from the title details to a fuller summary is most welcome.

Recent publications by Historical Group Committee Members

Chris Cooksey, “Tyrian Purple. The First Four Thousand Years”, *Sci. Prog.* 2013, **96**(2), 171-186.

I. Karapanagiotis, D. Mantzouris and C. Cooksey, “An Improved Method for the Analysis of Tyrian Purple Samples and the Application to Historical and Archaeological Samples”, DHA31, Antwerp, 2012. http://www.chriscooksey.demon.co.uk/dha/DHA31abstracts.doc

Ioannis Karapanagiotis, Dimitrios Mantzouris, Chris Cooksey, Mohammad S. Mubarak and Panagiotis Tsiamyrtzis, “An Improved HPLC Method Coupled to PCA for the Identification of Tyrian Purple in Archaeological and Historical Samples”, *Microchem. J.*, 2013, **110**, 70–80.

Alan Dronsfield and Peter Ellis, “Antabuse’s Diamond Anniversary”, *Drug and Alcohol Review*, November 2012. Published online, DOI: 10.1111/dar.12018.

This paper recounts the history of this once-popular drug used to fight alcohol dependency. Its mode of action was based on “aversion therapy” as, when combined with an alcohol intake, the result was headache and extreme nausea. However, its effectiveness depended on the patient’s reliability in taking the drug. Its place in today’s regimes for tackling alcoholism is discussed.

NEWS AND UPDATES

Society for the History of Alchemy and Chemistry

The Society for the History of Alchemy and Chemistry has recently launched its new website: www.ambix.org

Founded in 1935, SHAC has consistently maintained the highest standards of scholarship in all aspects of the history of chemistry from early times to the present. The Society has a wide international membership of over 250 members from 28 countries. The new website highlights SHAC’s wide range of activities: the research awards and prizes offered, its journal *Ambix*, now published four times a year, the scholarly support provided through the development fund and the graduate network it has established. The website also includes reports and photographs of past meetings, plus details of how to join SHAC. The current and previous issues of the Society’s newsletter, *Chemical Intelligence,* can also be downloaded at:

www.ambix.org/publications/chemical-intelligence/

The Partington Prize 2014

The Society for the History of Alchemy and Chemistry established the Partington Prize in memory of Professor James Riddick Partington, the Society’s first Chairman. It is awarded every three years for an original and unpublished essay on any aspect of the history of alchemy or chemistry. The prize consists of five hundred pounds (£500). The competition is open to anyone with a scholarly interest in the history of alchemy or chemistry who, by the closing date of 31 December 2013, has not reached 35 years of age, or if older has been awarded a doctoral thesis in the history of science within the previous three years. Scholars from any country may enter the competition, but entries must be submitted in English and must not have been previously submitted to another journal. The prize-winning essay will be published in the Society's journal, *Ambix.*

Entries should be submitted electronically as e-mail attachments. We prefer files to be Microsoft Word documents (Word 93–2013 or higher), although these may be accompanied by a PDF version if desired. Essays must be fully documented using the conventions used in the current issue of *Ambix*. Essays must not exceed 10,000 words in length, including references and footnotes. All entries must be submitted with a word count.

All entries should be sent to The Hon. Secretary, Dr Anna Marie Roos, at anna.roos@history.ox.ac.uk, with the words "Partington Prize" in the subject heading. Two documents should be submitted: the first, a separate title page giving the author's name, institution, postal address, e-mail address and date of birth (and, if relevant, the date of the award of the Ph.D.). The second should be the essay. The author's name and contact details must not appear on the pages of the essay as the identity of the author will not be made available to the judges. Essays (no more than one from each competitor) must be received no later than midnight GMT on 31 December 2013.

The decision of the judges appointed by the Council will be final. The Society reserves the right to divide the prize between two or more entries of equal merit, or not to award a prize should no essay be deemed of suitable standard. The name of the winner will be announced by 30 April 2014.

News from the Chemical Heritage Foundation (CHF)

Carsten Reinhardt, professor of history of science at Bielefeld University will become president and CEO of the Chemical Heritage Foundation (CHF) effective from 1 August 2013. He will be the third president of CHF, succeeding Thomas R. Tritton, who is retiring.

Reinhardt was selected following a worldwide search for a leader with a great depth of experience in the history of science and technology. He has extensively researched and published on the impact of chemistry on society through topics including the history of industrial research, the emergence of instrumentation, and chemistry's links to physics, biology, medicine, and technology.

News from the ACS Division of the History of Chemistry

The recipient of the 2013 HIST award of the Division of the History of Chemistry of the American Chemical Society is Professor William R. Newman, Distinguished Professor and Ruth Halls Professor of History and Philosophy of Science, Indiana University. This award is the successor to the Dexter Award (1956-2001) and the Sydney M. Edelstein Award (2002-2009), also administered by the Division of the History of Chemistry. The HIST Award will be presented to Professor Newman at the autumn national meeting of the American Chemical Society in Indianapolis in September 2013.

Liebig-Woehler-Freundschaft-Preis

The 2013 Liebig-Woehler-Freundschaft-Preis has been awarded to Dr Neill Busse for his University of Giessen dissertation "Die chemische Elite: Das Netzwerk Justus Liebig und seiner Schüler".

USEFUL WEBSITES AND ADDRESSES

American Chemical Society Division of the History of Chemistry
http://www.scs.illinois.edu/~mainzv/HIST/

Link to Open Access Issues of the *Bulletin for the History of Chemistry* at:
http://www.scs.illinois.edu/~mainzv/HIST/bulletin_open_access/bull-index.php

The British Society for the History of Science
http://www.bshs.org.uk

Chemical Heritage Foundation
http://www.chemheritage.org/

CHEM-HIST: History of Chemistry Electronic Discussion Group
http://www.uni-regensburg.de/Fakultaeten/phil_Fak_I/Philosophie/Wissenschaftsgeschichte/CH.htm

Chemist of the Month

Published monthly during the academic year, a vignette of a prominent chemist is announced in the Chemist of the Month Newsletter that is sent to students, alumni and faculty of the Catholic University of America, Washington DC, and to staff at other institutions. To read about the Chemist of the Month, go to the History Corner:

http://faculty.cua.edu/may/history.htm

The Commission on the History of Modern Chemistry (CHMC)
www.chmcweb.org

The European Association for Chemical and Molecular Sciences (EuCheMS) http://www.euchems.org/

Forum for the History of Chemical Sciences

The Forum for the History of the Chemical Sciences is a group of scholars and students whose aim is to promote research, education, and communication on the historical, social, and philosophical aspects of chemistry and related chemical sciences and technologies.
fohcs.blogspot.com or via http://www.hssonline.org/about/society_interest_groups.html

The Society for the History of Alchemy and Chemistry
www.ambix.org

For details of how to join the Society, please fill in the online application form by following the link from www.ambix.org/join-us/#howto
or contact the Treasurer and Membership Secretary: John Perkins, 19 Nethercote Road, Tackley, Oxfordshire, OX5 3AW. (shacperkins@googlemail.com).

The Society for the Propagation of the Music of the Chemist-Composers

This is an informal association that has been formed to publicize the music of chemist-composers. http://faculty.cua.edu/may/SPMCC.htm

The Working Party on History of Chemistry (WP)

Information on the activities of the WP can be found on its website:
http://www.euchems.eu/divisions/history-of-chemistry.html

Walter Sneader's website 'Sources of information about drugs and medicine'
http://historyofdrugs.net

Website for the history of science and technology in Europe
http://histsciences.univ-paris1.fr/

Website of the Max Planck Institute for the History of Science (Berlin)
http://www.mpiwg-berlin.mpg.de/en/index.html

Selection of English-language papers relevant to the history of chemistry
http://web.lemoyne.edu/~giunta/papers.html

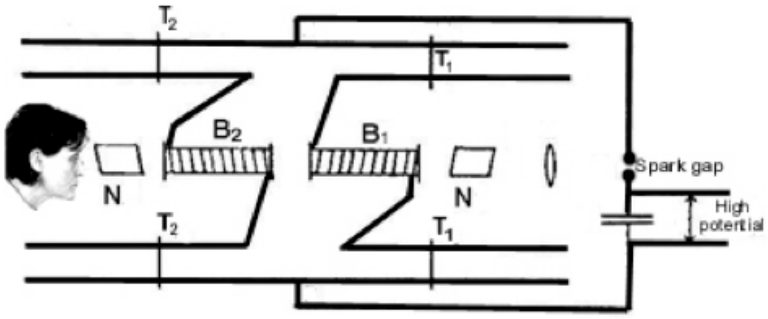
Website for the Nobel Prizes
http://nobelprize.org/

SHORT ESSAYS

Whatever Happened to Alabamium and Virginium?

Dmitri Ivanovich Mendeleev's periodic table contained twenty-nine gaps for missing elements. Among them, using the post–Moseley terminology, were those with atomic numbers 85 and 87. One of the triumphs of the periodic table was its predictive nature and this spurred the search for the missing elements. In 1930, Professor Fred Allison of the Alabama Polytechnic Institute, USA, announced he had found element 87 in samples of pollucite and lepidolite ores [1]. It was christened Virginium and given the symbol Va [2]. The following year Allison reported the identification of an element 85 [3], a member of the halogen group, in sea water and monazite sand and this he named Alabamium (Am) [4] in honour of his polytechnic workplace and state. But one searches in vain for Virginium and Alabamium in today's periodic table. These places are now occupied by the radioactive species Francium and Astatine.

Allison's bold claim was made by the use of the technique which he had been developing from 1927, the magneto-optic method of analysis. This has, as its genesis, an effect that Michael Faraday first reported in 1845: the plane of polarisation of plane polarised light, passing through a transparent medium, is rotated by the application of a powerful magnetic field. The extent of rotation is proportional to the path length of the cell containing the liquid and the strength of the magnetic field causing the effect. If the field is reversed, so is the direction of rotation of the light. Many attempts had been made to find a time delay between the application of the magnetic field and the alignment of the molecules of the liquid in a cell to cause the optical rotation. The general consensus was that this would be about 10^{-8} seconds.



Diagrammatic representation of Allison's apparatus

Allison and J. W. Beams devised an apparatus that could detect and measure this time lag and published their first paper on the phenomenon (which rapidly became known as the Allison Effect) in 1927 [5]. The apparatus is shown in the diagram below. Light from a spark was polarised by the Nicol prism (N) and then passed in succession through cells B_1 and B_2 containing the solvents or solutions. At the same time the current impulse from the spark passed through leads of variable length to oppositely wound solenoids round each cell, the magnetic fields were thus rotating the plane of polarisation in opposite directions in each cell. With the same liquid in both cells and the same magnetic field applied at the same time, the second cell reversed and cancelled out the rotation of the first cell. A final polarizer Nicol prism after this second cell was oriented 90^o out of phase with the first polarizer and a minimum of light intensity was observed. The liquid in B_2 was replaced by a second solvent/solution and the experiment repeated. The second cell was moved until the minimum was again observed. This distance, divided by the speed of light, gave a time lag of the order of 10^{-9} seconds. In effect what was being measured was the time it took for the effect to occur in the second cell and cancel the effect in the first cell. The light was not completely extinguished but a sharp minimum was observed. Alternatively the time lag could be measured by altering the length of wire leads at the trolleys T_1 and T_2, as this was the equivalent to measuring the time that the electric current had to travel to reach the second cell.

Allison's first paper [5] gave the differences in the time lags for various solvents against carbon disulphide in cell B_1. For example when B_2 was filled with carbon tetrachloride the cell had to be moved 32 centimetres to observe a minimum. This was equivalent to a time lag of 1.1 x 10^{-9} sec. A whole series of papers followed over the next few years. Further refinements of the method were described [6], including the use of a sliding trolley with a vernier scale to alter the length of the leads, the scale being in "Allison units". Sometimes a steady light source was used rather than an oscillating spark. Other workers recognised that using the eye for detecting the minima introduced an element of subjectivity into the technique and replaced it, apparently to good effect, by a photoelectric cell. [7]. It was claimed [8] that "each chemical compound produced a minimum at a point characteristic of the compound … (which) does not disappear until the concentration has been reduced to less than one part in 10^{10}". For inorganic compounds only the cation was detected but the anion had a modifying effect. The minima for series of inorganic salts (chlorides, nitrates, sulphates, hydroxides) of different metallic elements were measured and the scale readings plotted against the chemical equivalent of the elements [9]. Allison reported "after reading the minima of a number of compounds, it appeared on a study of the results that the positions of the minima were functions of the atomic weights of the metallic elements of the compounds, or more precisely, of the atomic weights divided by the valence, that is, the chemical equivalents" [6]. Furthermore elements which have two valences exhibit, as a rule, two minima. Thus to identify the metallic element present in an unknown salt, it could be converted into, say, its chloride, the minimum determined and its equivalent weight read off from the graph prepared for the chloride series. For quantitative analysis, comparisons were made with solutions of known concentration. The results achieved agreed within 10% of those determined by titrimetric analysis. There was no interference from other substances and the method was non-destructive. Furthermore, some inorganic compounds gave a number of minima which "with few exceptions, is the same as the number of known isotopes of the metallic element of the compounds" [8]. For example, the number of isotopes of eight metals were published [10], gold having two minima, palladium three and so on.

The Missing Elements

This method was then used to detect the two elements still missing from the periodic table, numbers 85 and 87. In 1930, Allison and Edgar Murphy announced evidence for element 87 [1]. They had found a minimum corresponding to this element in samples of pollucite and lepidolite ores at very low concentrations [1]. Further work was reported on the chlorides, sulphates, hydroxides and nitrate of this element, which they named Virginium (Va) [2]. Their technique also pointed to the fact that it appeared to exist as six isotopes. It had been suggested that the minima observed were actually those of rhenium but

J.L. McGhee and Margaret Lawrenz, working independently at Emory University, Georgia, also confirmed the presence of the missing element. Element 85 was discovered in 1931 [3]. It was reported to occur in seawater, monazite sand, etc. Allison and co-workers produced graphs of scale readings against chemical equivalence of metallic radicals for halogens, including element 85, which they named Alabamium (Am) [4]. They continued the study of this element including the preparation of lithium alabamide (LiAm), hypoalabamites, alabamites, alabamates, peralabamates and the corresponding acids. The truth about the elements 85 and 87 were revealed at about the end of the decade. Francium, element 87, was correctly reported by Marguerite Perey in 1939 and Astatine in 1940 by D.R. Corson, K.R. Mackenzie and E. Segre. These discoveries alone would have brought into question the very nature of the technique used to identify them but by 1935 the *Journal of the American Chemical Society*, and other reputable journals, were not accepting papers on the effect. The technique seemed rapidly to have gone into history.

Fact or Fiction?

As a means of analysis, the method had its attractions: it could identify cations at phenomenally low concentrations (one part in 10^{11}), it was non-destructive, comparatively inexpensive and, once the machine had been set up, it was a particularly rapid means of analysis. Apparently it had wide application. Although Allison's team used it mainly with solutions of inorganic materials, other workers used it to:

- detect the formation of formaldehyde from irradiated carbon dioxide and water
- detect vitamin A
- locate uranium salts in the organs of rabbits [11]

But there were several aspects which laid the technique open to challenge. Even Allison was cautious in extolling it. This arose not from the cascade of papers which stemmed from his department, but from the concern that the effect seemed to be "observer-dependent". He recorded that "its operation … requires the attainment of a considerable amount of experience and technique on the part of the observer. It is not to be expected that, in the present state of development, that the method will yield dependable results in the hands of the average user" [6]. He also stated that "not every eye is adapted to this type of observation" [8].

In 1936, on the cusp of its demise, Stancil Cooper and T.R. Ball [11] attempted to provide a balanced review of the status of the technique. Essentially, and somewhat uncritically, they put forward its successes: Alabamium, Virginium and all the rest. They also use as supportive evidence the following facts:

- Allison's minima were confirmed by other workers in other parts of the country.
- That it seemed to be successful in analysing "unknowns". Most famously, J.L. McGhee and Margaret Lawrenz gave Allison and co-workers twelve unknown solutions and they were correctly identified within three hours [12]. Similar tests were not as conclusive, with reports of "80% accuracy" and "10 out of 12 unknowns determined correctly".

Cooper and Ball also reviewed the opposing evidence. Many groups of workers had failed to find consistent minima. Sometimes minima were apparent both with and without the analyte substance in the second cell. Others considered that it would be impossible for solutions of such remarkable low concentration to exert the type of Faraday effects being reported, though Cooper and Ball counter this with the remark "Lack of an acceptable explanation for the Allison effect does not, however, invalidate the mass of experimental data which has been obtained on the magneto-optic apparatus". They found, eventually, in favour of the method: "the mass of positive data which has been confirmed by objective means far outweighs numerous negative results whether objectively or subjectively determined. The results obtained with the magneto-optic apparatus, therefore, have led the authors to believe conclusively that the minima exist and that they are characteristic of the substance, or substances, under investigation".

In 1953 Irving Langmuir gave a lecture (later transcribed and published in 1989 [13]) on what he termed *Pathological Science*. This comprised examples of science which, at their time, had appreciable followings and which engendered a stream of peer-reviewed publications. Essentially, though, the phenomena did not stand the test of time and their adherents fell away. Langmuir used the following criteria to identify "the science of things that aren't so":

- The maximum effect that is observed is produced by a causative agent of barely detectable intensity, and the magnitude of the effect is substantially independent of the intensity of the cause.
- The effect is of a magnitude that remains close to the limit of detectability or, many measurements are necessary because of the very low statistical significance of the results.
- There are claims of great accuracy.
- Fantastic theories contrary to experience are suggested.
- Criticisms are met by *ad hoc* excuses thought up on the spur of the moment.
- The ratio of supporters to critics rises up to somewhere near 50% and then falls gradually to oblivion.

Typical of his inclusions was his account of "N-rays" (1903-4) which seemed to emanate from heated iron, sun-soaked bricks, human heads and bent wooden twigs. Undergoing laws of refraction, confidence in the phenomenon evaporated when the refraction continued, even when the prism doing the job had been surreptitiously removed from the apparatus. But is it fair to include Allison's work in this category? We think not. Certainly the technique over-reached itself with bold, and later discredited, claims, though there was never any deliberate attempt to deceive. But in the identification of unknowns, where it appears to have had some success, perhaps there was something in it. Allison and his teams certainly had the gift of detecting minima, which seems to mean something. And yes, it is inexplicable … but so is water divination (if one admits it exists).

The Last Word?

As late as 1966, M.F. Mildrum and B.M. Schmidt of the United States Air Force published at length on the technique [14]. Presumably they felt that if they could make the method work, its sensitivity would make it an important tool for analysis. But although they conclude that the investigation "has produced the same subjective evidence observed by previous experimenters", there was no follow-up. To our knowledge, there have been no further attempts to explore the Allison method of analysis. In part, this may be because there are other, less subjective, means of analysing at very low concentrations. But it may also be because researchers may be reluctant to identify themselves with what might be a chimera: a figment of their imagination. And how many scientists are exploring cold fusion today? Not many, we think.

The Allison Effect and the Discovery of Tritium

The discovery of tritium is usually attributed to Ernest Rutherford and co-workers (1934) but Wendell Latimer used the Allison apparatus to show the existence of the isotope a year earlier in 1933. Of his discovery,

Latimer has said, "After I published that paper I could never repeat the experiments again. I haven't the least idea why. But those results were wonderful. I showed them to G.N. Lewis and we both agreed that it was all right. They were clean cut. I checked them myself in every way I knew how to. I don't know what else I could have done, but later on I just couldn't ever do it again". However, he did win a $10 bet with G. N. Lewis, who thought there was nothing in the Allison Effect.

The isotopes of hydrogen by the magneto-optic method. The existence of H-3 [15]

In order to test further the presumption that the minima observed in the magneto-optic method as developed by Allison depend upon the isotopes of the positive ions present, we examined water solutions containing approximately 2 and 4 percent of heavy hydrogen (H-2). A solution of HCl in ordinary water gives minima at 15.74 and 15.85 (Allison units); the latter, which is presumably due to H-1, is considerably stronger. These values agree with those reported by Allison in his earlier work in which he concluded the existence of H-2. In the heavy water solution we find the intensity of the 15.74 minimum almost equal to the one at 15.85 and in addition a third minimum at 15.65. The position of this minimum corresponds to that expected of H-3, and its intensity is somewhat less than the 15.74 minimum (H-2) in ordinary water.

We have checked the HCl results with HBr. The minima in the solution in ordinary water are at 12.97 and 13.09 and the new minimum in the heavy water solutions is at 12.84.

The heavy water was supplied to us by Professor G.N. Lewis, and he and Dr Spedding are carrying out further spectroscopic investigations of the existence of H-3.

WENDELL M. LATIMER, HERBERT A. YOUNG Department of Chemistry, University of California, Berkeley, California, September 25, 1933.

From the February 15, 1930 issue SCIENCE NEWS: [16]

ELEMENT 87 FOUND

With a method so delicate as to detect the presence of a chemical compound when dissolved in 10 billion times its own weight of water, Dr. Fred Allison and Edgar J. Murphy, of the physics department of Alabama Polytechnic Institute, have located the unknown element number 87 in two well-known minerals. They will make a preliminary report of their research in the forthcoming issue of the *Physical Review* official journal of the American Physical Society. Lepidolite, a form of mica, and pollucite, a mineral consisting chiefly of the elements caesium, aluminium, and silicon, were the substances studied. As the properties of element number 87 are known in a general way, even though it has not yet been discovered, Dr. Allison and his colleagues were able to predict its effect. Studies of the substances in four different chemical combinations all showed the effects that would be caused by element 87. This, say the experimenters, "affords evidence of considerable weight for its presence in the sample under test".

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Alan Dronsfield

Margaret Hill

Faraday's "Blue" Plaque - Commemorating a Remarkable Master as well as a Remarkable Servant

"Memorial tablets" (the predecessors of "blue plaques") were first proposed by William Ewart, MP in 1863. The proposal was taken up by the Society of Arts [1] [2], which erected thirty-five plaques between 1867 and 1901 [3]. The scheme passed to the London County Council in 1901 and is now administered by English Heritage. Of the thirty-five plaques, one erected in 1875-6 [4] can still be seen at N^{o} 48 Blandford Street in the Marylebone area of London. The plaque (Figure 1) states that Michael Faraday (1791-1867), Man of Science, was an apprentice there. Other plaques erected in 1875-6 along with Faraday's, or earlier, included those honouring Samuel Johnson, David Garrick, Horatio Nelson, Benjamin Franklin, Sir Joshua Reynolds, and Napoleon III.

Figure 1: The Plaque on 3 January 2013

The plaque is a red-brown colour – not blue! – with white lettering. Close inspection of the "pattern border" reveals in its upper half the words "ERECTED BY THE", and in its lower half the words "SOCIETY OF ARTS".

The story of how Faraday's apprenticeship as a bookbinder in Blandford Street led to his being taken on by Sir Humphry Davy at the Royal Institution in 1813 is a romantic one [5-8]. In mid-1791, the Faraday family left Outhgill in Westmorland seeking better financial prospects in the London area. (Outhgill, OS square NY 78 01, now in Cumbria, still has a "Faraday Cottage".) Initially, the family moved to rooms near the Elephant and Castle Inn, Newington; the family then consisted of James Faraday, a blacksmith, his wife Margaret (pregnant with Michael), and children Elizabeth and Robert. Michael Faraday was born on 22 September 1791. By 1796, the family was living in Jacob's Well Mews in Marylebone. It was while living there that Michael received rudimentary schooling, and from there, on 7 October 1805, that he was taken on as an apprentice bookbinder by George Riebau of Nº 2 Blandford Street, a few streets away (Figure 2). Despite the proximity of Riebau’s shop to the parental home, the norm would have been for Faraday to take up residence with his master.

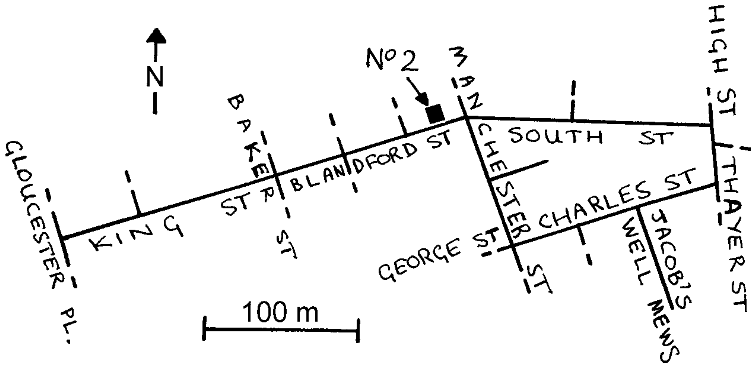

Figure 2: Modern Street Plan with *Former* Street Names According to Ref. [9].

King Street, Blandford Street, and South Street are now all called Blandford Street, numbered east-west. Riebau’s shop was Nº 2 Blandford Street, OS reference TQ 281(6) 815(5) by GPS near the front door, and is now numbered 48. High St is now called *Marylebone* High Street. George Street and Charles Street are now both called George Street. The other street names are unchanged. Portman Square is three blocks south-south-east of King Street.

Any lingering doubt that the modern Nº 48 was formerly Riebau’s shop at Nº 2 is dispelled by the close resemblance between a contemporary drawing (Figure 3), and a modern photograph (Figure 4), which are included in the online version of the newsletter. The irregular spacing of the first-floor windows distinguishes the house from other houses nearby.

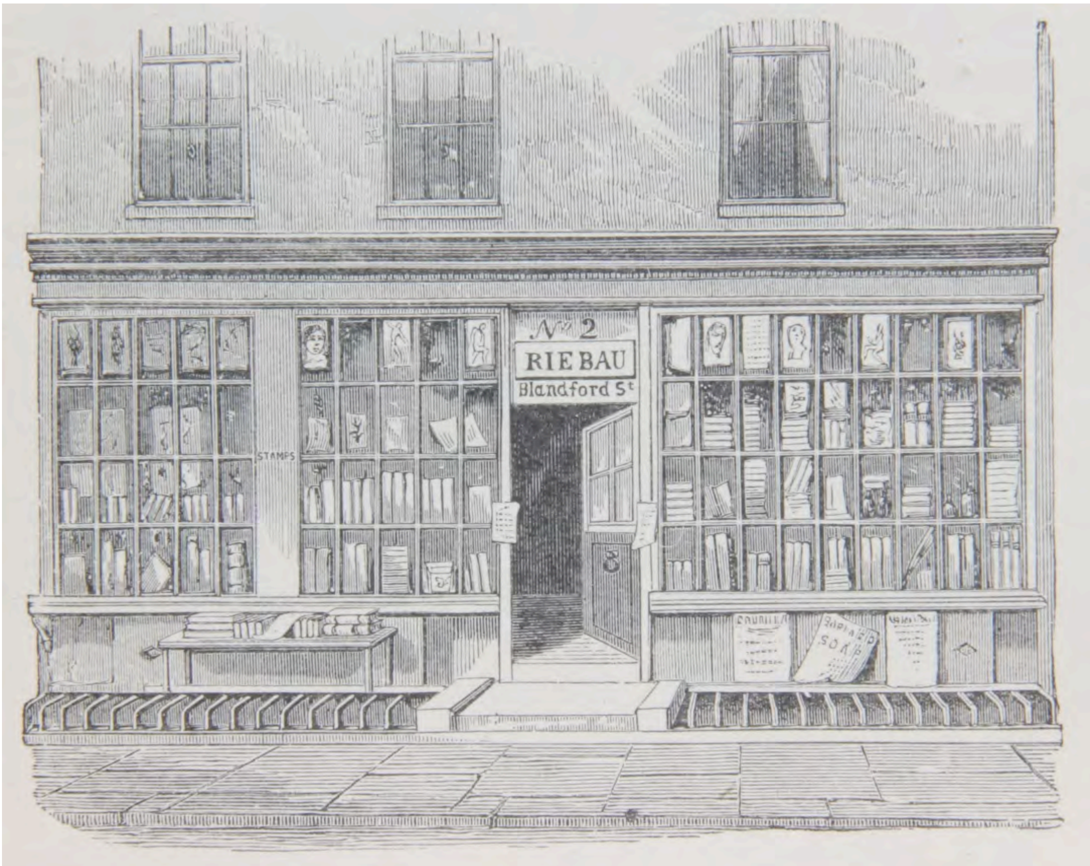

Figure 3: Riebau’s Bookshop [10].

“Nº 2” appears above “RIEBAU”, and “Blandford St” below.

Riebau recognised Faraday’s talent and generously facilitated Faraday’s intellectual development. At the same time, Faraday’s training as a bookbinder developed his skill with his hands. Without Riebau, science would almost certainly have been deprived of one of its greatest thinkers and experimentalists. Riebau encouraged Faraday to read scientific books that passed through the shop, including Lavoisier’s *Elements of chemistry*, Jane Marcet’s *Conversations on Chemistry*, and Thomas Thomson’s four-volume *System of Chemistry*. For electricity, Faraday used the *Encyclopaedia Britannica* article by James Tytler and *The Dictionary of Arts and Sciences*. In early 1810, Faraday began to attend the lectures of Mr Richard Tatum at 53 Dorset Street off Fleet Street [2, L30], not to be confused with the Dorset Street in Marylebone. Faraday also attended meetings of the City Philosophical Society which Tatum had established (in the 1820s, the CPS was to be informally absorbed by the Society of Arts [2]). Faraday received tuition to improve his writing from Edward Magrath of the Society. He attended Sir Humphry Davy’s lectures at the Royal Institution in Albemarle Street on 29 February, 14 March, 8 April, and 10 April 1812. Faraday made visits to bridges and waterworks to improve his general knowledge of civic and industrial installations. Riebau’s encouragement extended to allowing Faraday to use a back room as a laboratory outside working hours.

Figure 4: N^{o} 48 Blandford Street on 20 December 2012.

The house comprises two shops (the Doorsteps sandwich bar and Faradays Property Consultants) and two apartments, and has three front entrance doors.

The earliest of Faraday’s amateur experimental work for which there is evidence was the construction of a working electrostatic generator [11]. This was made by Faraday with money and materials from Riebau, his father, and his brother, which dates the commencement of the project before the death of Faraday’s father on 30 October 1810. Unfortunately, the original papers used by J.H. Gladstone, the author of reference [11], those of “the late Sir James South”, are now lost [12]. South had somehow acquired the machine itself, and had shown it to Faraday in his later years, who had been “much affected at the sight of the favourite of his boyhood”. Unlike South’s papers, the machine survives (and is on display at the Royal Institution). In the course of making the machine, Faraday had dissolved sealing wax in an unspecified solvent and then used the solution to coat the two corks which closed the ends of a large glass cylinder and allowed it to be fixed onto the machine’s rotating axis. Faraday later said that his dissolution and precipitation of the wax was his “first chemical experiment”.

Evidence of Faraday’s later amateur experimental work comes from a remarkable correspondence between Faraday, then in the last three months of his seven-year apprenticeship, and Benjamin Abbott. Abbott was a city clerk of good education whom Faraday had met through the City Philosophical Society and who lived in Long Lane, Bermondsey. Between 12 July and 1 October 1812, Faraday dealt at length with scientific matters in ten letters to Abbott [L3-5, L7-13], and received a comparable number of (now-lost) letters from

Abbott. As well as engaging in theoretical discussion, Faraday describes his construction of two voltaic piles and his electrolysis of aqueous solutions, moreover in a style that gives the reader confidence in the accuracy of his observations. Abbott was doing his own experiments, and one assumes that their amateur efforts had been going on for some time (compare [L30]). The principal reason for the correspondence – the two men met frequently – was set out in Faraday's first letter begun on the afternoon of Sunday 12 July 2012 [L3]. Faraday justified communication by "Epistolations" (his own neologism) as "improving the mind of the person who writes, & the person who receives". Faraday sought among other things to improve his "Grammar &c" and his ability to express himself. He noted that ideas "generated and formed in the head" became "clear and distinct" in writing.

But on 7 October 1812, Faraday's apprenticeship with Riebau ceased, and he took up a journeyman position with Henry de la Roche, of "King Street, Portman Square". At this period, before postal districts, it was normal to locate minor streets by reference to a nearby major street or square, which allows the identification of King Street with that in Marylebone, *i.e.* the westernmost section of the modern Blandford Street (Figure 2). The work load was high, and Faraday had presumably lost the part-time laboratory in Riebau's back room. In consequence, the correspondence became one-sided for the next five months, with Abbott writing numerous letters to Faraday but Faraday writing only two to Abbott, neither specifically discussing science [L14, L16]. Faraday wrote to another City Philosophical Society friend, T. Huxtable, "I must resign philosophy entirely to those who are more fortunate in the possession of time and means..... I am at present in very low spirits" [L15]. Faraday later recalled having thought that "trade" was "vicious and selfish" and having imagined that "the service of Science ... made its pursuers amiable and liberal" [L419].

Ironically, Faraday's escape from the bookbinding trade was assisted by his skill in that very trade. Faraday had presented to Riebau bound volumes of his notes of Tatum's lectures. Through Riebau, these were seen by a Mr Dance who lived in the adjacent Manchester Street (Figure 2) at N^{o} 17. It was Dance [13], a member of the Royal Institution, who gave Faraday his tickets to Davy's lectures in early 1812. With the encouragement or recommendation of Dance and/or Riebau, Faraday may have procured a meeting with Davy in early October 1812. At any rate, Faraday was sufficiently known to Davy that when the latter injured his eye in late October 1812 (a nitrogen trichloride explosion), he chose Faraday to serve as an amanuensis while he recovered. (Presumably Faraday did this outside his working hours for de la Roche.) And at some time during the last four months of 1812, Davy saw Faraday's bound volume of the notes he had taken of his own, *Davy's*, lectures. Davy had in May 1812 resigned from paid employment with the Royal Institution, but was still an honorary professor. In a letter to Faraday of 24 December 1812 [L17], Davy warmly promised to do what he could for him: "It would gratify me to be of any service to you. I wish it may be in my power". Faraday was an obvious choice should any junior post become available at the RI.

On 19 February 1813, such a post did become available when the laboratory assistant at the Royal Institution, William Payne, attacked the Institution's instrument maker, John Newman, and was sacked. On 22 February 1813, Davy sent a note to Faraday inviting him to a job interview. On 1 March 1813, Faraday was appointed Payne's replacement by the Institution's managers with rooms in Albemarle Street. On 8 March 1813, from his new situation, Faraday resumed writing to the tolerant Abbott, "in the expectation of a recommenced & reinvigorated correspondence" [L18] [14]. In this letter, he reverted to scientific matters, namely the work he had done for Davy on the extraction of sugar from beetroot and the preparation of carbon disulfide. Now a full-time worker in a properly equipped laboratory, Faraday's talents, already so evident during his apprenticeship with Riebau, could begin to develop fully.

The author thanks Professor Frank James of the Royal Institution, Ms Freddie Magner of Faradays Property Consultants, and Mr Malcolm Thick, FRHistS for their help. Refs [2] and [4] were kindly made available by the RSA archive, RSA, London.

"L" references in the text indicate the number given to a letter in Frank A.J.L. James (ed.), *The Correspondence of Michael Faraday, Volume 1, 1811 – December 1831, Letters 1-524* (London: Institution of Electrical Engineers, 1991).

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BOOK REVIEWS

Gerald Hayes, *The Catalyst Triangle: Mathieson, McKechnie and Wigg*, edited and published by Diana and David Leitch, 2013, Pp. 70, A4, paperback publication, £7.10 (including postage and packing).

This book, launched at an RSC Historical Group meeting in March at the Catalyst Science Discovery Centre in Widnes, tells the story of three men who were chemists and businessmen in Runcorn and Widnes in the mid-nineteenth century. The first was Neil Mathieson (1823–1906), who was born in Campbeltown, Argyll and Bute, and spent time in Glasgow employed as a soap maker before moving on to John & Thomas Johnson, soap and alkali makers in Runcorn, where he became works manager. The second was Duncan McKechnie (1831–1913). He was also born in Kintyre and followed the same route, being a soap boiler in Glasgow, before moving to become a foreman at a soap and alkali factory in Runcorn in 1864. Finally, Charles Wigg (1824–1899), was born in Liverpool and was a merchant there. Wigg and Mathieson established a new factory in Runcorn in 1865, known as the Old Quay Chemical Works, later known as the Wigg Works. Initially, the works manufactured soap and alkali, but soon moved on to extracting copper from pyrites ash, and later making bleaching powder and ferric oxide. Duncan McKechnie joined in 1869, but left the partnership in 1871 and moved to St Helens.

The ancestors and descendants of these three men are densely detailed in this book which is lavishly illustrated with vintage pictures and maps. In addition, there are present day colour illustrations of the Kintyre area and the Runcorn and Widnes area. With twenty-six references, this book provides an introduction to the chemical industry in the Runcorn and Widnes area in the nineteenth century. The author is a chemist, formerly a Principal Lecturer at the Department of Chemistry at Manchester Polytechnic, and now following his long-term interest in the history of chemistry. This book is a work in progress and the author welcomes any corrections or further information which is now becoming available through digitisation of old records. He can be contacted at chemhist@msn.com.

All proceeds from the sale of this book will support the Catalyst Science Discovery Centre. For further information, please contact Diana Leitch, diana.leitch@gmail.com.

Chris Cooksey

Michael Freemantle, *Gas! Gas! Quick, Boys! How Chemistry Changed the First World War* (Stroud: The History Press, 2012), Pp. 240, ISBN: 978-0-7524-6601-9, £18.99.

Most people will have discovered the appalling human suffering of combatants in the First World War through the poems of Siegfried Sassoon, Isaac Rosenberg and Wilfred Owen, written during the conflict and so heightening their sensitivity and impact for those who read them. The title of this book, *Gas! Gas! Quick Boys!* is a quotation from the poem by Wilfred Owen, ‘*Dulce et Decorum Est*’, but this title is misleading. While it is probably used to attract the attention of a prospective general reader, the book is a more serious study than just the deployment of chemical gases in the First World War. Chapters include: “Shell Chemistry”, “The Metals of War”, “Caring for the Wounded”, “Killing the Pain” and “Dye or Die”.

World War I has been called the Chemists' War because of the crucial part played by chemistry in the conduct of the war and Michael Freemantle's book reflects this wider role.

The book provides a detailed guide to the different explosives and the role of different metals in shell construction, and considers the different types of warfare gases, such as lachrymators (xylyl bromide) that irritate the eyes, sternutators (diphenylchlorarsine) that irritate the nasal passages causing vomiting, choking agents (chlorine and phosgene) that act as asphyxiators, vesicants (mustard gas) that blister the skin and blood agents (cyanides) that interfere with the oxygen take-up of blood, all of whom were used singly or in combination when deployed. Interestingly, it is generally accepted that it was the French who first used gas warfare in World War I when they deployed tear gas (ethyl bromoacetate) in August 1914 and this started an escalation on the part of the major participating nations that involved the use of more harmful agents, a variety of deployment methods and larger quantities of gases.

It is often difficult to find reasonable estimates of casualties and weapons to express concisely the impact of a war but this is probably not the case with World War I. The total number of casualties is estimated at over 37 million, with Britain suffering about 2.5 million casualties. It is estimated that the British alone fired 250 million shells over the period of the war, 28 July 1914 to 11 November 1918, which works out at about 100 shells per minute. It is also known that on certain days of this conflict that involved close-fought trench warfare as many as 66,000 British troops died. Reading this book prompts several moral questions about the futility of such loss of life and how justified it is to continue using tactics that result in such high daily loss of life for such little gain of territory or advance. There is also the question as to whether given the nature of trench warfare, the chemists' contribution actually shortened the war and reduced what might have been even higher casualties.

This is a very well researched and written book, and though aimed primarily at the general reader it has a good deal to interest historians of chemistry as well as historians of technology and medicine, and those engaged in war studies. Given its structure and thorough index, the book could also become a useful reference work. At £18.99 this is a book every chemist should try to read

Peter Reed

Carl Djerassi, *Chemistry in Theatre: Insufficiency, Phallacy or Both* (London: Imperial College Press, 2012), Pp. 112, ISBN-13: 978-1-84816-937-1, £16.

Of the few plays written about science and scientists, most deal with historical characters, from Priestley, Lavoisier and Scheele to the Curies, Bohr and Heisenberg. Among the sixty-two science plays covered by Sheppard-Barr [1] in 2006, rather few can be called chemical; professional playwrights generally keep well clear of the subject. However, the best known and most frequently performed science play is Michael Frayn's *Copenhagen*, with its fictional conversations in the 1940s between two Nobel scientists who were on the boundaries of chemistry and physics. With an interest in the molecular structure of organic compounds, I first came across Carl Djerassi through his ORD monograph [2] and his later books co-authored with D.H. Williams and H. Budzikiewicz on mass spectrometry. He is much more widely known now, of course, for his distinguished role in developing the oral contraceptive pill, for which he has received many awards; fifty years afterwards, his *This Man's Pill* [3] presents his subsequent reflections. Rather less famous, perhaps, though not for lack of promotion, is his career as a writer of science plays, especially of chemistry, and other fiction.

Born in Vienna, educated in the USA, and with much of his research in the States, Djerassi has homes in San Francisco (Emeritus Professor at Stanford), Vienna and London. I was in touch with him in London when we put on at Bradford University a rehearsed on-stage reading of the play *Oxygen*, written jointly by Djerassi and Nobel chemist Roald Hoffmann in 2001. This links contemporary concerns in academic science with a (fictitious) committee making a retro-Nobel award for the discovery in 1777 of oxygen to just one of Priestley, Lavoisier or Scheele. The RSC (Chemistry, not Company) arranged a presentation of this play. In 1996, the playwright Stephen Poliakoff, brother of the physical chemist Martyn Poliakoff, dramatized the cold fusion story about a Sun Battery in *Blinded by the Sun*, again metaphorically reflecting onto scientists' desire for recognition and the effect of commercial influences on scientific morality.

Djerassi's latest publication contains an extended preface and two one-act plays in which contemporary characters (with a historical insert) deal with fictional versions of real chemistry by chemists who are not Nobel Prize winners. The preface conveys Djerassi's message about chemistry plays that try to be educative through historical characters, especially as in *Oxygen*. He considers that the dialogue style is an aid to teaching. For aspiring chemistry playwrights, Djerassi suggests that one writes first as a text to be read (page rather than stage); this version can then be revised for a radio broadcast or public reading; ultimately, it may be revised further for a theatrical performance. To my mind, these plays seem, as they stand, to have too many short scenes for a conventional audience.

In *Chemistry and Theatre*, Djerassi's *Insufficiency* is a new play of only forty-five pages about a Polish immigrant scientist trying, through his research (based on actual science) on taste and champagne and beer bubbles, to gain tenure at a mediocre American University. Within nine short scenes, four characters manage to touch on peer review, scientific fashion and student evaluation. Like *Insufficienc*y, the play *Phallacy* has a romantic undercurrent, but essentially it involves the abrasive interaction between an art historian and a chemistry professor over the artistic appreciation of an antique naked bronze figure. Chemical analyses – thermoluminescence, energy dispersive X-ray microanalysis and computer tomography are mentioned – they are relevant to the archaeological dating, and perhaps therefore to the significance, of the statue; is it Roman or 'merely' Renaissance? The confrontation takes place in Vienna in the recent past, but there are flashbacks to Don Juan in 1572. As one might expect the title's spelling thinly veils an anatomical link. The character flaw evident in the play, that of defending a favoured hypothesis even when it is no longer tenable, can occur in art or science; it applied to at least one Nobel Prize winner.

The book is commended on its cover by two Chemistry Nobel Prize winners. For the more ordinary chemist, the preface and plays provide an enjoyable read and point one towards the value of the texts of chemistry plays even if they are rarely or never staged in a theatre.

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MEETING AND CONFERENCE REPORTS

The History of the Chemical Industry in the Runcorn - Widnes Area

Held at Catalyst, Mersey Road, Widnes, WA8 0DF, 2 March 2013

The Historical Group only rarely holds meetings outside of London, and in a new departure we decided to welcome to this event anyone who was interested - not just RSC members. We attracted many people from the local community, including former ICI employees and members of local historical societies, as well as people from other parts of the UK. There were almost one hundred attendees, including two Mayors with their Mayoresses, and Graham Evans, MP for Weaver Vale. The meeting consisted of seven presentations, and also featured the launch of a book, *The Catalyst Triangle*, written by Gerald Hayes and edited by Diana and David Leitch. The book describes the family history and contributions to the local chemical industry of three men, Neil Mathieson, Duncan McKechnie and Charles Wigg. Copies are available from Dr Diana Leitch diana.leitch@gmail.com at £7.10 including postage & packing. Purchasers from abroad should contact Dr Leitch for overseas rates.

Runcorn's Chemical Foundation, or Location, Location, Location
Dr John Beacham, TrusTech and University of Liverpool

Until the eighteenth century, Runcorn was an insignificant community, with a ferry on the banks of the River Mersey. This was changed by improvements to the Mersey (1740) and Weaver (1732) navigations, and the construction of the Duke of Bridgewater's Canal (1776) and its connection to the Trent and Mersey Canal (1791). These and later improvements made Runcorn a transport hub for raw materials and goods (salt, coal, soap and pottery), which was to peak in 1884. It connected the South Lancashire coalfield, the Cheshire saltfield, Manchester and the Potteries to a wider world through the Liverpool docks. This hub also made Runcorn a desirable site for manufacturing and several soapworks began in the early 1800s. Quarrying of Runcorn's sandstone was also stimulated.

Soap making requires alkali which was provided by using the Leblanc saltcake process, which in its turn needs salt from the Cheshire saltfield and a lead chamber sulfuric acid plant. To accommodate this growing soap, alkali and acid industry production now moved westward to available land at Weston (Rocksavage) and further encompassed bleaching powder production and copper recovery from the acid waste. Although still growing this was quickly overtaken by dramatic growth across the river at Widnes.

By 1890, competition from the new Solvay alkali technology established in mid-Cheshire by Brunner and Mond in 1874 caused all the Leblanc alkali makers to amalgamate into the United Alkali Company, UAC, (48 producers nationwide) and close half their plants. The Weston complex, however, remained an important producer.

More significantly, the Castner Kellner Alkali Company was formed at Weston Point (between Weston and Runcorn), in 1895 to operate mercury cells to produce sodium hydroxide and its co-product chlorine, by electrolysis. This technology was mistakenly rejected by the UAC and later bought up by Brunner Mond (1920). By 1910 excess chlorine was being used to make per and trichloroethylenes.

This technology became the major foundation of the twentieth-century chemical industry in Runcorn, with the alkali/acid complex at Weston eventually being closed. Industry in Runcorn old town was now mainly quarrying and tanning, with Runcorn becoming, for a time, the largest leather producer in Britain.

Leblanc Widnes
Dr John Hudson, Loweswater, Cumbria

Demand for alkali grew rapidly in the second phase of the industrial revolution, being required by a number of industries, among them soap, glass, textiles and paper. By the late-eighteenth century, the traditional vegetable sources of alkali were proving inadequate. Nicholas Leblanc in France devised the first viable process for converting salt into alkali, but the onset of the French Revolution prevented his newly erected works from going into production. The secret of his process became known in Britain, and the first Leblanc factory opened on Tyneside in 1802.

Leblanc alkali works were soon in operation in Liverpool, Runcorn, Newton and, especially, St Helens. In 1833 Widnes still had no industry, but in that year the Widnes dock opened, which was linked by both canal and railway to St Helens. Vicious competition between canal and railway drove down freight rates, so the Leblanc manufacturers of St Helens enjoyed cheap transport of the necessary raw materials (salt, pyrites and limestone) from the dock, and coal was available nearby. When the railway and canal merged in 1845, freight rates for all items except coal rose dramatically, so when John Hutchinson, who had been a partner in a Leblanc works at St Helens, wanted to set up on his own, the hitherto rural Widnes was the ideal location.

Thereafter Widnes developed dramatically. The Leblanc concerns manufactured the sulfuric acid they needed, and other processes utilizing products, such as the manufacture of soap, superphosphate fertilizer, bleaching powder, copper (recovered from spent pyrites) and sulfur recovery, grew up alongside. Within a few years Widnes, which had commenced chemical manufacture relatively late, had outstripped all of its neighbours as a chemical town. However, Widnes did not embrace the newer Solvay and electrolytic processes. Under threat, the Leblanc manufacturers nationwide combined in 1890 to form the United Alkali Company. Ferdinand Hurter set up the Widnes Research Laboratory for the UAC, and introduced many refinements to the Leblanc process. But the writing was on the wall. The Leblanc process couldn’t compete with its newer rivals, and the last plants were shut down in the early 1920s.

In spite of his efforts, which now appear somewhat misdirected, Hurter was a brilliant chemist. The research laboratory served as a fitting memorial, and many products and processes were developed there in the twentieth century. Even in his spare time, Hurter pursued chemical research, and did much valuable work on photographic emulsions. Widnes of course continued as a centre of the chemical industry until long after World War II.

Widnes: Where There’s Muck, There’s Brass!
Peter Reed, Leominster Herefordshire

In his thirteenth Annual Report to Parliament as Chief Inspector of the Alkali Administration in 1880, Robert Angus Smith wrote: “It is true that those coming to Widnes even from very dark and gloomy skies enter that town with a certain awe and horror.... and wonder if life can be sustained there”. The two main culprits were hydrogen chloride (or muriatic acid gas as it was known in the trade) and sulfur waste (or *galligu* as the inhabitants in Widens called it), both by-products of the Leblanc process. They were by-products, but they were treated as waste products until their economic value was realized.

Until the 1850s hydrogen chloride was inefficiently released from tall chimneys and was a constant source of complaint. Then the acid tower invented by William Gossage was introduced converting the gas to hydrochloric acid. Until the early 1860s there was little use for this acid so it was run into rivers, streams and canals; one form of pollution was replaced by another! With the importation of esparto grass for manufacturing paper the demand for chlorine for bleaching powder increased. The hydrogen chloride in the form of the acid or gas was converted into chlorine by the Weldon process (1866-69) using the acid and by the Deacon process (1868-70) using the gas.

The *galligu* was a black, gooey, smelly substance containing a high proportion of the sulfur originating in the sulfuric acid. By the 1870s, 500,000 tons were produced each year and most was dumped on waste ground close to the alkali works. Sulfur was an expensive commodity and when in the late 1830s supplies from Sicily were restricted, the source of sulfur switched to iron pyrites (later copper pyrites). Attempts were made by William Gossage (1837) and Ludwig Mond (1861) to recycle the sulfur, but only the Claus-Chance process (1888) could handle the very large quantities. However by this time the Leblanc process was becoming obsolete. Remnants of the *galligu* survive in a chemically stable form even today.

While successful treatment of the hydrogen chloride gas and the sulfur waste reduced the level of pollution in Widnes, the economics of the Leblanc process were improved, confirming the adage: where there's muck, there's brass!

Runcorn and Widnes in the First Half of the Twentieth Century
Dr Diana Leitch, Information Consultant

The creation of the United Alkali Company in 1890 came just before the building of the Manchester Ship Canal in 1894. The latter, together with the building of the Transporter Bridge in 1905, transformed the transport infrastructure of the area. The two towns of Runcorn and Widnes which had been divided by the River Mersey were brought together, improving transport to the hinterland of Manchester and the passage of chemicals. Companies on both sides of the river thrived and developed. Using a wide range of illustrations from both her family's own collection and other local collections, Diana was able to show some of these transport changes and also late-nineteenth and early-twentieth century images of firms such as McKechnie's, Wigg's, Mathieson's, Gossage's, Evans, Lescher and Webb, Castner Kellner, Salt Union and Towers Glassblowers. The role of firms in World War I such as Pilkington's and Sullivan's and the lead up to the creation of ICI in 1926 by the amalgamation of many local firms was also illustrated, as were early copies of the ICI Magazine and its contents. Rare photos relating to staff who worked at KEMET (Chemical and Metallurgical Corporation) and ICI Research Laboratory, Widnes, in the 1930s were included. ICI Rocksavage Works was opened in 1938 by the Ministry of Supply and its role during World War II plus that of ICI Randle, or 'The Hush-Hush' Works on Wigg Island, and their relationship to 'Valley Works' near Flint was shown. The all-encompassing influence of 'The Company', namely ICI, on the lives of local people in Runcorn and Widnes was well-illustrated with staff pictures, social events and a brief history of the remarkable company guest house, Lawson House in Runcorn. The dramatic changes that have occurred in the area since then were obvious around the Catalyst building. The involvement of Diana's family over the period in question mirrored those of the families of many people present. It was fitting that this talk was given in the Catalyst Centre where Diana's aunt had worked when it was Gossage's Soap Works in the 1920s and 1930s.

Nuclear Bomb Work at Runcorn and Widnes During World War II
Dr T. Vincent Attwood, University of Liverpool

Predictions of nuclear weapons followed the discovery of nuclear fission in 1939 and George Thomson with the MAUD Committee examined the possibility of such a bomb. Norman Haworth, Professor of Chemistry at Birmingham, assumed responsibility for the preparation of uranium, fluorine and fluorinated compounds, while ICI Runcorn and Widnes were chosen to produce the above materials for use in an isotope separation plant. Uranium hexafluoride was required for diffusion through a porous membrane to separate uranium 235 from the heavier isotope, uranium 238. A prototype diffusion unit was built near Rhydymwyn in North Wales where it separated some chemical compounds, but it was abandoned before testing with uranium hexafluoride.

In January 1942 there was an accident involving a worker at the Widnes plant, he was hospitalised and while the exact cause was not established, it was probably due to the inhalation of uranium fumes when he helped to extinguish a fire following the spontaneous ignition of some uranium. This accident instigated a series of tests to find the levels of uranium contamination of the site and of the workers.

Metallic uranium needed for the diffusion separation plant was required in rod form and various methods of preparation were tried including casting and rolling. In America both uranium 235 and plutonium were refined and bombs made. The first bomb tested at Alamogordo was a plutonium device followed by 'Little Boy', a uranium 235 device over Hiroshima, and the plutonium device on Nagasaki a week later.

The Latter Days of Widnes Research Laboratory
Professor Colin Suckling, University of Strathclyde

The Widnes Laboratory was probably the first industrial chemical research laboratory founded specifically for the purpose of pursuing applicable and commercially relevant scientific research. In 1891 Dr Ferdinand Hurter, the first chief chemist of the United Alkali Co. Ltd., persuaded his directors to found the Laboratory on a site in Widnes. Over the course of time, through mergers forming ICI and expansion, the Widnes Laboratory became one of the major locations for innovation and development in the chemical industry world-wide. Its final twenty-five years of activity, from approximately 1945 to 1960, was marked by research and development in an exceptionally wide range of chemistry, including elements such as titanium and silicon and especially halogenated organic compounds, including chlorinated hydrocarbons (Cereclor), chlorinated rubber (Alloprene), herbicides such as Methoxone and Gramoxone, and the inhalant anaesthetic, Halothane. Professor Suckling's father worked at the Widnes Laboratory during its last quarter century. Through this family connection, and using recollections of visiting the Widnes Laboratory at weekends, published materials, and the ICI General Chemicals Division Research Papers Archive held at Catalyst, Professor Suckling discussed the special characteristics of integrated research and development that made the Widnes Laboratory such a powerful force for innovation.

Runcorn and Widnes - The Future
Jenny Clucas, Cogent Sector Skills Council

Jenny's presentation gave both a personal and industrial perspective on the chemical industry in the Runcorn and Widnes area. Her chemical career has been closely linked with the area since finishing her Ph.D. at Liverpool University and starting with Laporte Chemicals in Widnes.

The chemical sector is a crucial component of our world-leading science base here in the UK and will be a key driver for UK growth. It spans chemistry and chemical engineering and underpins advances in a number of scientific areas, e.g. life sciences, materials science, nanotechnology, and industrial biotechnology. The chemical sector is a vital component of the North West economy, with over 650 companies and a turnover of £10.2bn; the North West constitutes at least 22% of the UK chemical industry (Chemicals Northwest Mapping Study 2010). The strengths of the industry in the North West include materials chemistry and formulation technology expertise, the manufacture of high value speciality chemicals, halogen chemistry and manufacture and contract manufacturing. This is all mirrored in the Runcorn/Widnes area.

Whilst the powerhouse of ICI has gone there is still a wide range of 'big', 'established' and 'new' companies present in the area. The presentation highlighted companies in each of the classifications and illustrated that they are investing in new innovations, new processes and plant, and new people. For example: the multinational global UK company Croda relocated a sunscreen plant to Widnes from Teeside and has built a new fermentation plant to exploit industrial biotechnology; the small and medium-sized enterprise (SME), Syntor, is developing new advanced materials, expanding its R&D facilities (building a brand new high-tech facility in Runcorn) and recruiting graduates; Nanoco, a spin-out from Manchester University, which produces quantum dots, is doubling its space and team in Runcorn.

In looking to the future, skills are a vital component of a thriving industry and a pipeline of talent is essential to maintain and grow the industry - we need the scientists and technicians of the future. The area has excellent universities close by, a wide range of colleges and schools, and numerous outreach activities, including resources and activities provided via the RSC. Given that this conference was held at Catalyst, Jenny highlighted the role Catalyst plays in educating and inspiring students (and teachers and parents) about chemicals and science in general and how it relates to our everyday lives. Catalyst has been successful in winning funding for two new projects: "Origins – The Birth of the Chemical Elements" and "Explore Your Universe", the former with support and funding from the RSC. These projects will deliver exciting new workshops and cutting edge science programmes.

In summary, variety now gives the region its current and future strength, with key commodity production underpinning speciality products, and SMEs growing and leading the way with innovation. Companies are investing in the region; the chemical industry is still here in Runcorn and Widnes!

John Hudson

History of Fluorine - Some Historical Aspects of the Chemistry of Fluorine

This meeting was held on Thursday 21 March 2013 in the Chemistry Centre at Burlington House, with eighty attendees. After coffee and registration at 11.00, attendees were welcomed by Alan Dronsfield, who also chaired the morning session.

The Isolation of Fluorine.
Richard Toon, formerly of Keele University

Georgious Agricola (1494-1555), an established mineralogist, described a mineral which helped some ores melt at lower temperatures. He called this "fluores" after the Latin *fluere,* to flow. Heinrich Schwanhardt (1601-1667) noticed that his spectacles became clouded when he left them near to a reaction of fluorspar with a strong acid. Carl Scheele (1742-1786), who continued Schwanhardt's work, also noted that glass became corroded, and called the acid "fluoric acid". André Marie Ampère (1775-1836) stated that fluoric acid had similar characteristics to hydrochloric acid and proposed that fluorspar consisted of calcium and fluorine. Humphrey Davy (1778-1829) was curious about Ampère's theory and tested it using an electrolysis method with hydrofluoric acid; however, he failed to isolate fluorine, but suffered injury to his eyes and fingernails. The Knox brothers, George and Thomas, continued the quest for fluorine, also using electrolysis. They isolated a gas, which was not "pungent or irritating", but George Gore later stated that some crucial experimental detail was missing. Edmond Frémy (1814-1894) used Davy's electrolysis procedure with anhydrous molten calcium fluoride and noted that a gas (most likely fluorine) escaped from the anode. George Gore revisited Frémy's work in 1869, using anhydrous liquid HF, with electrolysis. However, he had difficulty with this method, his charcoal anodes disintegrating with extreme violence. Henri Moissan finally succeeded in isolating fluorine, in 1886. He used finely divided silicon, which spontaneously burst into flames in the presence of fluorine. He also used Frémy's dry potassium acid fluoride (KHF_2) dissolved in anhydrous liquid HF, with platinum and iridium electrodes. He was awarded the Nobel Prize in 1906 for his isolation of fluorine and his development of an electric furnace, but died from appendicitis very soon afterwards.

Personal Reminiscences of Fluorine Research

John Holloway, OBE, University of Leicester

My research was in inorganic fluorine chemistry and, seminal to the development of work in this area, was the role of UF_6 in facilitating the production of the atomic bomb. Of similar importance was the influence of that select band of chemists, such as Harry Emeléus, who kept alive an interest in inorganic chemistry in the UK in the 1940s when it seemed that the subject had declined into mediocrity, and also Norman Haworth who made the University of Birmingham a cradle for the growth of fluorine chemistry research in the country. My career grew out of my parents' conviction that education via a good grammar school might provide a route out of the tough mining environment in which I grew up. A series of serendipitous events led to a life working with this most exciting of elements in Birmingham, Aberdeen and Leicester, the extraordinary thrill of synthesising a range of new binary fluorides, being at the forefront of the discovery of noble-gas compounds, and the creation of new classes of species, the transition metal carbonyl and chalcogenide fluorides. It also brought me into close contact with the pioneers who had been involved, not only with noble-gas chemistry, but also with those extraordinary people who had created the transuranic elements and given birth to the Fullerenes. I have also come to realise that the successful pursuit of new science involves deep thought, hard work, serendipity and an acceptance that progress can only be made when the appropriate technology is in place.

The first afternoon session was chaired by Chris Cooksey

The History of the Fluorinated Anaesthetics

Alan Dronsfield, University of Derby

General anaesthesia became commonplace around the middle of the nineteenth century. For the next one hundred years the main agents were nitrous oxide (for minor operations such as tooth extractions), ether and chloroform. There last two had their drawbacks. Induction was unpleasant, especially with ether, neither was without the risk of sudden death (though this was rare) and recovery was usually accompanied by nausea and vomiting.

During the 1930s several fluorocarbons were synthesised for use as heat transfer media in refrigerators. Usually non-toxic, a few of these Freons were explored as possible anaesthetics, but all were found to be wanting. Post-war, ICI chemists Charles Suckling and his chief, John Ferguson, decided to capitalise on the company's experience with Freon-type materials to engage on a research project that might yield a "tailor-made" fluorinated anaesthetic with better properties than those associated with chloroform and ether. The research was systematic and was guided, in part, by a consideration of the "physical chemistry of anaesthesia", at least as far as it was known at the time. Success attended their efforts and in 1956 *Halothane* ($CF_3CHClBr$) was released to the world. It remained popular until the 1980s. However during the latter part of its life doubts began to accumulate about its safety record. In particular, it was associated with liver damage. Some of the inhaled material was being metabolised in this organ, yielding the fluoride ion which caused damage, sometimes (but rarely) with fatal results.

Fortunately, the AirCo Company in the USA had been exploring the fluorinated ethers as potential anaesthetic agents. The approach here (mainly conducted by chemist Ross Terrell) was more of the "scatter-gun" variety, with more than 700 compounds being synthesised for anaesthetic potential. Among them were three or four ethers which were as effective as halothane, but were associated with much less liver damage as the vapours were simply breathed out, rather than ending up being metabolised within the body.

Today if you have an anaesthetic for a minor operation it will probably be an intravenous injection of *Propofol* (2,6-di-isopropyl phenol), but for anything major you will most likely be put to sleep by one of Terrell's fluorinated ethers: *Isoflurane* [$CF_3CHCl.O.CHF_2$], *Sevoflurane* [$(CF_3)_2CH.O.CH_2F$] or *Desflurane* [$CF_3CHF.O.CHF_2$].

Davy, Faraday and the Royal Institution

Frank James, Royal Institution

From the early nineteenth century it was understood that this most reactive of gases must be a chemical element, and much effort was put into isolating it, particularly by Humphry Davy and Michael Faraday working in the laboratory of the Royal Institution (RI).

Davy was appointed to the RI in 1801 after working at Thomas Beddoes's Pneumatic Institution in Bristol where he had discovered the physiological effects of nitrous oxide – laughing gas. At the RI, he had the best equipped laboratory in England and one of the best in Europe. Following the invention of the electric battery by Volta at the end of the eighteenth century, the RI acquired an array of powerful batteries for demonstrations in the lecture theatre. In autumn 1807 Davy began to use them to decompose chemical compounds, thus starting the science of electro-chemistry, a term that he coined. On 19 October 1807, Davy isolated potassium for the first time by passing a strong electric current through potash; in that month he similarly isolated sodium and boron and in 1808 magnesium, calcium, strontium and barium.

In 1810 he studied muriatic acid (HCl) hitherto assumed, by Lavoisier's definition of acidity, to contain oxygen. Davy was unable to decompose it electrochemically and deduced that it contained an element which he named chlorine from its green colour. He tried to electrolyse fluoric acid (HF), known since the eighteenth century, persisting with his attempts and may have succeeded since he produced some temporary damage to his fingers and eyes. He believed that an element (which he called fluorine following Ampère's suggestion) existed, but did not continue his researches.

Davy's successor at the RI, Faraday, returned to the pursuit following his own electrochemical work in the early 1830s where, amongst other things, he introduced the terms electrode, cathode and ion. He thought in February 1834 that he had isolated fluorine, and announced that he had done so and would publish further details later. When he came to continue his work, he realised that he had not isolated it and despite considerable effort during 1834 and 1835 was unable to do so – a negative result that he published when he collected his papers together in a single volume.

Davy and Faraday's problem was that they could not develop a container that would not react with fluorine. It was Moissan's idea towards the end of the nineteenth century, to construct a container of a material that already contained fluorine and would therefore not react with it. He isolated fluorine and for this he won the 1906 Chemistry Nobel Prize, just over a century after Davy had started his electro-chemical work.

Fluorine and the ICI Connection

Richard Powell, formerly of ICI

Following Fluorine exploratory research in the 1930s by General Chemicals Division (Widnes), ICI produced UF_6 for the Manhattan Project; Jack Rudge, the UK's first industrial fluorine chemist, was responsible for the experimental programme. In 1946 Rudge and Harry R. Leech envisaged a speciality fluorochemical business based on F_2. ICI produced SF_6, ClF_3 etc, but ceased F_2 production in 1974. In 1943 an alternative vision proposed the production of CFC (CF_2Cl_2, $CFCl_3$) and HCFC (CF_2HCl) (Arcton™) fluids and the polymer, PTFE, based on $Sb_xCl_yF_z$ catalysed Chlorine/Fluorine exchange, which ICI successfully developed from 1944. The highly profitable CFC plant peaked at ~100,000 tonnes per annum, with production ceasing in 1995, a result of the Montreal Protocol. In 1952 Suckling invented the first modern anaesthetic, Fluothane™ ($CF_3CHBrCl$). Using similar technology, fire-fighting agent BCF™ (CF_2BrCl) was also developed. ICI pioneered chromia catalysed Chlorine/Fluorine exchange in the mid-1930s, which was subsequently developed in the 1960s for CF_3CF_2Cl, and then for the chlorine-free CF_3CH_2F in the 1980s and 1990s. ICI pioneered the CHF_2Cl steam cracking to $CF_2{=}CF_2$, a major advance in PTFE production in the 1960s. From the 1970s onwards, fine organofluorine products were produced: insecticides and herbicides (Plant Protection Ltd.), drugs (Pharmaceuticals Division) and fluoroaromatics etc (Fine Chemical Manufacturing Organisation). Successful Monofluor™ surfactants (1970-1981), based on TFE F^-, catalysed oligomerisation, but were later abandoned.

Thomas Midgley and the Chlorofluorocarbons

Dr Chris Cooksey, formerly of University College London

Thomas Midgley, Jr. (1889-1944) was an engineer and inventor. His first contribution to the world was the introduction of tetraethyl lead into gasoline as an anti-knocking agent in 1923, leading to greater efficacy and more powerful vehicles. Midgley worked for General Motors who purchased the Guardian Frigerator Company in 1918 and renamed it Frigidaire. His next contribution was to introduce the use of chlorofluorocarbons as non-toxic and non-flammable refrigerant fluids to replace those in use at the time, viz., NH_3, SO_2 and CH_3Cl, in 1930. In the nineteenth century, natural ice was widely harvested as a refrigerant, but, by the end of the century, due to health concerns it was being replaced by artificial ice and manufactured on an industrial scale. In the 1930s home refrigerators and air conditioning units were increasingly popular, and this led to a rise in the manufacture of chlorofluorocarbons, especially CF_2Cl_2, then called Freon 12 (now R12). Initially, the manufacture of Freon 12 followed the recipe of Frédéric Swarts (1866-1940) who first prepared it in 1892 from CCl_4 and SbF_3, but this was soon replaced by passing CCl_4 and HF over a heated carbon catalyst. Production of CF_2Cl_2 steadily increased to reach a peak of about half a million metric tons per year in the early 1970s, then dropped to zero by 2004, phased out due to concerns about ozone-layer depletion.

The meeting ended at 17.30 after a final and lively discussion.

Bill Griffith
Imperial College, London

Robert Woodward – Chemist Extraordinary

This half-day meeting was held on Friday 17 May 2013 in the Council Room at Burlington House. It attracted over forty delegates and, in part, had been arranged to present Peter Morris with the Group's *Wheeler Award* for his contributions to the history of chemistry.

A Souvenir of Robert Woodward in Action

Phil Hughes

Phil spoke briefly about his admiration for this great chemist and presented members present with free copies of a DVD he had made of a recording of R.B. Woodward lecturing on his work on cephalosporin. This presentation was given in 1965 and was video-recorded at the Technion University, Haifa, Israel.

Hofmann and the Beginnings of Organic Synthesis
William Brock, University of Leicester

The purpose of the paper was to provide a general historical introduction to the topic of organic synthesis. According to the *Oxford English Dictionary* the first recorded use of the term *synthesis* occurred in the lectures of Peter Shaw, the English Newtonian lecturer and disciple of Boerhaave. Before then, Greek philosophers and alchemists commonly used the terms *diakrisis* for the separation and analysis of materials, and *synkrisis* for the aggregation and composition of new materials. These usages can be seen in Stahl's definition of chemistry as "the art of resolving compound bodies into their principles and recombining them" (1723), and in Dalton's chapter "on chemical synthesis" in his *A New System of Chemical Philosophy* (1808), in which he stated that "chemical analysis and synthesis go no farther than to the separation of particles from one another and to their reunion". Long before Dalton, synthesis was clearly a chemical aspiration. In his lectures at Glasgow in the 1760s William Cullen voiced the Enlightenment aspiration that "Chemistry is the art of ... producing several artificial substances more suitable to the intention of various arts than any natural productions are". A good example of a fulfilled aspiration is the synthesis of expensive ultramarine by Christian Gmelin and Jean-Baptiste Giumet in 1826. This was in response to a prize worth 6000 francs offered by a French industrial society. We should recall, too, Lavoisier's analysis and synthesis of both "air" and water and his comment in *The Elements of Chemistry* (1794) that chemists must never be satisfied that they know the composition of a substance unless it has been both analysed and synthesised, something that (as Ursula Klein has pointed out) was built into the eighteenth-century tables of affinity. Nor should we overlook the extremely grand claims and aspirations of the alchemists who evidently (as William R. Newman reminds us in *Promethian Ambitions*) went as far as conceiving the possibility of creating living forms artificially just as they appeared to be generated spontaneously in nature. (For example, Paracelsus's recipe for the homunculus which involved human sperm, horse dung, human blood and prolonged fermentation.)
By the beginning of the nineteenth century the classification of materials as animal, vegetable and mineral had become simplified into mineral/inorganic and organic/organised. A hoary question in the history of chemistry has always been did Wöhler dissolve the distinction? As Peter Ramberg and others have suggested, Wöhler's synthesis of urea in 1828 became a "foundation myth" in the hands of later chemists and historians. What seems to have fascinated contemporary chemists more was that urea possessed exactly the same composition as ammonium cyanate - a phenomenon which, in the light of many other examples, Berzelius called *isomerism* in 1832. The explanation was clear: isomers must differ in the way individual atoms were arranged in the compound. Wohler's artificial preparation of urea did not destroy assumptions that living creatures, from which organic compounds were produced, possessed a vital organizing force; but it did confirm that organic compounds obeyed the same Daltonian laws and that their synthesis was possible.

But how could the chemist determine the ways in which atomic arrangements differed in isomers and in organic compounds generally? The answer was through *metamorphosis* or the analysis or degradation of organic compounds into simpler products whose compositions were known with some certainty. This is why many early papers on organic compounds are entitled "on the metamorphosis of x, y, z, etc". In effect, chemists used the term metamorphosis instead of synthesis and hoped that the isolation and identification of common (or very similar or related) degradation products would lead to an understanding of parental composition. Liebig and his school at Giessen became masters of this form of "analytical synthesis" or "synthetical experiments" (as Catherine Jackson has termed them) by exploiting the new Kaliapparat, improved purification techniques, and the Pythagorean possibilities of paper chemistry based on stoichiometric deductions. The task facing chemists was extremely challenging. To use an analogy made by Philip Ball, the empirical formula of quinine $C_{20}H_{24}N_2O_2$ tells one nothing about how the atoms are arranged; it is like being told to find a word made up of $QUIN_2E_2$.

By the 1830s, however, chemists had Berzelius's electrochemical theory and Gay-Lussac's concept of radicals to guide them. As Liebig proclaimed in 1831: "Through the discovery of artificial urea and the completely new manner of elements combining, organic compounds have become understood. I regard these two discoveries as the beginning of a truly scientific organic chemistry". Thus, using empirical molecular formulae, the analysis of decomposition products, radical and electrochemical theories, Liebig and his successors – notably A.W. Hofmann – began to deduce compositional arrangements. For example, the metamorphoses of benzaldehyde and uric acid suggested that the radicals *benzoyle* and *uril* provided a common constitutional arrangement. Such successes led Liebig and Wohler to announce in 1838 that:

The production of all organic substances no longer belongs just to organisms. It must be viewed as not only probable, but as certain, that we shall produce them in our laboratories. Sugar, salicin, and morphine will be artificially produced. Of course, we do not yet know how this goal can be achieved because we do not yet know how the precursors out of which these compounds arise. But we shall come to know them.

What was also needed, of course, and which was not available until the 1850s, was the concept of valency. This came about through Kolbe's and Frankland's search for the nature of radicals and their supposed "isolation" and synthesis in the mid-1840s, and Gerhardt's classification of organic compounds into "types", modelled on the formulae of hydrogen, hydrogen chloride and water, to which Hofmann added the ammonia type in 1849.

In a series of analytical papers published from Giessen with British pupils of Liebig such as James Sheridan Muspratt and John Blyth, and continued at the Royal College of Chemistry from 1845, Hofmann laid down a vocabulary of reagents and reactions that enabled chemists to be more confident about the arrangements of atoms within molecules. In his paper on toluidine, published with Muspratt in 1843, Hofmann declared that the time was drawing near when the information gleaned from metamorphoses and analytical experiments would be sufficient to enable chemists to synthesise valuable commodities like quinine. Naphthalene (he pointed out in 1849) is abundantly available from coal gas production and is easily transformed into an alkaline base, naphthalidine, $C_{20}H_9N$ [C=6, 0=8]. But if quinine was $C_{20}H_{11}NO_2$, the sole difference was two equivalents of water [HO]. He concluded: "We cannot, of course, expect to induce the water to enter merely by placing it in contact, but a happy experiment may attain this end by the discovery of an appropriate metamorphic process". With aspirations such as these pervading the laboratory at the Royal College of Chemistry, it is scarcely surprising that young William Perkin should attempt to transform allyltoluidine into quinine in 1856 by removing hydrogen and adding oxygen. When this experiment failed, he tried aniline instead and created the British dyestuffs industry. Hofmann was to follow suit and create the complementary and eventual world-leading German industry.

By 1860 Marcellin Berthelot was able to lay down rules for the progressive synthesis of organic compounds from first principles. However, as Catherine Jackson has recently demonstrated, it took another decade of structural modelling, laboratory building and the development of new glass apparatus and experimental techniques before the hopes and dreams of Liebig and Hofmann concerning synthesis began to be fulfilled.

Woodward and the Woodward-Hoffmann Rules
Henry Rzepa, Imperial College

Discoveries in science are almost always about "standing on the shoulders of giants" and making connections between known facts. The famous announcement of the Woodward-Hoffmann rules based on orbital symmetry is a classic example of this. It is also a story interwoven with missed opportunities by those who preceded the famous duo, now affectionately known as WH.

My story will start around 180 years ago, with a young French mathematician Évariste Galois. He died at the age of twenty after a duel, and left behind a manuscript that was the foundation of groups and permutations. We now know this as *group theory*, and it has proved to be the foundation stone for many a chemical theory. Abstract mathematical symbolism is not for everyone and so the next phase of the story depended on chemists creating symbols that they could use as a language to communicate the ideas of symmetry amongst themselves. Emil Fischer for example developed the Fischer projection (from three into two dimensions) that started the process of chemists thinking in 3D. Stereochemistry was born. But it was a difficult journey. J.J. Thomson, who discovered the electron in 1896, was still thinking of it in two dimensions as late as around 1918. In 1924, Robert Robinson (following G.N. Lewis in 1916) started using arrows to represent the changes in electron pairs that occur during a reaction (the "reaction arrows"). But he too thought only in two dimensions, and it was Hückel in 1930 who moved the understanding of such electrons into three dimensions, in effect applying Galois's group theory to the solution of a simplified wave equation. A decade later, organic chemists began formalising a more general 3D stereochemical symbolism for molecules than Fischer's, although it took a further thirty years or so to become part of an organic chemist's DNA, so to speak.

Enter Robert Burns Woodward. He had come to prominent attention with his synthesis of quinine in 1944. We see from his articles that he was not yet using stereochemical notation, as we will now call the representation of 3D chemistry. In his own discussions of the time, he had not yet mastered the art of controlling it in his syntheses (which we now describe as having been non-stereospecific). The person first credited with explicitly associating stereospecificity with a pericyclic synthesis was Gilbert Stork in 1951. By 1956, Woodward had moved on to the synthesis of LSD. Finally in this article, but literally only in a footnote, do we find a concise and clearly knowledgeable remark on the stereochemical implications of that molecule. At the same time however, Derek Barton had been busy utilising stereochemistry in developing an elegant theory of conformational analysis, for which he went on to win the Nobel Prize. Clearly, mastering stereochemistry was becoming very important to organic chemists.

We go back in time five years at this stage to Michael Dewar. In an infamously inaccessible article in 1951, he set out his π-complex theory of chemistry. It is clearly constructed using Galois' group theoretical ideas, applying this to molecular orbitals and seeing how these orbitals can combine to form new molecules. For example, we see the application of π-complex theory to alkene-metal complexes (also presented in a footnote!), in particular focusing on the symmetry of the π-electrons of the alkene and how they might interact with the metal (the Dewar-Chatt-Duncanson model). When in 1964, WH came out with rules of pericyclic reactivity based on the conservation of orbital symmetry, their diagrams can be traced directly *via* Dewar's back to Galois. I make this point since I do not believe the association is sufficiently well known. Moving forward again to the period 1958-1963, three separate groups following in Stork's stereospecific footsteps carried out experiments which directly showed that pericyclic reactions were more generally not only stereospecific, but also inexplicably so (to them at least). The fruit, so to speak, was now hanging low. But neither Vogel (1958), Corey (1963) nor Havinga and Schlatmann (1961) managed to pick it, although the latter came within a cat's whisker.

Finally, Woodward did so. He too had observed a reaction very similar to that carried out by Corey and Havinga and Schlatmann, during his attempts to synthesize vitamin B12. He took these three observations and his own and talked to a chemist who was immersed in symmetry and Galois' group theory as applied to molecular orbitals, Roald Hoffmann. Like most puzzles, the pieces just dropped into place! The review article of 1969 formalising the observations in a set of rules has become one of the most famous in the history of chemistry. Not least because there was a section entitled *predictions* (every good theory has to make verifiable ones) and the wonderfully teasing *Violations. There are none!* That remark alone probably provoked 5000 research projects alone, if not more!

I close by asking if the connection to Galois might have evolved differently? Hückel, back in 1930, is equally, if not more, famous for describing the group-theoretical-based molecular orbital pattern of benzene that we now associate with aromaticity (the so-called 4n+2 rule). Benzene of course is famously flat, and no stereochemistry is apparently needed to describe its chemistry. But in 1964, a chemical connection was made to the mathematics of *topology*, and in particular an object known as the Möbius strip. Heilbronner designed a thought molecule using the same π-electrons as studied by Hückel, asking what would happen if they were twisted into a Möbius strip. Such a molecule turned out to be stereochemically chiral (quite when this connection was made is not known). Stereochemistry would be needed after all to describe aromatic molecules! Over the years, an alternative approach to pericyclic stereoselectivity based on (what we now call) Hückel and Möbius aromaticity evolved, based on describing the *transition state model* for the pericyclic reaction. The key concept had evolved from symmetry to topology, and from Galois' group theory to Poincaré's topological transformations of 3D space-curves. Stereochemistry was being conceptually linked to topology; specifically for pericyclic reactions in terms of the topology of the electron density of an (aromatic) molecule (transition state) being described by objects such as *torus links* and *torus knots* and topological invariants known as *linking numbers*. Since the taxonomy of links and knots is extensive (it dates back to the time of Lord Kelvin) we can now start to ask whether a whole new host of connections are just waiting to be made in chemistry as a result of WH's work.10

A Wheeler Award to Peter Morris
Alan Dronsfield, Chair, RSC Historical Group

I encountered Peter Morris at Forest School, Snaresbrook, London, in 1970. He was a 14-year-old pupil and I was a young chemistry teacher. Encouraged by Peter, I and a handful of similarly minded enthusiasts set up an out-of-hours chemistry club where the young students could try out experiments of their own under my benevolent supervision. Peter delighted in reproducing classic experiments of yesteryear and I particularly remember his success at synthesising Griess's classic dye, methyl orange. Smitten by the "bug" of historical chemistry, he studied at the University of Oxford achieving a D.Phil. for his studies in "The development of acetylene and synthetic rubber by IG Farben 1926-1945". Career progression, initially at the Open University, led him to the Science Museum where, having been Senior Curator in Experimental Chemistry, he became Manager of Research in the Collections Unit. He is currently Keeper of Research Projects.He is a prolific and highly respected author, his books and papers reflecting his interests in the development of chemical instrumentation, the rise of organic chemistry in the late nineteenth and early twentieth centuries, and the history of the chemical industry. Peter has served our Group as a long-standing committee member and was editor of our Newsletter from 1996 to 2001. From 2001 to 2012 he edited *Ambix*, the journal of the Society for the History of Alchemy and Chemistry. In 2006 he was a recipient of the Edelstein Award for excellence in the history of chemistry, an honour bestowed by the American Chemical Society.

Given my forty-plus years connection with him, it gave me great pleasure to present Peter with our *Wheeler Award* to mark his commitment to, and excellence in, Historical Chemistry.

(Peter has only submitted a short abstract of his talk. The full version will be published as an occasional paper, later in the year)

The Wheeler Lecture: Some Aspects of Robert Burns Woodward
Peter Morris, The Science Museum

In this talk, I discussed some themes central to Woodward's thinking using Woodward's own words. The first theme was the *history of chemistry*. Woodward's was interested in W.H. Perkin, Louis Pasteur and above all, his fellow Scots chemist, Archibald Scott Couper. Couper's proposals for structural formulae lead naturally to the next theme, *organic chemical theory*, by which Woodward largely meant structure theory. He considered it to be central to the development of organic synthesis. Nonetheless, Woodward realised that the determination of organic chemical structures was in the process of being transformed by *instrumentation*. He argued that one of the most important uses of this new instrumentation was the monitoring of reaction mixtures. No longer tied to the proof of structure as its primary *purpose*, organic synthesis could now become supremely creative. Organic chemists were placing a new Nature alongside the old. Woodward certainly thought that syntheses had to be *planned*, how it could be otherwise? But he was totally opposed to the development of pre-determined or mechanized methods of synthesis, which he held to be "entirely a creative activity". The organic chemist had the thrilling ability to create new forms of matter. Woodward saw chemistry as being the uniquely *sensuous* science, filled with beauty, surprise and wonder - crystals were particularly beautiful. In keeping with this sensuous and Romantic view of chemistry, Woodward saw Nature - which he always capitalised - as a bountiful source of material, an ally, and a model to emulate. While he greatly enjoyed the creative aspects of synthesis, Woodward also believed it was important that this almost frivolous creativity was *constrained* by the need to obey the laws of nature; hence organic chemistry was both art and science. The ability to create new molecules while being able to predict the course of reactions and obey the rules laid down by Nature showed the power of chemistry. Woodward often wrote in a flamboyant Romantic style out of keeping with current chemical norms, but his concern with surprise and wonder reveals his links with the *Scottish Enlightenment* as Adam Smith also saw surprise and wonder as being central to the development of science.

Alan Dronsfield

Chairman Alan Dronsfield presents
Peter Morris with his Wheeler Award

FORTHCOMING MEETINGS

Royal Society of Chemistry Historical Group Meetings

Chemistry and Medicine: Some Historical Aspects
Wednesday 23 October 2013 at 10.30 am
Burlington House, Piccadilly, London, W1J 0BA

This meeting will examine various historical aspects of chemistry and medicine from the nineteenth and twentieth centuries.

10.30 Reception and Coffee

11.00 Welcome

11.05 "From Serendipity to Science - inhalational anaesthesia in the mid-late 19th century". Henry Connor, Hereford

11.45 "Leo Sternbach and the Discovery of the Benzodiazepines" Ann Ferguson (Broadstairs) and Alan Dronsfield (Derby)

12.25 "Chloroform before Simpson" David Zuck, London

13.00 Lunch. This is not provided but there are many cafés and bars close by.

14.10 AGM, Historical Group

14.25 "Chemistry and the Treatment of Cancer, ca 1940s-1970s" Viviane Quirke, Oxford Brookes University

15.00 "Type 2 Diabetes and the Discovery of *Metformin*" Alan-Shaun Wilkinson, University of Derby

15.35 Tea

16.00 "Sir James Black and the Discovery of *Cimetidine*" Robin Ganellin FRS, University College London

16.35 "Prostaglandins" Rod Flower FRS, Queen Mary University of London

17.10 Summary and Close of Meeting

Registration in advance of the meeting is essential by Monday 7 October 2013. To register and for further information please contact the Royal Society of Chemistry Historical Group Secretary, John Nicholson, john.nicholson@smuc.ac.uk

Society for the History of Alchemy and Chemistry Meetings

SHAC-Sponsored Meetings

The First Century of Chemistry at the University of Edinburgh: the James Crawford Centenary
Thursday 24 October 2013
Royal Society of Edinburgh, 22-26 George Street, Edinburgh

The University of Edinburgh appointed its first professor of chemistry in 1713. The present School of Chemistry at Edinburgh has organized a conference which will consider the first hundred years of research and teaching on the subject. The speakers will be Tim Addyman, Andrew Alexander, Robert G.W. Anderson, Hasok Chang, Matthew D. Eddy, John Christie, John Henry, Peter Morris, A.D. Morrison-Low, John C. Powers and Georgette Taylor. The meeting will be held at the Royal Society of Edinburgh on Thursday 24 October 2013. Further information and registration details can be found at: http://www.rse.org.uk/events/event.php?id=330

There will be a reception for delegates on the evening of Wednesday 23 October in the University Library, George Square, which hosts the exhibition, "Edinburgh 300: Cradle of Chemistry". Please see http://www.rse.org.uk/851_RelatedEvents.html
This exhibition runs from 2 August to 2 November. This link also gives details of a "Musical Celebration of Chemistry", a concert of music by Julian Wagstaff which includes the first performance of his short opera celebrating chemistry at Edinburgh University. This will take place at the Assembly Rooms, 54 George Street, Edinburgh on the evening of 24 October.

Chemists and their Books
9 November 2013
Royal Institution, Albermarle Street

This will be held on Saturday 9 November at the Royal Institution, Albermarle Street, London. It is a joint meeting with the Bolton Society of the Chemical Heritage Foundation, Philadelphia, on the theme "Chemists and their Books". Papers have been offered by Ron Brashear, William Brock, Elizabeth Clarence, Ned Heindel, Frank James, David Knight, Pierre Laszlo, Gary Patterson, Peter Reed, Ronald Smelzer, Anke Timmermann and James R. Voelkel. The SHAC Annual General Meeting will take place during the course of the day. To register for the meeting please contact the Hon. Secretary Anna Marie Roos at: aroos.@lincoln.ac.uk

American Chemical Society – Division of the History of Chemistry

Dallas, 16-20 April 2014

Sessions on HIST Tutorial and General Papers; History of Chemistry in North Texas; and A Century of Physical Organic Chemistry: A Celebration of the Discoverers of Organic Reaction Mechanisms.

San Francisco, 10-14 August 2014

Sessions on HIST Tutorial and General Papers; Found and Lost: Incredible Tales of Spurious, Erroneous and Rehabilitated Elements; and Recent Studies in the History of Modern Organic Chemistry.

See the HIST website: http://www.scs.uiuc.edu/~mainzv/HIST/index.php

FORTHCOMING CONFERENCES

Sites of Chemistry in the 20th Century
21 August 2013

This is the third conference of the project Sites of Chemistry, 1600-2000 and will be held in Uppsala on Wednesday 21 August 2013. Please note the change in location and change in date. It will now be held in the same venue as the 9th ICHC conference which follows immediately after. For further information please contact the organisers John Perkins jperkins@brookes.ac.uk and Antonio Belmar Belmar@ua.es

The project investigates the multitude of sites, spaces and places where chemistry has been practised since the beginning of the seventeenth century. It is part of a series of four annual conferences each devoted to a particular century. Selected papers from each conference will be published in special issues of *Ambix* and two volumes of essays will be published at the end of the project. Full details on the general project as well as on the past conferences on Sites of Chemistry in the eighteenth and nineteenth Centuries (Oxford 2011, Valencia 2012) are available at www.sitesofchemistry.org

Chemistry in Material Culture
9th International Conference in the History of Chemistry (9ICHC)
Uppsala University, 22-24 August 2013

Chemistry is the premier science dealing with the material world. From early modern times to the present, chemists have been involved in the analysis and synthesis of materials, in manufacture and industrial production. Engaging in diverse fields such as medicine, metallurgy, dyeing, agriculture, etc., the science has had an important part in the shaping of the modern world, and was in turn shaped through its interactions with technology and industry. The conference will investigate all aspects of the history of alchemy and chemistry in its engagement with material culture, including the chemistry of materials and the philosophy of matter. The keynote speakers at the conference are Mary Jo Nye (Oregon State University), Marta Lourenço (University of Lisbon), and Lawrence Principe (John Hopkins University).

For a full programme please see the conference website: http://www.9ichc.se