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RSC INTEREST GROUP
HISTORICAL

Historical Group

NEWSLETTER and SUMMARY OF PAPERS

Editor: Dr Anna Simmons

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RSC Historical Group Newsletter No. 87 Winter 2025

Contents

From the Editor

Welcome to the winter 2025 Royal Society of Chemistry Historical Group Newsletter which brings readers a selection of short articles, reports and news on the history of chemistry. This issue includes John Nicholson's biographical study of Dr Ishbel Campbell (1905-1997), the first female member of staff of the Chemistry Department at the University of Southampton, and part of John's "chemical family tree". Members have also contributed articles which explore various aspects of their careers in science and technology. Vincent Daniels writes about the creation of the British Museum's Research Laboratory, where he worked for twenty-nine years. Kerry Pendergast recalls his employment in the early 1980s as a laboratory analyst in the Magnetic Media Division of the Control Data Corporation in Gwent. In a variation to the regular section: "Two books that markedly influenced my chemical career", Michael Jewess discusses "Two books that led me to history of science and technology": *Subtle is the Lord – The Life and Science of Albert Einstein* by Abraham Païs and *Most Secret War* by Reginald Victor Jones. Readers will also find information on the recent overhaul of the online RSC Historical Collection and reports of the group's meeting on Chemistry, Medicine and History at Burlington House in October 2024 and the unveiling of a new gravestone for John Newlands (1837-1898). There are summaries of the group's popular monthly Tuesday online seminars and details of the next International Conference on the History of Chemistry in Valencia.

There will be a pause in Historical Group meetings this spring and the next meeting will take place on 16 October 2025 on Astrochemistry, with further details included in the Summer 2025 Newsletter. In preparation for marking the fiftieth anniversary of the Historical Group, Peter Morris would like anyone who believes they are a founder member of the group to contact him on doctor@peterjtmorris.plus.com.

If you would like to contribute items such as short articles, book reviews, news items and reports to subsequent issues please contact me. I am always very happy to hear from readers and discuss potential articles. The deadline for the summer 2025 issue will be **Friday 6 June 2025**. Please send your contributions to a.simmons@ucl.ac.uk as an attachment in Word. As ever, I am indebted to Gerry Moss for his assistance in pagination and production and to Alice Halman for all her help as membership secretary.

Group members should receive an e-alert from the RSC informing them when the latest newsletter is available, but for the record the Newsletter appears twice each year – usually in January/February and July/August. It is often available online before official notification is sent out by the RSC, so please look out for the newsletter on both the RSC and Queen Mary Historical Group websites: http://www.rsc.org/historical or https://rschg.qmul.ac.uk. We are also using the Group's LinkedIn page, managed by Andrea Gallio, to keep you updated and share items from the newsletter.

Anna Simmons, UCL

RSC HISTORICAL GROUP NEWS

Secretary's Report for 2024

The Group held two one-day scientific meetings at Burlington House, London, in 2024, open to members and non-members. Both of these were in-person. The March meeting was a survey of the chemist's notebook from Robert Boyle to Linus Pauling, which also marked the completion of the Humphry Davy notebooks project. The meeting in October was on the relationship between chemistry and medicine. including the monitoring of diabetes and drugs for TB, which was concluded by a keynote speech by former RSC President Sir Simon Campbell.

Full reports of our meetings have been published in the RSCHG Newsletter, two issues of which appeared in 2024. This publication continues to be edited by Anna Simmons, and is something we are particularly proud of. Anna maintains a consistently high standard, and succeeds in attracting a wide range of articles, meeting reports and other news items. She deserves all our thanks.

In addition to our one-day meetings, we continued our highly successful online lecture series on the third Tuesday of the month (August excepted), and these covered a wide range of topics on the history of chemistry. They continue to be well attended; audiences typically being up to around sixty participants, with people taking part from all over the UK and beyond. Lastly, we held two committee meetings during the year, both of which were virtual and this is likely to be our pattern for the foreseeable future.

Bill Griffith, who served as Historical Group Secretary from 2002 to 2012 and then as Membership Secretary until 2024, stood down at our committee meeting in March. Our long-standing committee member, Henry Rzepa, decided to retire at the end of October and our former Chair, Alan Dronsfield, left the committee at the end of 2024. We are very grateful for

their service to the committee. I myself stepped down as Secretary (for the second time) at the end of 2024. I am sure you will all give my successor Mike Leggett a warm welcome and give him your support as he eases himself into the post.

Peter Morris

Message from the New Secretary of RSC Historical Group – Michael (Mike) Leggett

From 1 January 2025, I will be Secretary of the RSC Historical Group and I would like to introduce myself to group members. Following a BSc Joint Honours Degree in Chemistry and Pharmacology (University of Nottingham, 1981) and a PhD in Chemistry (Bristol Polytechnic, 1986), I was employed for five years as a Development Chemist working on office products. I retrained as a Technical Author and joined the British Standards Institution in 1993 as a Technical Editor. From 1995 I managed development projects for British, European and International Standards for a wide range of industries until my retirement in 2021.

A member of the RSC since the 1980s, initially as a Graduate, from 1990 I became a Member and Chartered Chemist. I have been a member of the RSC Historical Group for about twenty-five years. Historical interests include astrochemistry, medicinal, macrocyclic and colour chemistry, though not as an active researcher. I am assisting in the organisation of two historical conferences, including one on Astrochemistry in October 2025 and also a possible conference on coordination chemistry sometime during 2026. History of astronomy is also an interest and I am General Secretary of the Society for the History of Astronomy (since 2020). If any Historical Group member wishes to contact me, my email address is leggett189@btinternet.co

Mike Leggett

Message from the Membership Secretary

If you have recently joined the group, our membership secretary, Alice Halman, sends a warm welcome. To find out more about the group, please visit our website or LinkedIn page and look at the contents of the newsletter. We hold speaker meetings at Burlington House and also monthly webinars and it would be lovely to see you at any of these. If you have any questions about group membership or have ideas about improving member engagement or suggestions of topics for future meetings, please contact Alice on alicemhalman@hotmail.com.

Alice Halman

LinkedIn

The Historical Group is pleased to invite you to join our growing community on LinkedIn. In 2024 we launched a page to build our online presence, share the latest updates on the group's activities, news, and scholarly content, and to publicise events. By following us on LinkedIn, historical interest group members can stay regularly informed on developments from the group, access content and connect with fellow enthusiasts for the history of chemistry.

The page is called 'Royal Society of Chemistry Historical Group' and can be accessed through the following link https://www.linkedin.com/company/the-royal-society-of-chemistry-historical-group/about/. Subscribers to the newsletter with a LinkedIn profile are encouraged to follow the page and engage with it by interacting with posts they might find interesting and circulating to their own network. The page is currently being managed by committee member Andrea E. Gallio. For any further information please do not hesitate to get in touch.

RSC HISTORICAL GROUP MEETINGS AND ONLINE LECTURES

Astrochemistry Meeting

The next one-day in-person meeting organised by the Historical Group will take place on Thursday 16 October 2025, at Burlington House, Piccadilly, London W1J 0BA. Further details will be available in the summer 2025 newsletter. There will be no meeting in March 2025 and the meeting marking the 50th anniversary of the group will take place in March 2026.

Online Lectures

These are continuing on the third Tuesday of each month at 2 pm. On 21 January 2025 Helen Cooke discuss an apothecary shop in Nantwich belonging to Raphe Walley (1625-1661) and the inventory which was discovered during research for an exhibition at Nantwich Museum. On Tuesday 18 February Diana Leitch will be talking about a famous series of paintings commissioned by ICI. The lectures are presented on the RSC Zoom Platform at 2 pm. Please start to log on at **2 pm sharp**. Look out for the Zoom links in the e-alerts circulated by the RSC on behalf of the Historical Group.

OBITUARY

Raymond G. Anderson

Ray, the treasurer (and membership secretary) of the Historical Group between 1994 and 1999, passed away in Brighton on 25 February 2024. He was on the committee of the group for ten years in the 1990s, but perhaps his most important service to the group was during the period when we had our main meeting at the RSC Annual Chemical Congress. With his unfailing friendliness and affability, he did much to persuade chemists who dropped into one of our sessions to join the group. He gave talks about the interaction between chemistry and brewing, and was happy to assist anyone researching his predecessors, Peter Griess (azo dyes) and Henry Medlock (magenta). His true passion was the history of brewing on which he published widely. He was a friend to many of us and for several years I enjoyed receiving a bottle (or two) of Christmas Ale in December.

Ray was born in Tynemouth in 1947 and brought up in Whitley Bay. He went to Rutherford College of Technology (now Northumbria University) where he graduated with first class honours in Applied Chemistry. Ray then took an MSc in Microbiological Chemistry at the University of Newcastle followed by a PhD on "The biosynthesis of the bacterial cell wall". He joined the Brewing Industry Research Foundation at Nutfield as a Research Fellow in 1972. Ray then moved to the research department at Allied Breweries in Burton-upon-Trent, and he became the manager of the research laboratory in 1983. Following the takeover of Allied Breweries by Carlsberg, Ray took redundancy in 1998. He was instrumental in saving the archives of Allied Breweries which spanned three centuries. Ray published a history of the Institute of Brewing and Distilling with the title *Brewers and Distillers by Profession* in 2012. He was a keen follower of Newcastle United and also enjoyed watching cricket and growing vegetables.

(Acknowledgements to the obituary by Peter Brookes in the April 2024 issue of *Brewer and Distiller International*).

Peter Morris

NEWS FROM THE RSC LIBRARY
The Historical Collection 2.0

What is it?

The Historical Collection was originally launched in 2015 after a major project to digitise the collections stored throughout our premises in Burlington

House. This new platform meant that members and subscribers could access this unique collection from wherever they were in the world. Also, fewer people handling the physical items meant they would be better preserved for the future.

Why was it redeveloped?

With the contract for our previous host coming to an end we took the opportunity to overhaul the platform. Along with a redesigned interface we've corrected a number of technical issues and added a significant amount of new content.

What's in it?

The platform is split into two collections:

Society Publications and Minutes:

Documents produced by the Institute of Chemistry, Chemical Society and Royal Society of Chemistry. It includes council minutes (from the very first in 1841), lists of fellows and annual reports. Users may also access the complete collection of *Chemistry in Britain* as well as *Education in Chemistry* (1964-2006) and monographs, lectures, and reports on a range of topics from Joseph Priestley to Modern Explosives.

Historical Books and Papers:

Historical books, papers and letters from the sixteenth to twentieth centuries including collections from Sir Henry Roscoe, Sir Frederick Abel, Colonel Sir Frederic Lewis Nathan and items previously owned by Sir Humphry Davy.

What's new?

We have two new collections plus content added to existing ones:

The Abel Papers (New Collection in Historical Books and Papers):

A unique collection donated by Sir Frederick's Abel descendants in 2010. Contains many handwritten items including his diaries and letters from the Channel Tunnel Defence Committee (in 1882), Michael Faraday, the Duke of Devonshire and William Rockefeller.

Manuscript Letters (New Collection in Historical Books and Papers):

Letters written, mainly, to Chemical Society officials on a variety of subjects including a letter to Henry Roscoe about the death of the Duke of

Devonshire and letters from Justus von Liebig concerning among other topics, the Cholera epidemic in the mid-nineteenth century.

Additional Content Added to Lists of the Chemical Society and Institute of Chemistry (in Society Publications and Minutes):

"Lists of official chemical appointments" of society members to positions in public and private organisations. These also provide further information on the history of certain organisations such as the Government Laboratory and the regulations for a number of professions, e.g. gas examiners.

Additional Content Added to The Roscoe Collection (in Historical Books and Papers):

"The Roscoe Letters " are a unique collection of correspondence between Sir Henry Roscoe and many of his contemporaries including Bunsen, Faraday and Mendeleev. Some of them provide a fascinating insight into the period, often showing how little changes. "Roscoe Lecture Notes" are his handwritten notes for lectures on a variety of topics including fire, non-metallic elements, atomic theory and light.

What are the highlights?

The Chemical Society Council Minutes

Chemistry in Britain

Natural Magick (1658) by John Baptista Porta

The Sceptical Chymist (1680) by Robert Boyle

Conversations on Chemistry (1807) by Jane Marcet

How do I access it?

Directly: https://historical-collection.rsc.org/

Members' area: https://members.rsc.org/ (Under 'Insight and Information')

RSC Library: https://www.rsc.org/library

What if I have a problem accessing it?

Most issues are resolved by trying a different browser and/or deleting your cache and cookies. You should also ensure you have updated your password and are able to log into the Members' Area following the system upgrade in October. Sometimes, accessing via your institution may cause a conflict but if you are still unable to access, please e-mail library@rsc.org.

David Allen, RSC Librarian

NEWS FROM THE DIVISION OF HISTORY OF CHEMISTRY

On 23 October 2024, the European Chemical Society (EuChemS) general assembly voted in favour of promoting the Working Party on History of Chemistry to a Division of History of Chemistry. EuChemS is an umbrella organisation representing national Chemical Societies, including the RSC, and other chemistry-related organisations in Europe. The Working Party on History of Chemistry organises a biennial international conference to facilitate communication between historically interested chemists, museum curators, science educators and historians of chemistry, and to gather the community on a regular basis. Earlier in 2024, the Working Party decided to apply to EuChemS to become a Division after forty-seven years of existence to enhance its international presence and visibility. Congratulations to all involved in achieving the new status, which will be a most positive contribution to the future of the field.

SHORT ESSAYS

Dr Ishbel Campbell (1905-1997)

In 2023, when Professor Gill Reid was President of the Royal Society of Chemistry, she appeared on the Radio 4 programme *The Life Scientific*. The host, Jim Al-Khalili introduced her as the first female member of staff of the Chemistry Department at the University of Southampton. But he was wrong; she wasn't. That honour belongs to the lady who is the subject of this short article, Ishbel Grace McNaughton Campbell [1].

Dr Campbell was on the staff at Southampton from 1938 until her retirement in 1971, though she continued teaching chemistry to medical students for some years after her career ended formally. She taught organic chemistry, and also carried out research that led to several original papers in the literature. She studied mainly organic compounds of phosphorus, tin, arsenic and antimony, and was interested in their stereochemistry and optical activity [2].

Family and Early Life

Ishbel Campbell, known widely as "Ish", was born on 13 October 1905, the ninth and last child of the Rev. John Campbell and his wife Elizabeth of Kirkcaldy, Fife in Scotland. The family comprised one brother, Duncan, and eight sisters; all the girls completed their education at the University of St Andrews [3]. In order of birth, they were Phyllis, Jessie, Mabel, Adeline,

Margaret (known as Daisy), Annie, Katherine and Ishbel. Of these, Jessie, Mabel, Adeline and Katherine all studied medicine and in turn graduated MB ChB. Surprisingly, Duncan does not seem to have attended university.

Ish went up to St Andrews in 1923 and studied chemistry. This was not as unusual as we might think. As early as the 1910-11 session, the first-year cohort in chemistry at St Andrews consisted of fifteen female students out of a total of forty-two [2]. As a student, Ish lived in University Hall, which had been opened in 1896 as the first hall of residence in Scotland specifically for women students. As well as her studies, Ish found time to be an active member of the university drama society, known as *The Mermaids Society*, and to serve on the Student Representative Council. She also played tennis for the university. In 1927, she graduated with her BSc, obtaining First Class Honours, on the basis of which she stayed on to study for a PhD. Her supervisor was the professor, John Read.

Research and Teaching Career

Professor John Read was an interesting chemist [4] who had studied for his PhD at the University of Zurich. There, his supervisor was Alfred Werner, the pioneer of co-ordination chemistry. In fact, Read graduated PhD and BSc (London) in the same year, 1907. He was able to achieve this unusual feat because, as a student, he had studied at Finsbury Technical College in London, and his college diploma, obtained in 1904, was sufficient to gain a place to work for his doctorate. In those days the London BSc was awarded entirely by written examination (with no final year research project), so could be taken by external private study. This is what Read did.

Although Alfred Werner had made a major contribution to co-ordination chemistry, he provided a piece of purely organic chemistry for Read's doctoral research, a topic in stereochemistry. From this beginning, Read remained active in organic stereochemistry for the rest of his life. In addition, he carried out important scholarly work in the history of chemistry for which he won the ACS Dexter Award in 1959 [4].

The research on which Read put Ish to work for her PhD was also in the area of organic stereochemistry. Her thesis, submitted in 1930, had the vague title *Researches in the hydrobenzoin series* [5] and led to three papers, all published in 1930 [6]. She actually graduated *in absentia* because, by the time of the ceremony, she was in New York, working at Cornell University. Her time there was funded by a Commonwealth Fellowship, now known as Harkness Fellowship, one of the first to be awarded to a woman.

Ish returned from America after a year and became a lecturer in chemistry at Swanley Horticultural College at Hextable in Kent. At that time, it had become a women's only college, and several of its students went on to distinguished careers in a variety of places, including Kew Gardens [7]. The college later became part of Wye College, and the latter was closed down in 2009.

Ish remained at Swanley for five years before moving to Bedford College, which was then part of the University of London. Her job title at Bedford College was Demonstrator and Teacher. After two years there, Ish made her final move to become a lecturer at what was then University College, Southampton. This institution received its Royal Charter in 1952 as the University of Southampton and in due course Ish was promoted to Reader.

In her time at Southampton, Ish continued her research, described in nineteen papers, of which she was sole author of five. She had relatively few research students, though the numbers were what might be expected in a small provincial university at the time. Altogether, some six individuals can be identified as her research students, based on the fact that the papers include acknowledgements for funding received from various organisations, mainly the Department of Scientific and Industrial Research, DSIR. This was the body that supported research students working for PhDs. In most cases, only the student and Ish are named as authors, which shows beyond all doubt that she was the supervisor. The one exception was Martin Hocking whose work on phospholes (phosphorus analogues of pyrroles) resulted in a substantial paper in *Journal of the Chemical Society* in 1965 [8] and included the Head of Department, Professor Richard Cookson, as a co-author. However, several sources make it clear that Hocking was actually supervised by Ish [1, 2, 9]. In fact, this was the only paper published by Ish from Southampton where she was not the senior author. Hocking himself went on to have a successful academic career, later moving to Canada and becoming Professor at the University of Victoria, British Columbia [9].

While on the subject of publications, we should note that, as well as her research papers, Ish contributed reviews to the organic section of *Annual Reports the Progress of Chemistry* in 1951 and 1953.

Memories from Southampton

There are very positive memories of Ish in various former students' accounts of her which suggest that she was both a "character" and kind. Brian Halton, who was an undergraduate at Southampton from 1960 to

1963, and eventually Professor of Organic Chemistry at the Victoria University of Wellington in New Zealand, describes her as a delightful lady [9]. When he arrived at Southampton, Ish was sharing the teaching of organic chemistry with Dr Eric Parker, who left the university in 1962 to become the Registrar of the Royal Institute of Chemistry [9]. She was a chain smoker and used to open her first lecture by telling the students that the university did not allow smoking in lectures, so from then on, all her classes were going to be tutorials. She then proceeded to light a cigarette from the previous stub, and begin.

Her smoking was also commented on by her PhD student Martin Hocking, who attributed her ability to cause unpromising tars to form crystals to the traces of cigarette ash that accompanied her in the laboratory [2]. This ash, he claimed, acted as a nucleating agent for crystallization, though he also conceded that she was a skilled experimentalist, well able to grow crystals by scratching the inside of test tubes with glass rods and cooling the mixtures down.

Ish's kindness was shown in the care she gave to the students around examination time. She would wait outside the examination hall and check that everyone had arrived. If someone in the class was not there, she would hurry away to find the missing individual and remind them of where they should be [9]. Also, in the summer term, she would lead walking expeditions in the countryside around Southampton that ended in picnics and she would often invite students to join the group.

Last Years

As we have seen, Ish retired formally in 1971, but she did not leave the University. Instead, she continued to teach chemistry to medical students, an activity she claimed kept her young. When she finally did stop teaching, she continued to live near the main university campus and would visit from time to time. At the end of her life, Ish moved to the Blenheim Court Nursing Home, Blenheim Avenue, Southampton, not far from the university. It was here that she died on 10 October 1997, just three days short of her ninety-second birthday.

Connection with the Author

Around the time I received my PhD, there was an article in the RSC magazine *Education in Chemistr*y on the subject of chemical family trees. The main idea was that one's PhD supervisor is effectively one's chemical parent. I decided to trace my chemical family tree. In doing so, I discovered that Ish Campbell was one of my chemical ancestors.

As a result of this discovery, I wrote to her, care of the Chemistry Department at the University of Southampton. In due course, I received a charming hand-written reply that I still have in my files. In it, Ish described herself as my "chemical great-grandmother" [5], and gave me details of her PhD work and other aspects of her career. I later realised that, because my PhD supervisor had been an undergraduate at Southampton in the years 1959-62, she had almost certainly been taught organic chemistry by Ish.

Some interesting themes that can be traced through the years of this chemical family tree. Most notable is co-ordination chemistry, which we all did. Also, since Ish introduced it with her work on tin, arsenic and antimony, main group organometallic chemistry been another common feature of our work. Sadly, these end with me, as they are not part of the work of any of my PhD students. I have done a little more co-ordination chemistry since my PhD, but not with my research students. The main aspects have been on co-ordination states of calcium, zinc and aluminium in biomedical cements used for hard tissue repair.

References

1. J. Corsi, "WiSET/WFRC Campbell Lecture: So Who Was Ishbel Campbell?" https://generic.wordpress.soton.ac.uk/wfrc/2014/02/19/wisetwfrc-campbell-lecture-ishbel-campbell (accessed 7.10.2024).
2. M. Rayner-Canham, G. Rayner-Canham, *Chemistry Was Their Life: Pioneering British Women Chemists, 1880-1949* (London: Imperial College Press, 2008), 269-71.
3. A. McNaughton, "The McNaughtons and the University of St Andrews", https://clanmacnaughton.net/docs_articles/University of St Andrews.pdf (accessed 8.10.2024).
4. Obituary of John Read. *Proc. Chem. Soc.*, 1963, 353.
5. I.G.M. Campbell, private communication, 1982.
6. J. Read and I.G.M. Campbell, *J. Chem. Soc,* 1930, 2377; *op. cit.*, 2674; *op. cit.*, 2682.
7. S. Richards, *Wye College and its World: A Centenary History* (Ashford: Wye College Press, 1994).

8. I.G.M. Campbell, R.C. Cookson, M.B. Hocking and A.N. Hughes, *J. Chem. Soc.*, 1965, 2184.
9. B. Halton, *From Coronation Street to Consummate Chemist*, Victoria University of Wellington, 2011; https://www.wgtn.ac.nz/scps/about/attachments/from-coronation-street-to-a-consummate-chemist.pdf (accessed 11.10.2024).

John Nicholson

The Creation of the British Museum's Research Laboratory

Work on the scientific study of the properties, preservation and manufacture of objects in museum and gallery collections has been going on at the British Museum's Research Laboratory (now known as the Department of Scientific Research) for 104 years. This article is based on a RSC Historical Group online talk which outlined the history of the laboratory and why it was created.

The British Museum was formed in 1753 to hold several nationally important collections of books, manuscripts and other collectibles. Right from the start there was a need for what we now call conservation. Scientific questions were raised about the deterioration and preservation of the objects, but the museum had no full-time scientific advisors, although some of the museum's later Trustees were scientists, for example, Sir Humphry Davy and W.H. Wollaston. This article starts with Davy's protégé Michael Faraday who seems to have been greatly interested in the deterioration of objects. This was possibly because he had been apprenticed as a book-binder and thus had an intimate knowledge of how paper, glue, leather, cloth, canvas and other materials behaved not only when being made into books but also how they aged over a significant period of time. In 1830 the Trustees invited him to look at some sculptures which may have been damaged by exposure to the London air. Faraday was still advising the British Museum seventeen years later on various problems including the construction of the Reading Room's dome and the surfaces of the Parthenon sculptures.

As a member of The Athenaeum Club, Faraday was consulted on the unexpectedly fast rotting of the leather bindings in their library. In 1842 he was on a committee of the Royal Society of Arts to investigate this phenomenon and concluded that fumes from the gas lamps were responsible. By means of a practical demonstration he showed that the burning of coal gas produced sulphuric acid, which we still believe to be a cause of red rot on leather. Several years later Faraday was involved with the National Gallery, which in 1850 set up a Committee of Enquiry to investigate why the Gallery's pictures became dirty so quickly. Suspects were the visitors themselves who in those days were regarded as generally unclean and also the outside air, which was polluted with soot and sulphur dioxide from coal and wood burning. There were biological sources which added to the air pollution. The National Gallery is not far from the river Thames, then rather malodorous, notably in the year of Great Stink in 1858. However, the problem had already existed for several years and three years previously Faraday was investigating the problem. A cartoon from *Punch* magazine shows him presenting his calling card to Father Thames. Hydrogen sulphide from rotting sewage was a contributor to the smell. It reacts with basic lead carbonate (aka flake white), a white pigment commonly used on paintings, to form black lead sulphide.

Whilst this phenomenon does occur on oil paintings, it is most apparent on watercolours. Initially white highlights may turn into what look like dark shadows giving the effect of a photographic negative. Faraday must have been a valued member of this committee as one of the members asked " Do you think that if you were employed professionally or officially to make certain experiments in reference to the preservation of pictures by means of varnishes or other things, very beneficial results might accrue from such experiments?"[1]. Faraday replied in the affirmative, but he did not become a member of staff at the Gallery. The first professional scientist was not recruited there until 1934.

It did indeed seem that objects in public galleries deteriorated faster than those in private collections but it was not known for certain what were the main agents of deterioration. Was it the atmosphere of London "filled with noxious ingredients which penetrate everywhere", the "breath of the crowd and the dust brought within from without", the "very hazardous evil of artificial lighting", or a range of other factors[2]? J.C. Robinson, Surveyor of the Queen's Pictures and Curator at the South Kensington Museum correctly attributed one of the most important agents as fading caused by light. He had a preference for display in electric (incandescent) light as opposed to daylight. Nowadays most of us would feel the causes of fading were obvious and attribute it to light, especially that at the ultraviolet end of the visible spectrum. However it was not so in those days. Sir James Linton, Presiden of the Royal Institute of Painters in Water Colour, said that

Robertson's views were erroneous and proceeded from ignorance of the art of watercolour.

As a consequence of all this controversy, in 1888 the Treasury asked Dr W.J. Russell (later President of the Chemical Society and the Royal Institute of Chemistry) and Captain W. de W. Abney to carry out a series of experiments to determine the action of light on watercolours as these were usually the most vulnerable types of paintings.

The British Museum has two books of samples which were used in these experiments. It was demonstrated that moisture and light, especially blue/violet and ultraviolet, were responsible for the fading of watercolours and the pigments most susceptible to the effects of light were identified. Additionally the pigments most susceptible to atmospheric pollutants were noted. As a consequence of this work, artists' suppliers began to encourage the sale of stable paints and pigments only susceptible to fading in the most extreme conditions. The Russell and Abney report also mentioned that some pigments would not fade if kept in an oxygen-free environment. This pre-dated a recent conservation practice; inert gas storage to prevent oxidation of objects. In the British Museum and elsewhere, rubber objects are sometimes stored in a nitrogen atmosphere to protect them from oxidation. Using plastic or metallised plastic films to make sealed storage bags, the oxygen can be absorbed from the interior by placing sachets of oxygen absorbing chemicals inside with the objects. The sachets used are primarily made to assist in food storage so are quite cheap to obtain. Larger scale inert-gas storage is also practised. In Washington DC the Declaration of Independence is stored in an air-tight showcase containing an argon atmosphere. Similar cases filled with nitrogen have been made for Egyptian artefacts at the Cairo Museum.

The British Museum's Laboratory did not open until 1920, but before this date there was a chemist who made an extensive comparison of conservation methods for archaeological objects; he was Friedrich Rathgen, the first Director of the Chemical Laboratory of the Royal Museums, Berlin. In 1898 he published a book summarising the various methods which had been used; it appeared in an English translation in 1905 entitled *The Preservation of Antiquities* [3]. Rathgen not only compiled a comprehensive catalogue of many treatments available, but he also tried many of them out on clay, stone, ceramics and corroded metal. Rathgen emphasised that previously buried objects had special conservation issues as they appeared to deteriorate faster than objects made of the same material which had never been buried. He correctly explained that excavated material often contains significant concentrations of soluble salts typified by sodium chloride. There are two main consequences of the presence of soluble salts in objects. One is that metals can corrode significantly faster and another is that salts may migrate around a porous object. With relative humidity, fluctuations crystallise and re-solubilise at or below the surface of an object causing layers of the surface to be lost.

Nowadays, archaeological metal objects with corrosion layers are usually put under a microscope and unwanted corrosion is slowly and painstakingly removed with a scalpel. A skilled conservator can sometimes recognise a layer of corrosion which conforms to the original surface and the original shape of the object can be recovered while still preserving some of the corrosion. While some of the conservation methods described by Rathgen involve simply soaking in water to remove salts, other liquids dissolve away corrosion to a greater or lesser extent. For example, the methods Rathgen describes for corroded iron range in aggressiveness from soaking in water to (if the translated text can be believed) placing corroded iron objects in molten potassium cyanide which would certainly not be considered today on safety grounds or ethical considerations.

Porous buried stone and ceramics can also contain soluble salts. One important problem is that of unstable Babylonian cuneiform tablets. The tablets are made from clay into which wedge shaped marks are made with a stylus. Excavated tablets often contain salts, the crystallisation of which can eventually push off the upper surface damaging or completely obliterating the writing. It would help if the salts could be washed out but the unbaked clay cannot be soaked in water as it would soften and disperse. It is difficult to say who first came up with a successful process, but Rathgen describes a method for firing these tablets in a kiln so that they are stable in water and the salts can be extracted by soaking. Later, similar processes were adopted and adjusted by the British Museum and other major museums which hold large collections.

The story of conservation research at the British Museum really starts with the First World War when a large part of the Museum's collection was stored in safe locations away from the danger of bomb destruction. At this date, the Museum's collections included not only the vast range of object types held today, but also millions of books and manuscripts now located in the British Library, which split off from the British Museum in 1973. The locations used for this storage varied considerably and ranged from tunnels

and caves to stately homes. One location was Post Office train tunnels in Holborn. At the end of the hostilities, some objects had deteriorated and the Director of the British Museum asked the Department of Scientific and Industrial Research for advice. The result was that Dr Alexander Scott FRS (1853-1947), recently the Supervisor at the Davy Faraday Research Laboratory, was asked to make a report. He suggested setting up a laboratory at the Museum for three years under the aegis of the DSIR. Coincidentally Scott was the father-in-law of W.J. Russell, previously mentioned. The new laboratory started in 1920 in a small room only big enough for one person to work in. However, after several months some rooms in a building on the perimeter of the Museum were found. This enabled flames, furnaces and flammable solvents to be used without the danger of burning down the main museum; the new laboratory was at 39 Russell Square. The new facility opened on 17 March 1922, when Scott was sixty-eight. He had various assistants, but the most significant was the chemist Harold Plenderleith who started in 1924 and stayed thirty-seven years to become Head of Department. Work in the laboratories covered a wide range of activities. Soon the curators saw the value of the scientists' work in finding out what objects were made of, how they were made and finding new and better ways of conserving them. In 1931 it was decreed that the laboratory should become permanent and part of the Museum. It has now been in existence for 104 years making it the museum laboratory which has been in longest continuous existence.

Gradually the number of staff increased as did the array of analytical equipment. The materials and equipment budget for the laboratory was just over £100 a year to start with and Scott provided apparatus from his private laboratory at his home. A wide range of qualitative and quantitative analysis must have been carried out by classical methods. The first expensive bit of kit arrived when Scott purchased a second-hand microscope for £25. This could be used for analysis of fibres, pigments and corrosion products.

Instrumental analysis for elemental composition was initially available externally. There is a report in existence from Scott's time which describes a bought-in analysis carried out by carbon arc emission spectroscopy of a residue in a jar from Tutankhamun's tomb. Suitable apparatus was eventually purchased in the 1930s. The laboratory soon became famous and attracted interest from people all over the world. Howard Carter, who was excavating in Egypt, used to pay an annual visit to discuss conservation of his finds and Scott paid a visit to the Tutankhamun excavations in 1923.

Other famous archaeologists regularly visited the laboratory to work on their finds. These included Leonard Woolley, best known for his excavations in Ur, and his assistants Max Mallowan and Agatha Christie, who was later to become Mrs Max Mallowan. Assistance was also given on prestigious conservation problems in British buildings and objects. In 1931 Scott wrote to many of the major museums and galleries in the UK offering the laboratory's services.

Scott wrote annual reports which provide a useful guide to the laboratory's activities. One thing the laboratory was particularly proud of was an improved process for reversing the blackening of lead white pigment. The new process involved the oxidation of the black lead sulphide to white lead sulphate using hydrogen peroxide. A feature of the new process was that the hydrogen peroxide solution was shaken with diethyl ether. This meant that the ether containing a small amount of the oxidising agent could be brushed onto paper, thereby avoiding any hazards arising from making the paper wet. This process is still widely used today. Other successes included the use of new types of bleach for discoloured paper, the use of biocides to treat insect and fungal problems, improvements in methods for dealing with corroded metal objects and the baking of cuneiform tablets. Scott and Plenderleith became involved in a committee run by the Royal Society of Arts which looked at what they described as "ailing pictures" and performed work on the methods of construction of panel paintings and their varnishes.

Soon after Scott retired, Plenderleith brought out two small books, one on the conservation of paper-based objects and another on antiquities. He later wrote what was to be the standard reference work for object conservators for several decades. It was more or less the *only* book on scientific conservation for many years and was later revised by Plenderleith's successor, Anthony Werner [4]. Nowadays there are many books on conservation of all types.

The Second World War severely disrupted the work of the laboratory. Non-essential work stopped for the duration and much equipment was dismantled and sent into storage. Plenderleith had served in the trenches in the First World War and was awarded the Military Cross so was considered to have a good idea of the problems the British Museum was going to face. Well before the Second World War started he was advising other institutions on the measures they should take to protect objects. Some British Museum, objects were moved out of the museum to safe storage in stately homes and disused mines. This time the relative humidity and temperature of the underground storage areas were controlled and no harm came to the objects

that had been removed. However the same cannot be said of the British Museum building and its residual contents. When the war started in September 1939 the Director, Sir John Forsdyke, asked Plenderleith to live on the museum site for the duration so that he would be present whenever there was an air raid. Mrs Plenderleith's job was to supply food to the commissariat. He was soon in charge of ARP at the museum. Plenderleith and his team were responsible for saving many of the remaining objects and parts of the museum from destruction. Work in 39 Russell Square was rendered impossible on 14 October 1940 when a landmine blew out all the windows and damaged the building's structure rendering it unsafe. Plenderleith and his assistant Mr Bell provided emergency treatment for damaged objects in a basement elsewhere in the museum. Later a flying bomb caused further damage to the laboratory building.

After the war, temporary premises were found for the laboratory on the north-west corner of the museum site at 1 Montague Street and this was occupied until the buildings at 39 Russell Square were rebuilt. The refurbished laboratory opened in 1962 with strengthened vibration-resistant floors now occupying both 39 and 40 Russell Square. The dates on which new equipment arrived in the laboratory are still a matter for research but it is thought that much new apparatus must have arrived at this time. It was designed by Robert Organ who joined the British Museum in 1951. Organ developed the electrolytic reduction of corroded metal, a subject he made his own.

A new extension contained a laboratory for conservation and conservation research on the ground floor and a radiocarbon dating laboratory in the basement. Plenderleith acted as an advisor to several other museums and galleries. He was an advisor to the National Gallery for several years and it opened a laboratory in 1934. The Gallery was very interested in analysing varnishes and the binding media in paint as well as pigments. It consequently became a leader in the analysis of organic materials in the heritage sector.

At present, the British Museum's laboratory is well equipped and has equipment for x-ray diffraction, x-ray fluorescence, x-radiography, two environmental scanning electron microscopes various types of chromatography and five mass spectrometers. The laboratory moved into a new building on the main museum site in 2014. In the Department of Scientific Research alone there are twenty-seven full-time equivalent core staff, Research Fellows or PhD students. The work carried out is now largely the scientific examination of objects in the collection. Conservation of the collection is carried out in a dedicated department nearby. Today, there are other laboratories all over the world which carry out this type of research and several journals and many books have been published.

References

1. Quoted in Norman Brommelle, “Material for a History of Conservation. The 1850 and 1853 Reports on the National Gallery”, *Studies in Conservation*, 1956, 2(4), 176-188, on 184-5.

2. Norman Brommelle, “The Russell and Abney Report on the Action of Light on Water Colours”, *Studies in Conservation*, 1964, 9(4), 140-50.

3. F. Rathgen and R. Bormann, *The Preservation of Antiquities: A Handbook for Curators*, translators G. Auden and H. Auden (Cambridge: CUP, 1905).

4. H.J. Plenderleith and A.E.A Werner, *The Conservation of Antiquities and Works of Art*, second edition (London: OUP, 1971).

Further Reading

The British Museum Technical Research Bulletin 2007-2015 can be viewed online without charge: https://britishmuseum.iro.bl.uk/collections/f17003b2-adcb-4224-8871-f39072e24f19?locale=en

V. Daniels ed., *Early Advances in Conservation* (London: The British Museum, 1988).

W.A. Oddy, *The Art of the Conservator* (London: The British Museum, 1992).

R. Organ, *Design for the Conservation of Antiquities* (London: Butterworths, 1968).

Studies in Conservation, 1952 to present, is possibly the leading journal for publishing articles on the scientific study of object conservation.

Vincent Daniels

Magnetic Coatings and the Control Data Corporation

In 1977 Kerry Pendergast became a research student in the chemistry department of Aberystwyth University, where he trained in the techniques of lattice imaging electron microscopy and electron diffraction, and was introduced to far infrared spectroscopy by Mansel Davies. At this time, Kerry began a lifelong collaboration with Myron Wyn Evans, concerning how far infrared spectroscopy and computers could be used to delve in to the world of molecular dynamics. In this article, Kerry provides an insight into the employment of analytical chemists in the computer industry in the early 1980s by reflecting on his experiences at the Control Data Corporation in Brynmawr and the broader changes taking place in Welsh industry and computing technology.

From 1980 to 1982, I was employed as the Laboratory Analyst in the Magnetic Media Division of CDC (the Control Data Corporation) in Brynmawr in Gwent, where I worked as a chemist in the manufacture of computer tapes, and 760, 880 and 882 fourteen inch disks and disk packs. The plant had previously been occupied by RCA (Radio Corporation of America) and in later years by Xidex. RCA had entered the mainframe computer market in the sixties, but could not compete with IBM, gaining only a four percent market share and so closed its computer division in the early seventies. While left vacant by RCA, the plant was used to film Dr Who in the episodes entitled “The Green Death” from the original tenth season, with Jon Pertwee the then Doctor. Broadcast in 1973, these episodes featured the last appearances of his assistant Jo Grant, before Sarah Jane Smith took on the part. The ploy included scary, large, wasp-like creatures associated with a coal mine and it turned out a megalomaniac computer was the cause of the problem. The Doctor had to confront the computer in the plant and caused its destruction by causing it to overload!

During my time at Brynmawr, the plant tripled in size. Building and improvement work in its interior was ongoing and an additional building was built as another chemical store. However, the plant was eventually demolished to make way for major improvements to the Heads of the Valleys Road (the unofficial border between rural and industrial South Wales), at the top of the Clydach Gorge, bordering the Brecon Beacons National Park. This took place from 2011-2021 and, at a cost of £336 million, was the biggest and most expensive road project in Wales over that ten year period.

The Rise of Control Data

To keep their code breaking engineering team together after the war, the US Navy arranged for them to be employed as the Engineering Research Associates (ERA) from 1946. Many of this team felt under appreciated by the computer companies that subsequently bought out ERA and so, were subsequently involved in the creation of the Control Data Corporation in 1957. Seymour Cray (1925-96) was its chief designer and he was keen to create the world's fastest computers. Cray is said to be both the father and Thomas Edison of the supercomputing industry. CDC started by selling memory systems, such as drum memory to other companies and bought up various companies to give them a computer peripheral business, which in time would include card punchers and readers, disk and tape drives, disks and tapes. In 1960, CDC's first minicomputer the 160A and their commercially successful CDC 1604, then the fastest computer in the world, were marketed. This was followed in 1964, with the CDC 6600, arguably the world's first supercomputer. This is when CDC developed its fourteen inch hard magnetic disks, which could be assembled as multi-platter disk packs. These became a major product line, destined to become a real money spinner and to be manufactured in their millions in the Welsh plant in Brynmawr. The CDC 7600 supercomputer was then developed, so that CDC's and Cray's later supercomputers were the world's fastest supercomputers over decades. Today the Hewlett Packard Cray, is currently the world's most capable supercomputer.

Quality Assurance

My work at Control Data involved checking the quality of raw material chemicals such as the magnetic Bayer Oxide (needle shaped and coated, advanced ferric oxide powder), which arrived by juggernaut from Germany each week, and the diverse range of organic ingredients that were to be mixed together to create the disk and tape coatings. Further testing of both types of slurry mixtures then occurred before being coated onto the Mylar jumbo rolls, prior to baking off the solvent in the roof ovens of the coating line for tape or for spinning on the aluminium substrate discs. The lab was at the centre of the plant, nestling between the loading bays, the mills and chemical mixing areas, the coating head and the white room.

Magnetic tapes and disks were produced by mixing and dispersing magnetic powder with a binder resin, an organic solvent and other necessary components to prepare a magnetic paint for coating on an aluminium substrate disc or Mylar film for tape. The solvent was then evaporated.

Tape Production

The tape was made by a continuous process and used chemicals in bulk with three slurry kettles on wheels being filled in turn, with one being milled, one standing ready and one being filled with bags of chemicals the size of potato

sacks in turn from the list of ingredients, with cyclohexanone solvent added from the pipeline from the storage tanks underground. The kettles looked like giant saucepans six feet across and four feet high. Two types of plastic pellets were mixed in separate tanks with the cyclohexanone solvent, and added by separate pipelines from the next-door mixing area to the slurry as the solid ingredients were thrown in. The contents of the slurry kettle, after an hour stirring, now had the consistency of porridge and were now ready to be sucked into the bottom of the first of four vertical mills filled with 3 mm lead glass beads, and from the top of the first mill into the bottom of the next mill and so on. Once it reached "Let Down", where the milled slurry now looked like oxtail soup, having been collected in the receiving kettle, more solvent was added to it, making it less concentrated and less viscous, ready for activation. Here, a small amount of a component chemical was added to facilitate cross-linking occurring in one of the dissolved and milled plastics. This in turn caused hardening of the film to take place, to bind and lock in all the chemicals together. The mix was now passed through filters and pumped into the coating head room, in a time sensitive part of the process, which had to take place before the mixture had thickened due to the cross-linking of the plastic with the activator. Here a jumbo clear Mylar roll, three feet across, had been unboxed and placed horizontally on a roller (similar to how a toilet roll is readied for unwinding), ready to be unrolled and coated. The end had been taken vertically up to the ceiling where it entered the roof ovens over the white room, descending into the white room to be rolled up as a coated jumbo awaiting slitting by the knife box and spinning onto the familiar computer tape reels. The end of the coated jumbo was sampled by cutting off a piece before the coating had hardened. Acetone on the end of a cotton bud stick was then rubbed on to the tape to remove the coating on a small spot of tape. The tape was then put in an electronic feeler gauge to measure the tape thickness and its thickness where the spot had been cleared. This reading was then fed back to the team at the coating head to adjust the gap between the rollers accordingly. The white room was the large dust free room, where the liquid coatings were added to the substrate aluminium discs and clear Mylar tape. The reels were then placed on tape drives by the women workers in the white room, to be loaded with data and checked and graded for errors, as a quality control step before shipment to customers.

The laboratory was continuously manned by a technician who received samples hourly from the tape line to check the solids and pigments content and its viscosity. One sample was from the completed slurry mix in the kettle being stirred ready for milling. The other was the "Let Down" sample which was past milling with extra solvent added. This was ready for activation and filtering and pumping to the coating tray in the coating head for spilling onto the Mylar as it was unwound on its way up vertically into the coating oven above the white room. The ovens and muffle furnace played an important part in the laboratory testing. The solids in the slurry and "Let Down" could be determined by squeezing samples between aluminium foil and baking for an hour. The pigments or incombustibles were determined by weighing the sample in a crucible and then placing in a high temperature muffle furnace for an hour. These pigments represented the iron and aluminium oxides.

The technician's shift pattern had been three shifts a day, but subsequently changed as production ramped up to cover weekends. The new shift pattern was complicated, changing every two or three days, making workers continually jet lagged from switching between mornings, afternoons and nights. Previously, workers could offer to work overtime on the weekend, but as the demand for tape had increased, tape production was increased by the addition an extra shift of workers. All weekends were covered and workers only got one weekend off a month in what was known as the continental shift system, which repeated on a four week cycle. Therefore, I got to know four teams of technicians and their slurry filler workers, seeing two shifts a day, since I normally worked days. However, when technicians went on holiday, I frequently covered for them, so I got to know the joys of night and shift working, as well as all of the production workers and their different lifestyles compared to the day staff. For one thing, they had longer breaks, because they knew that the tape line could be run faster than the management knew without causing problems!

Disk Production

To get to the laboratory you walked past the fitting shop to the loading bays and into the milling area for disc and tape. The disc ball mill was enclosed, with access through the same door that was used for filling and extracting the disc mix. The mixture was prepared by one shift working days only on weekdays. This was a batch process requiring much smaller quantities than the tape line because the coating on the discs was so thin. The older 760 disks had thicker coatings on thicker substrate aluminium discs than the later more advanced 880 and 882 disks. From month to month in the laboratory it could be seen that the ratio of samples was changing, indicating that the older 760 disks, which had been sold in the largest quantities, were now

being outsold by the newer 880 disks. The 882 disks would be the main disk in the near future as the technology rapidly advanced.

As the plant had grown, I was taken on to perform the bulk of the raw material testing, along with trouble shooting across the plant and preparing the laboratory coater in the white room for special formulation research and development. When using the laboratory coater for the first couple of times, a production worker would turn up to help, with a heavy spanner. The laboratory coater was located in the dust free, white room and was used to coat Mylar clear tape with new formulations of disc mix, ready for evaluation. This only took place occasionally. The laboratory coater was a metal box, four foot high and six foot wide. It had two glass doors in its front and no moving parts. Inside, four wide tubes poked out, with holes in them pumping air, for the tape to hover on while being coated. My job was to get the air inside up to about two hundred degrees, ready for coating. Opening the door to place the Mylar without touching the hot metal surfaces inside was a skill. While your head was in this 'oven', the helper would carry out his manoeuvre that he had been quietly waiting for, for the last twenty minutes. He would bang the top of the laboratory coater with his heavy spanner, causing you to jump and bang your head and touch your hands on the hot surfaces. Experience is a good thing and some months later, when again doing the honours; I would expect the bang at the opportune moment and would carry on obliviously doing my task. Having completed the task without mishap, I would then take my head out of the oven, and ask my 'helper' if he had heard thunder. At this point, he would slink away.

Raw Material Testing

Around once a week, a jar of cyclohexanone would arrive at my desk, signalling that the tanker had arrived and was ready to fill our underground cyclohexane tanks. However, before the tanks could be filled, the sample needed to be checked with an infrared spectrum to show that it was indeed cyclohexane. It was also checked with Gas Liquid Chromatography (GLC), which is a quick method to check the purity and number of components in volatile organic liquids. GLC required only sampling with a fine needle, followed by injection of a very small drop of the sample into a metal coiled tube contained in a heated block, through which ran a carrier gas such as nitrogen. The technique was used for our incoming volatile organic solvents, with a graphical readout being available in just a couple of minutes. The worst part of using GLC was manhandling the heavy five-foot-high gas cylinders to and from the loading bay when they were being replaced!

About every ten days the oxide juggernaut would arrive and I would sample paper sacks for oxide content using the muffle furnace, and place a sample in a long glass tube and go into the white room to carry out magnetic measurements. Another test was simply, after noting the colour and appearance of the oxide was correct, to place one hundred millilitres of the powder in a measuring cylinder, which was then tapped on the bench for it to settle and its new volume noted. The oxide contained magnetic ferric oxide needles less than a micron in length and with a width of about 0.1 microns. Once passed, the quality assurance department labels would be changed from yellow to green to let production workers know that the batch could be used.

An alternative supplier to Bayer was the American company, Hercules Incorporated, which gave a markedly lower tap density and percentage pigments results and needed the technician to instruct the slurry team to add extra oxide to the mix and to re-stir for one hour, to bring the iron content up to specification.

Carbon black was used to provide conductivity and came in cubic boxes five feet high. The boxes were huge, but could be picked up, because the contents were so light. The bags inside would be slit with a blade for sampling and then sealed with tape afterwards. The carbon black was then tested for particle size in the laboratory using oil adsorption on a clock glass. I was interested to see carbon black in use because, a couple of years earlier, I had been shown lattice images taken with the electron microscopes I was training to use in Aberystwyth's chemistry department. The folding of the layers at the atomic scale was clearly seen. Payment for the images taken routinely for the manufacturer provided the funding for the electron microscope technician in Aberystwyth's chemistry department.

Many chemicals arrived in metal oil drums and were stacked horizontally in the yard or chemical stores. This meant I frequently had to coordinate my raw material sampling with the forklift truck driver. I could be outside in all weathers, sometimes in snow, because the plant was located next to the highest town in Wales. I would thus roam the plant with my rubber gloves, pliers for breaking the metal drum seals, a long, rectangular, steel Z-shaped drum key, and a metal egg-cup-sized sampler on a metal arm with a hole at

the bottom to allow the liquids to run into the sample bottle. The only all plastic oil drums contained a mixture of three highly concentrated acids destined for the tanks used to etch the bare aluminium substrate discs. Extra care had to be taken sampling these drums, because of the nature of their contents, one of which was hydrofluoric acid! The samples were titrated with suitable indicators to check that the composition was correct.

The Dunlop Factory

The nearby Dunlop Semtex factory was in its last days during my employment at CDC. CDC took over part of Dunlop's large finished goods distribution warehouse for extra storage capacity. As a result I would frequently take the half-mile trip to sample various chemicals. Dunlop Semtex had a nine-domed concrete roof designed by Ove Arup, who went on to work on the Sydney Opera House. The design of this roof is credited as a partial inspiration for the iconic Australian building. The Dunlop factory was the first post- World War II industrial building to achieve listed status, but was still demolished in 2001.

Changing Times

Control Data Computers were the famous Cray computers. However, both CDC and their rivals IBM would find that they would soon have to compete with new Japanese entrants to the field of supercomputers and would be squeezed by the power of the up and coming mini and microcomputers also competing for their trade. The CDC magnetic peripherals division became a joint venture with Sperry and Honeywell in the eighties. At this time the Brynmawr plant had already produced a million fourteen-inch disks and three million magnetic tapes. Industry was a great experience and challenging, but I liked meeting lots of people to talk about chemistry and many other diverse topics. I then realised that I wanted to teach, and while still in industry started teaching a TEC evening class in a local college and obtained a teacher training place for the following academic year .

When I worked at the plant in the early eighties, it was a great hope for the area's industrial regeneration. This was a time when thousands of jobs were being lost at the famous Ebbw Vale Steelworks, coal mining was in its death throws in the area and the Dunlop Semtex factory closed in 1981, with the loss of six hundred jobs. While I worked at CDC, tape and disk production peaked. However, within a few years, the rise of microcomputers to the mass market heralded the demise of large magnetic media products. CDC found the market had become unprofitable in the mid-eighties and withdrew from computer manufacture and sold off its affiliated companies in 1988. With the CDC Brynmawr plant now surplus to requirements, it was taken over by Xidex, a leading manufacturer of computer hard disks for personal computers. Making hard and floppy disks, Xidex had gained a quarter of the world's floppy disk market and employed 11,000 people worldwide. However, they too soon found their markets were collapsing, as computer disk drive manufacturers cancelled millions of dollars worth of orders, due to the rapidly changing nature of computer technology and storage. Xidex was in turn acquired by Anacomp in mid-1988, and within weeks started consolidating its disk business at its headquarters in Santa Clara in California. The Brynmawr operation was marked for closure and so the Welsh plant, which had brought the hope of new employment with it to the area at a time of pit closures, now itself was soon to close. The plant was left empty for many years, until its removal, along with much of the hill it was built on, to make way for the Heads of the Valleys road, a major road artery into Wales.

Figure 1: The former Control Data Corporation Site in Brynmawr, Gwent, during construction of the Heads of the Valley Road, summer 2016. Photograph by Kerry Pendergast.

Control Data's 7600 Supercomputer and Molecular Dynamics

Interestingly, at this time I was also collaborating with Myron Wyn Evans, back in Aberystwyth University [1]. He had been a user of the University's Elliott (ICL) 4130 computer, when computer cards and tape were still in wide use [2]. He used the computer to perform Fourier transforms to

produce far infrared spectra from the data he had produced with the NPL-Grubb Parson developed spectrometer [3]. He also used it to run the Algol curve fitting programs he had adapted to test the data against the theory. This work had gained him the RSC's Harrison Memorial Prize in 1978 and the Meldola Medal in 1979, following the NPL (National Physical Laboratory) team advising the RSC about the importance of his work [4, 5]. He then became a regular user of the Control Data supercomputer; the CDC 7600 in Manchester, Britain's most powerful, via a link from Aberystwyth. This research employed the supercomputer to simulate molecular dynamics, frame by frame, in the picoseconds timeframe and in 1986, he was head hunted by IBM, who got him to cross the Atlantic to IBM Kingston, New York, with the lure of unlimited computer time on their supercomputers there [6, 7], and subsequently in their Cornell Theory Center [8] and ETH in Zurich [9].

IBM was first to market in 1957 with a hard disk drive, with fifty-two, stacked 24 inch disks. By 1962, IBM had developed removable disk packs, sporting six fourteen inch disks. IBM invented the floppy disk drive and manufactured 8 inch floppies from 1969, but left the market open for companies like Xidex to produce the later, smaller floppy disks. Fixed disks connected to the CPU, could be augmented by removable disk packs data storage units, which could be swapped in seconds with other packs, giving a vast data archive which could be built up nearby. Such disk archives could be transferred to tape, for lower cost storage. When I worked for Control Data, we were told that computer tape was on the way out and would be replaced by the Random Access Memory (RAM) disks that we were also making. However, as tape heads have become capable of reading and writing on smaller and smaller areas of tape as the magnetic particles on the tape have become smaller, computer tapes can now store vast amounts of data. This makes them ideal for archiving data and for back-up memory, which can restore data to a system that has been lost. Furthermore, data stored on magnetic disks and tapes are resilient from hacking, because they can be stored away from the computer on shelves, giving them a physical separation, to protect the data.

References

1. K. Pendergast *et al.,* "Soliton Models and Transport Properties of Polyacetylene", *Advances in Chemical Physics*, 1985, 63, 1-67.
2. Jeremy Perkins, "A History of the Computer Unit", compiled in 1999, https://history.dcs.aber.ac.uk/Article/computer-unit (accessed 06.01.25).

3. M.W. Evans, Mansel Davies and I. Larkin, "Molecular Motion and Molecular Interaction in Nematic and Isotropic Phases of a Liquid Crystal Compound", *Journal of the Chemical Society*, *Faraday Transactions 2*, 1973, 69(7), 1011-22.

4. J. Goulon, D. Canet, M.W. Evans, and G.J. Davies, "Reinvestigation of the Methyl and Methoxy Group Hindered Rotation in *p*-Dimethoxybenzene by Comparison of Dielectric and Far-Infrared Spectra with Carbon-13 NMR Relaxation Data", *Molecular Physics* 1975, 20(4), 973-95.

5. J.S. Rowlinson and M.W. Evans, "The Motions of Simple Molecules in Liquids", *Annual Rep. Prog. Chem., Sect A: Phys. Inorg. Chem.*, 1975, 72, 5-30.

6. M.W. Evans, G.C. Lie and E. Clementi, "Molecular Dynamics of Liquid Water in a Circularly Polarised Field", *Journal of Chemical Physics,* 1987, 87(10), 6040-45.

7. M.W. Evans and D.M. Heyes, "Brownian Dynamics Simulation", in *Modern Techniques in Computational Chemistry (MOTECC 89)*, ed. E. Clementi (Leiden: Escom Science Publishers, 1989), chapter 9.

8. M.W. Evans and Chris Pelkie, "Optical NMR Theory, Simulation and Animation", *J Opt. Soc. Am.*, *B-Opt Physics*, 1992, 9(7), 1020-9; and *Scientific Excellence in Supercomputing: The IBM 1990 Contest Prize Papers*, eds. K.R. Billingsley, H.U. Brown and E. Derohanes, volume 1 (Atlanta: Baldwin Press, c. 1992).

9. M.W. Evans, G. Wagnière and S. Woźniak, "Molecular Dynamic Simulations of Nonlinear Optical Effects, Electric Polarization due to Optical Rectification in a Circularly Polarized Laser", *Physica B*, 1991, 173, 357-85.

Kerry Pendergast

Two Books That Led Me to History of Science and Technology

Introduction

The two previous articles in this series [1] have been entitled "Two books that markedly influenced my chemical career"; both have included teenage reminiscences. If I were to write an article along those lines, I would begin by responding to Nigel Jopson's article (page 16) that I did personally

produce As_2S_3 unsupervised during a lunch break at school [2], which, he specifically suggests, would nowadays cause an "uproar".

However, the Editor has allowed me a different topic and therefore title, as above. The result is that the rest of this article focuses on my more mature years, up and including 2024. After Oxford chemistry finals, I worked in two research groups [3] in the University's Inorganic Chemistry Laboratory. Thereafter, I had six non-academic jobs spanning a wide range of science and technology, mostly doing intellectual property law – not just patents but also negotiating and drafting technology transfer agreements. In parallel with those jobs, both for enjoyment and so as to maintain a broad scientific base, I read a wide range of history of mathematics, science, and technology, acquiring articles, monographs, reference works, and original texts. Ceasing full-time employment in 2009, I continued with intellectual property law on my own account, but was able to spend more time than before on history, including in organising/speaking at meetings of the Historical Group [4].

The Books

The two books that started me on this path were outside the history of science and technology mainstream, even though, as just stated, my library soon became dominated by mainstream works. The books are *Subtle is the Lord – The Life and Science of Albert Einstein* (Oxford: Oxford University Press, 1982), by Abraham Païs (1918-2000); and *Most Secret War* (London: Hamish Hamilton, 1978), by Reginald Victor Jones (1911-1997). I read the books shortly after their publication. Both are still available.

Païs

Païs's book is a scientific biography, written by a top physicist about a great one, explaining the context and development of the ideas of Albert Einstein (1877-1955). Païs engages deeply with the thought of Einstein (whom he knew personally), and assumes his readers have good scientific knowledge.

Païs also carefully placed Einstein's work in the context of previous work. Now, I already knew –

(a) that the equation today written as $E = h\nu$ [5] had emerged from the work of Einstein in the first decade of the twentieth century, who had relied on the work of 1900 by Max Planck (1858-1947), and

(b) that Planck had in turn relied on preexisting experimental data on the emission spectra of black bodies (ones that absorb all incident radiation).

What had always puzzled me, but which Païs explained (pages 2 and 364-5), was why scientists had invested so much effort into creating this data, especially in devising techniques for far infrared radiation (up to λ = 60 µm). Païs observes that it was Gustav Kirchhoff (1824-1887) who had encouraged people to do so. In 1860, Kirchhoff asserted that because the radiation emitted by a black body was independent of the material of which the body was made [6], the spectrum, once determined, would expose an underlying fundamental simplicity; accordingly, such determination was "highly important" – as indeed it turned out to be forty years later.

Another striking account by Païs (pages 245-9) is of the Einstein-de Haas [7] experiment of 1915. This very difficult experiment involved observing the torsional oscillations of a metallic iron cylinder suspended coaxially within a solenoid carrying an alternating current. The experiment offers to a modern chemist or physicist a concrete, simple insight into the magnetism of materials at the atomic level. Contemporarily, it addressed the fundamental question of whether, contrary to classical electromagnetic theory, an electron could maintain constant rotatory motion and thereby be in a "stationary" energy state; by answering this question in the affirmative, the experiment provided support to the planetary model of the hydrogen atom that had been proposed in 1913 by Niels Bohr (1885-1962). But further and more precise proof of such electronic states soon emerged from spectroscopy, and the experiment was mostly forgotten. I myself recently used some original PowerPoint graphics to remind historians and physicists of the experiment [8].

History of science when written by someone such as Païs, with scientific training and serious understanding of subsequent developments, is immediately at risk of being criticised by some people as "Whiggish" or "presentist" [9]. The former term derives from *The Whig Interpretation of History* (1931) in which Herbert Butterfield (1900-1979) criticised political and social historians who were biased in favour of subsequent "progress" up to the present. As matters stood in 1931, a writer on history of science could have avoided such suspicion simply by impartially seeking to understand the background against which historical practitioners were working, being careful –

(a) not to criticise historical practitioners merely because they were later proved wrong, or were hampered by a widely-accepted but unprofitable intellectual framework or by unavailability of good apparatus and pure materials; and

(b) conversely, not to misinterpret historical texts in the direction of modern understanding, e.g. by importing anachronistic significance into words such as "atom" or "molecule" or into superficial resemblances between historical drawings and modern ones.

However, in the past sixty years or so, some historians and philosophers of science have greatly extended the scope of alleged "Whiggish" or "presentist" error (and, as it happens, implicitly to identify errors made by Butterfield when, in his later years, he himself wrote history of science). Thus, in some quarters statements such as the following would be objected to: "What X [the historical practitioner] calls A we now call B" [10], or "X cannot have discovered C as he claimed, for there is now overwhelming evidence that no C exists with the properties he describes" [11], or "What must have happened in X's experiment, unknown to X, is D" [12]. Païs enriches his writing with such statements; I likewise am content, despite the risk, to make such statements, provided that there is evidence to support them and I have the linguistic and scientific skill to interpret that evidence.

A few years ago, the historian of chemistry Bill Brock sought my own scientific expertise (not that I compare remotely with Païs!) to create jointly a short biography of a chemist Robert Fergus Hunter (1904-1963) [13]. In this, we did quite definitely include statements similar to those in the last paragraph when discussing an episode of Hunter's life that damaged his scientific reputation. The episode was a public, aggressive dispute about the electronic theory of chemical bonding. The dispute began with a 1934 paper by Hunter and a physicist Rudolf Samuel (1897-1949) which challenged the "octet rule". The rule, which works well for non-transition elements, had been promoted by the eminent Nevil Vincent Sidgwick (1873-1952); indeed it had previously been espoused by Hunter himself. Hunter and Samuel's paper was arrogantly worded; it disingenuously cited the work of two other major scientists, Linus Pauling (1901-1994) and Christopher Ingold (1893-1970); and *Nature* published blunt criticism of it.

In our article, Bill and I discussed this dispute at such a level that, hopefully, less scientifically knowledgeable readers could get a feel for the dispute while taking our drawings of electronic structures on trust. In principle, we could have dumbed down the science, discussing only the personalities and the statuses of the disputants; but this would have been to short-change our more scientifically knowledgeable readers. We navigated the confusing terminology that had arisen in this nascent field [14] and correlated it with modern terminology. We assessed what expertise Hunter and Samuel had brought to their 1934 paper, and the contemporary criticism of the paper, concluding that their work lacked competence by the standards of 1934. As a sanity-check on this conclusion, we noted that even in the twenty-first century the octet rule flourishes in university chemistry as a useful first approximation.

Jones

Jones' book is a memoir of his scientific intelligence work during the Second World War (1939-1945). At Oxford, after a First in physics in 1932 and a DPhil in 1934, Jones took up a research fellowship, proposing to do infrared astronomy preparatory to going to the USA. But from 1936 to 1938, still in Oxford and convinced that a war was coming, he accepted commissions from the Air Ministry to research military applications of infrared technology. He then left Oxford actually to join the Air Ministry, where he established a scientific intelligence function. In June 1940, with the grade only of Scientific Officer, he personally presented to the Prime Minister, Winston Churchill (1874-1965), what was known about the system *Knickebein* that guided German bombers to targets in the UK. By 1945, he had risen to Assistant Director level and had been made CBE. However, Jones disagreed with the post-war reorganisation of scientific intelligence, and was happy to escape, with Churchill's endorsement, to a Professorship in Aberdeen.

The book's theme is the application of scientific method to discovering enemy technology and foiling it. Jones warns against jumping to conclusions, such as when there was an unjustified scare about German radar being able to distinguish between British fighters and British bombers (page 243). He recommends Occam's Razor to scientists, the principle that the most likely (but not certain) explanation of a set of observed facts is the simplest. In a sequel, *Reflections on Intelligence* (London: Heinemann, 1989) he contrasts the Razor with Crabtree's Bludgeon, "No set of mutually inconsistent observations can exist for which some human intellect cannot conceive a coherent explanation, however complicated" [15]. He warns (also in *Reflections*) against relying on calculations made without qualitative understanding; his example is Lord Kelvin (1824-1907), who calculated,

contrary to geological evidence, that the earth was only a few hundred million years old.

As well as providing such practical insights for working scientists, Jones's memoirs are of intrinsic value to historians, albeit that they must be assessed for the bias which arises from his being a participant. Likewise, interviews with living scientists [16] and witness seminars [17] are all grist to the historical mill, containing unique information, but possibly biased. A witness account of my own, relating to computational technology from 1966 to more recent times [18], was not I think biased, but memory can be deceptive, so I checked my recollections against artefacts and written sources. My article about the Harwell research site in Oxfordshire (1946 onwards) [19] was not primarily a witness account, despite my having worked there for a couple of years. I believe that, rather than importing bias, my direct experience helped me (a) to compensate for bias in a previous, very favourable account written by a long-term employee, and (b) to identify sources that others might not have considered.

Final Comments

The historical process of seeking out sources and evaluating them can be tedious. But I was mentally prepared: I assisted my wife [20] in her early years as a diplomatic historian, and I also spent many years doing legal work. The latter included interpreting technical documents as of their own time despite terminological difficulties similar to those mentioned above in relation to chemical bonding. I am presently engaged in resolving obscurities in one well-known eighteenth-century French work with the aid *inter alia* of two editions of another well-known work, Pierre-Joseph Macquer's (phlogistonist) *Dictionnaire de chymie*. But, following Païs's example, I also use modern knowledge to sanity-check the experimental observations reported in the work in question.

The project just mentioned is typical scholarly history of science. But an advantage of being an independent scholar is that I am not confined to this; I may address any question that attracts me. My interest in Michael Faraday (1791-1867) and Dr John Snow (1813-1858), associated contemporarily with now-invalid street addresses, resulted in a guide to finding historical locations in London despite the vast extent, from 1855 to 1939, of legislatively-enabled official street renaming and house renumbering [21]. Study of Isaac Newton (1642-1727) not only allowed me to help a little with a new translation of *Principia*, but also led me to pose and solve a "recreational mathematics" problem in gravity [22, 23]. Following my witness account of historical calculation technology, I identified a class of awkward-looking equations that, unexpectedly, could have been readily handled without electronic computation [24]. Having read accounts of a compact portable barometer that was in common use from *ca* 1600 to *ca* 1900, I worked out its physical chemistry [25]. And as the junior author of a regular scientific paper [26], I included historical information that attracted attention and helped promote the paper [27].

Païs and Jones set me on a path that I have greatly enjoyed following.

References and Notes

1. Henry Rzepa, *RSCHG Newsletter*, Winter 2024, **85**, 1-15; Nigel Jopson, *RSCHG Newsletter*, Summer 2024, **86**, 15-20.
2. I followed Experiment 135 at page 648 in a handed-down copy of the information-packed book, T.M. Lowry and A.C. Cavell, *Intermediate Chemistry*, 6th edition (London: MacMillan, 1954).
3. In the groups of Peter G. Dickens and Lionel A.K. Staveley, studying the thermodynamics of solids.
4. Presentation of an RSC plaque in Penzance to honour Humphry Davy, 2015; centenary of H.G.J. Moseley, 2016; centenary of induced transmutation, 2019; sesquicentenary of molecular chirality, 2021.
5. $E = h\nu$ is the foundation stone of quantum chemistry, delivering, especially with spectroscopy, key insights into chemical structure and bonding.
6. Compare the fundamental equality of gravitational and inertial mass of any body regardless of the material composing it.
7. Wander Johannes de Haas (1878-1960).
8. Michael Jewess, "The Einstein – de Haas experiment of early 1915: so important to Einstein that he interrupted his work on General Relativity for it", lecture, *4th International Conference on the History of Physics* (Dublin, Trinity College, 8-10 June 2022).
9. *Bull. Hist. Chem.*, 2022, **47**(1), numerous articles; Michael Jewess, "Essay review", *RSCHG Newsletter*, Winter 2023, **83**, 47-53, Annex; Keith M. Parsons, *Why it's Ok to Trust science* (London: Routledge 2024), Chapters 1 to 5; and citations therein.

10. Example, equating Joseph Black's "fixed air" with "carbon dioxide".
11. Example, rejecting Noddack and Tacke's claim to have discovered element of atomic number 43.
12. Example, commenting that the vacuum or sample purity must have been poor when Lavoisier reported that charcoal evaporated when heated in a vessel attached to a vacuum pump.
13. William H. Brock and Michael Jewess, "Unwise Relationships and an Unsound Valence Theory: The Chemical Career of Robert Fergus Hunter (1904–1963)", *Ambix*, 2021, **68**(4), 407-430.
14. "Valence", "valency"; "linkage", "bond"; "coordinate", "dative"; "resonance", "mesomerism".
15. Jones's publishers were probably unaware that he was referring to the Crabtree Foundation https://www.ucl.ac.uk/crabtree, of which Jones, a keen practical joker, was one of the first "Scholars". The Foundation has annual dinners to celebrate the extraordinary exploits of the otherwise undocumented Joseph Crabtree (14 February 1754 – 14 February 1854).
16. Bernadette Bensaude-Vincent has done many of these.
17. These are common in relation to governmental topics; once the official papers are open, retired civil servants (even retired spies!) attend. Our own Historical Group meetings frequently have eye-witness speakers or audience members.
18. Michael Jewess, "Calculating Chemistry: How it Used to be Done, a Witness Account", *RSCHG Newsletter*, Winter 2023, **83**, 26-37 (hard copy pages mis-ordered, RSC website easier). The article includes photographs of a hand-cranked calculator, of mathematical tables, and of a slide rule.
19. Michael Jewess, "Harwell Old and New: Its Renaissance as Symbolised by the Relocation of an RSC National Chemical Landmark Plaque", Forschungs-Neutronenquelle Heinz Maier-Leibnitz (FRM II), 2019, https://neutronsources.org/media/harwell_old_and_new___a_perspective_by_michael_jewess_dec19.pdf.
20. Professor Kathleen Burk.

21. Michael Jewess, "The 'Great Renaming': Locating History of Science in London", *Viewpoint*, October 2021, **125**, 6-8 (hard copy corrupt, instead see BSHS website).
22. Isaac Newton, *The Mathematical Principles of Natural Philosophy*, translated and annotated by Charles Leedham-Green (Cambridge: Cambridge University Press, 2021).
23. Michael Jewess, "Optimising the Acceleration Due to Gravity on a Planet's Surface", *Mathematical Gazette*, 2010, **94**, 203-215.
24. Michael Jewess, "$xy = \cos(x + y)$ and Other Implicit Equations that are Surprisingly Easy to Plot", *Mathematical Gazette*, 2024, **108**, 1-11. The cover of the issue features a hand-cranked calculator.
25. Michael Jewess, "An Equation for the 'Weather Glass' ", *Physics Education*, 2024, **59**, 035006.
26. Michael Jewess and Robert H. Crabtree, "Electrocatalytic Nitrogen Fixation for Distributed Fertilizer Production?", *ACS Sustainable Chem. Eng.* 2016, **4**, 5855–58.
27. Michael Jewess, "Davy Hits the Headlines Again", *RSCHG Newsletter*, Summer 2017, **72**, 28-39 (hard copy), 15-16 (RSC website online). Corrigendum: interchange "cathode" and "anode" between equations (R2) and (R3).

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New Gravestone for John Newlands Unveiled

John Newlands (1837–1898) is famous for his development of a periodic law of the elements in 1864, five years before Dimitri Mendeleev and Lothar Meyer. Unfortunately, he called it the Law of Octaves, which led to considerable ridicule from other chemists. Henry Enfield Roscoe gave Newlands priority for the idea, in his major *Treatise of Chemistry* in 1879, despite being a friend of Meyer. Newlands campaigned even more strongly for recognition after the Royal Society awarded Mendeleyev and Meyer its Davy Medal for the discovery of the periodic law in 1882. He published a book *On the Discovery of the Periodic Law* in 1884 and eventually he, too, was given the Davy Medal in 1887. Meanwhile, he had established himself

as an analytical chemist in 1864 and four years later became chief chemist of James Duncan's London sugar refinery.

The gravestone unveiling, with attendees including Bob Flanagan (5th from left) and Peter Morris (6th from right) with Peter Newlands to his right. Photograph courtesy of Heritage of London Trust/ @holtoflondon

Newlands was buried in West Norwood Cemetery, near Dulwich, but his gravestone had fallen into a state of disrepair. His descendant Peter Newlands set up a fundraising campaign to restore it, to which the RSC via the Historical Group contributed. Assistance was also given by the Heritage of London Trust. As part of the restoration project, the stone was refaced and the memorial lettering cut and lead infilled to match the existing lettering. The new gravestone was unveiled on 9 September 2024 by Peter Newlands and Peter Morris, representing the Historical Group. Unfortunately, it rained during the ceremony, but there was a good turn-out with fifteen people present. There were short speeches by Peter Newlands and Peter Morris, and teachers from a local school showed the work of their pupils who had studied the life and impact of Newlands. Bob Flanagan, who lives locally, also represented the Historical Group.

Peter Morris

RSC HISTORICAL GROUP MEETING REPORT

Chemistry, History and Medicine

Wednesday 16 October 2024, Burlington House, Piccadilly, London

Without chemistry's contributions to medicine, especially with respect to drug-discovery and development, life indeed would have remained, to use Thomas Hobbes' 1651 phrase, "Poor, brutish and short". Only a few effective medicaments were in use up to the mid-nineteenth century. These were mainly of natural origin: quinine as both a cure for (and a prophylactic against) malaria, castor oil as a purgative (and its cousin, the more mildly-acting senna, extracted from the shrub *Senna alexandrina*) and laudanum (a tincture from opium poppies) to alleviate pain and induce euphoria. This meeting considered different aspects of the history of chemistry and medicine, including the development of the pharmaceutical industry and how organic chemistry and electrochemistry have contributed to the amelioration of disease, and the prolonging of life. It concluded with a lecture by Sir Simon Campbell, former President of the RSC.

Figure 1: Speakers (left to right) Alistair McKenzie, Anna Simmons, Tilli Tansey, Alan Dronsfield, Sir Simon Campbell and John Dungate

The Chemistry, History and Medicine Meeting was somewhat of a swansong for Alan Dronsfield as it was the final meeting he has organised

before stepping down from the historical group committee at the end of 2024. Crucially Alan served as chair of the group for nine years from 2005 to 2013 (officers' terms start at the beginning of the year). Over the years Alan has been a prolific contributor to the historical group's newsletter, an organizer of multiple meetings and a fantastic chair and committee member, both in terms of the work he has undertaken on behalf of the group and the calm, efficient and reliable way he has done it. We will miss his contributions to the committee greatly, although we hope to continue enjoying catching up at meetings and reading his articles in the group's newsletter and elsewhere.

A History of the Treatment of TB, Principally Using Drugs

Alan Dronsfield, University of Derby

Tuberculosis killed about 50,000 people in England and Wales per year in the 1930s. The disease was aptly named "the captain of death". Once diagnosed, half the sufferers would be dead within five years. The disease is caused by the bacillus *Mycobacterium tuberculosis*. The lungs were infected in nearly every patient, but it could also affect a range of other organs, including glands of the neck and abdomen, bones, joints, and skin. Infection of the skin was called *lupus vulgaris* (the common wolf) because of the imagined resemblance to a wolf bite. Infection of the adrenal glands was one cause of Addison's disease. It was this complication that probably led to the death of novelist Jane Austen in 1817 (RSCHG *Newsletter* Winter 2024).

Before the Second World War there was no really satisfactory treatment. Patients might be incarcerated in sanatoria (dedicated hospitals) for months on end, and subjected to "rest" and maximum exposure to fresh air and sunlight. Over the years, various drug remedies were proposed, and false hopes were built up when the treatment appeared to coincide with a patient going through an "improving" spell of this undulating disease.

Initial studies sought agents present in nature that might cure the disease, much as Alexander Fleming's penicillin. Success came in 1945 with Selman Waksman's discovery of streptomycin from a mould living in soil. The alternative approach, pioneered by Paul Ehrlich and his discovery of Salvarsan, was to seek a totally synthetic chemical with anti-tubercular activity. Noting that the TB bacillus would take up and incorporate molecules rich in oxygen, Jorgen Lehman sought one that might additionally contain a group that would poison the bacillus. Success came with 4-amino salicylic acid, given orally in 20g daily doses. Like streptomycin, this required two years of uninterrupted therapy. The disease would return in a drug-resistant form if the treatment was stopped prematurely. Spectacularly good results were achieved if both drugs (streptomycin and the 4-amino salicylic acid) were given together and this combination approach to therapy is used today. The third drug has a very distant connection to the sulfonamides. Tibione had an unusual (from a therapeutic point of view) hydrazide function and to render this less toxic it was attached to an isonicotinic acid group. The product (Isoniazide) was highly active and is the mainstay of today's combination therapy. Thanks to this post-war drug discovery the yearly death rate from tuberculosis in the UK has dropped from over 50,000 to about 350.

Figure 2: Alan Dronsfield's talk on the history of the treatment of TB

Diabetes: A History of the Monitoring of Blood and Urine for Glucose

John Dungate

After isolation in 1921, insulin was first used in 1922 to control Type 1 diabetes by the team of Banting, Best, McLeod and Collip. The general

press rightly praised the researchers for their life-saving work. However, the public has been little informed about the developments needed to monitor the glucose concentration in a patient's blood. Insulin injections can only be used safely if made in tandem with such analytical measurements as an overdose of the hormone can lead to swift patient death from hypoglycaemia, whereas under-dosing can lead to life-shortening complications and premature death.

Initially (for home do-it-yourself testing) it was only possible to infer, roughly, the concentration of glucose in a patient's blood by urine analysis. The first techniques were based upon the well-known Fehling's/Benedict's methods, in which glucose, a reducing sugar, produces a suspension or precipitate of red cuprous oxide. The results, based on crude visual comparisons, were semi-quantitative at best.

The first method to measure the concentration of glucose in smallish quantities of blood used a more complex reaction sequence, developed by Folin and Wu in 1920. Blood glucose concentration gives a more rapid feedback of the effect that the insulin is having on the patient. The test involved the precipitation of interfering proteins, followed by sequence of redox reactions to form a coloured product, molybdenum blue. The glucose concentration, proportional to the intensity of the colour, was determined by standardised colorimetric methods.

Patient self-testing (PST) is now well-recognised as a successful method for the treatment of type 1, and increasingly, type 2 diabetics. Most convenient, and less invasive, was to analyse urine for glucose content, even though the connection back to blood glucose levels was imprecise. Home test kits, with test-tubes and spirit burners, were not easy for non-chemists to use in their home environments, but were arguably preferable to the older historical method of tasting the urine for sweetness and making a guess! These Cu(II)/Cu(I) methods for PST were displaced in the 1950s by enzymatic methods, the end stage of which was to produce a coloured dye, the intensity of which was proportional to the concentration of glucose in the urine.

The Miles Company, which had earlier made a fortune from its "Alka-Seltzer" tablets, introduced a dip-stick method with the reagents impregnated on a patch that reacted on contact with a urine sample. The most important innovation was to use the enzyme *glucose oxidase* to catalyse the oxidation of glucose by the air, at room temperature, removing the need for external heating. A second reaction sequence catalysed by peroxidase (from horseradish) formed a coloured patch based on the oxidation product of *o*-tolidine (3,3′-dimethylbenzidine), and the intensity of colour (and hence the glucose concentration) estimated from comparison charts. A very similar product "DIASTIX" is still used today.

The same principle was developed to produce desk-top machines to measure directly blood glucose concentrations, using semi-permeable membranes to remove the interfering proteins. Reflectance colorimeters were incorporated to quantify the results. There is now a wide range of miniaturised devices in use by patients today using similar principles. Moreover the same redox reaction sequences, forming electron transport chains, can be used to deliver an electrical current via an electrode. Here the current intensity is used indicate the glucose concentration.

More recently continuous glucose monitors (CGMs) have improved patient care further, especially when linked to insulin pumps. These monitors have electrode systems not much thicker than a hair inserted under the skin. They make use of new and classical electrochemical redox sequences to give an electronic signal sensed by the under-skin probe. Sophisticated (yet disposable) electronics contained with in a module adhering to the patient's skin allow for wi-fi transmission of data to suitable hand-held readers, smart phones or even, yet more remotely, to agencies responsible for patient care. With the range of technology that is now available it is interesting to see the repeated use of older chemical reactions being used in the most advanced of current devices!

Chloroform as an Anaesthetic: Some Historical Perspectives

Alistair McKenzie, Former Consultant Anaesthetist Royal Edinburgh Infirmary

Chloroform was first prepared in 1831, independently by Eugène Soubeiran (France), Justus von Liebig (Germany) and Samuel Guthrie (USA) – although none of them named it so. It was named chloroform in 1834 by the French chemist Jean-Baptiste Dumas, who expressed its formula as C_2HCl_3. In the USA it was called chloric ether and promoted as an ingredient of cough mixtures.

Enthusiastic about the advent of general anaesthesia with ether in Britain in December 1846, James Young Simpson began to use it in obstetrics in Edinburgh from the following month. However, he searched for a superior

anaesthetic agent by testing numerous volatile liquids. On the suggestion of his friend David Waldie, chemist at Apothecaries' Hall in Liverpool, Simpson tried chloroform. He obtained several ounces from Duncan, Flockhart & Co. in Edinburgh and self-experimented at his home on 4 November 1847. Within two weeks he published on its use as an anaesthetic in surgery and midwifery. He championed chloroform for the relief of pain in childbirth and produced a pamphlet arguing against religious objections to this.

Despite reports of sudden death under chloroform, Simpson continued to promote it for the rest of his life. He and others in Scotland administered it liberally by "rag and bottle", declaring it safe if attention was paid to the breathing. By contrast in England, John Snow and his followers commonly administered it by inhaler to control dosage – monitoring the pulse as they thought overdose impaired the heart.

A huge demand for chloroform followed Simpson's enthusiastic promotion of it. He liaised with the Professor of Chemistry at the University of Edinburgh, William Gregory, who advised on the large-scale production and purification of chloroform by Edinburgh manufacturers. With the economic advantage of lower spirit duty in Scotland compared to England, the Edinburgh manufacturers attained a monopoly of chloroform production in the UK. Notably Duncan, Flockhart & Co. expanded from a small pharmacy to a large factory with laboratories.

Chloroform remained the anaesthetic of choice in Scotland until around the First World War. But in England after 1873 the anaesthetic of choice reverted to ether, because of overcoming the difficulties in ether administration and concern about deaths under chloroform. Anaesthetic deaths were less reported in Scotland compared to England, partly due to differences in their legal systems. It was not until 1911 that Goodman Levy showed that chloroform could induce ventricular fibrillation, and this did not begin to be accepted by anaesthetists until the 1930s.

Apothecaries, Chemistry and Medicine in Early Nineteenth Century London: William Thomas Brande and John Nussey

Anna Simmons, UCL

This paper explored the interconnectedness of medicine and chemistry through the lives of two apothecaries, William Thomas Brande (1788-1866) and John Nussey (1794-1862).

The word “apothecary” is derived from the Ancient Greek ‘apothḗkē’, meaning a storehouse or repository. London apothecaries were originally members of another city livery company, the Grocers’ Company. However, the apothecaries specialised skills in buying, preparing and retailing drugs set them apart. In 1617 they were granted independence and the Worshipful Society of Apothecaries was incorporated by royal charter as a City of London livery company. The institution’s medical and chemical activities expanded and evolved over time. In 1672, a laboratory for manufacturing chemical medicines was opened at its livery hall in Blackfriars and this developed into one of the largest sites for wholesale drug production in London. In the Apothecaries’ Act of 1815, the Society was given the statutory right to conduct examinations and grant licences to practise medicine in England and Wales.

Figure 3: Alistair McKenzie and his periodic table of postage stamps, which was displayed at the meeting. This periodic table is made up of stamps from around the world which represent the different elements: for example mercury is illustrated by a Spanish stamp, zirconium by an Australian stamp and manganese by a South African stamp.

Through biographical studies of the chemist, William Thomas Brande, and the royal apothecary, John Nussey, the paper explored how chemistry was considered key to solving the pressing medical concerns of the time and

how the subject was central to the education of medical students. Both men were prominent members of the Society of Apothecaries, attending the same dinners, committees and ceremonial events and had trained through apprenticeship to royal apothecaries. However, as the activities of the apothecary shifted and medicine and chemistry became increasingly professionalised their paths diverged. Brande was one of London’s leading chemists, whilst Nussey had an illustrious career as a medic to royalty as apothecary to George IV and Queen Victoria.

However points of commonality remained which underlined how medicine and chemistry were intertwined. Contributions to medical education were key. Brande had a long and prolific lecturing career – most London medical students in the first half of the nineteenth century would have been taught by him at some point – and his textbooks were widely consulted. Nussey was involved in the regulation and registration of medical practice and practitioners, serving on the General Medical Council. They also played essential roles in the Society’s pharmaceutical trade: Brande improving production processes in its laboratories and Nussey through financial and managerial matters.

Chemists in the Early Pharmaceutical Industry: A Case Study of Burroughs Wellcome & Co

Tilli Tansey, Queen Mary University of London

This paper examined the early history of Burroughs Wellcome & Co (BW&Co) from its foundation in London in 1880 until the First World War. The founders, Silas Burroughs and Henry Wellcome, both young American trained pharmacists, initially acted as agents for several American companies but by 1883 had established works and laboratories in Wandsworth, London, later superseded by larger premises in Dartford, Kent. Here, and throughout the company, they employed individuals with chemical knowledge and experience - some with degrees in relevant sciences or medicine, or qualifications from organisations such as the Worshipful Society of Apothecaries or the Pharmaceutical Society. Chemists in the factory and laboratories worked on production, quality control and product development, whilst others contributed to the writing of product information and advertising materials, or were employed as representatives to visit chemists and doctors to demonstrate and explain the company’s goods. In 1895, Burroughs died, making Wellcome the sole proprietor of the company, and over the next few years he established chemical laboratories for analytical and development purposes within the factory itself (The Wellcome Chemical Works, WCW); research laboratories in the City of London near the Company's Head Office (The Wellcome Chemical Research Laboratories, WCRL); and laboratories in Herne Hill for the raising of the new biological therapy, serum anti-toxins (The Wellcome Physiological Research Laboratories, WPRL) which also employed well qualified research chemists. Interactions and collaborations between the staff of these three establishments, who included George Barger, Francis Carr, Arthur Ewins and Henry Dale, produced several new and improved compounds, some of which were immediately marketed by the Company; and they also produced numerous scientific publications. Just before the First World War, Henry Dale was elected a Fellow of the Royal Society - the first person associated in any way with the pharmaceutical industry to receive such an honour. Also by that time, BW&Co was unique in the UK in being capable of producing chemicals and biologicals needed for the war effort, as noticed by other, more traditional, chemical manufacturers. After that conflict, chemical staff from BW&Co's laboratories were hired by British Drug Houses, Boots, Nathan & Co (Glaxo), and May and Baker to set up research laboratories, whilst several others were invited to join the newly created Medical Research Committee (later Council, the MRC) and others achieved University chairs.

Reference: Roy Church and E.M. Tansey, *Burroughs, Wellcome & Co: Knowledge, Trust, Profit and the Transformation of the British Pharmaceutical Industry, 1880-1940* (Lancaster: Crucible Books, 2007).

Diabetes: An Overview with a Glance at the Chemistry

Miranda Rosenthal, King's College Hospital

Diabetes is a chronic disease that occurs when the body cannot produce or use insulin properly, resulting in high blood sugar levels. Type 1 occurs when the body's immune system attacks and destroys insulin-producing cells in the pancreas and Type 2 is when the body does not produce enough insulin, or cells do not respond to insulin properly. Type 1 diabetes is less common than Type 2, affecting about 5–10% of people diagnosed with the disease. It was previously known as *juvenile diabetes* because it often develops in children, teens, and young adults, but it can occur at any age. Untreated, it is ultimately fatal, but the discovery of insulin in 1921, and its use in therapy, by F.G. Banting, C. Best and J. MacLeod changed the outlook for sufferers. With careful control of injected insulin to match the

body's production of glucose from the carbohydrate intake, they can now lead long and active lives.

For many years this control was achieved by pricking the skin with a lancet, sometimes several times a day, assaying the blood drop for glucose and injecting an amount of glucose judged to be appropriate.

Innovation and technical development has changed the medical management of Type 1 diabetes in two main respects. Firstly, probes inserted beneath the skin can continually monitor the blood for glucose and transmit the readings (wirelessly via a smart-phone app) to the patient so s/he can adjust the insulin dose to compensate for deviations from an acceptable level. This gives better control than the lancet method. Secondly the glucose concentrations themselves can automatically control the insulin dose, delivered by a body-worn pump connected to an implanted catheter.

The technology of monitor and pump is not cheap, but the combination is presently being offered to an increasing range of Type 1 diabetics in the UK. And patients are happy to exchange the slight pain when the probes and catheters are (self) inserted for the better control of blood-glucose levels that they engender.

Science, Art and Drug Discovery, a Personal Perspective

Sir Simon Campbell CBE FRS, Former SVP for WW Discovery, Pfizer

At the start of our research programme in Sandwich that lead to amlodipine, a once-daily calcium antagonist for the treatment of angina and hypertension, there were over ninety published patents around the parent dihydropyridine ring system which posed a significant challenge for innovative drug design. Moreover, agents of the class suffered poor pharmacokinetics, and there was little information on how to improve. However, innovative medicinal chemistry led to a novel series of alkoxyamino derivatives with potent calcium antagonist activity which displayed high, and unique bioavailability, together with long plasma half-lives. After extensive pharmacological profiling, UK 48,340 (amlodipine) was selected for clinical development and subsequently received worldwide approval as Norvasc™ (Istin) for the once-daily treatment of hypertension and angina. Norvasc- became the world's leading antihypertensive agent and the fourth best-selling drug worldwide, with billions of patient days of therapy achieved since launch.

Sildenafil, the first oral treatment for male erectile dysfunction, was the innovative result of a putative cardiovascular research programme aimed to block the action of the degradative enzyme PDE5 and increase levels of cGMP, which would relax smooth muscle and increase blood flow to target tissues. Starting from zaprinast, a weak and non-selective PDE5 inhibitor, computer modelling and scientific insight guided innovative medicinal chemistry to achieve significant increases in inhibitory potency and selectivity within a novel series of pyrazolopyrimidones. Optimisation of SARs and pharmacokinetics led to UK 92,480 (sildenafil), which was essentially devoid of cardiovascular activity in clinical trials. However, innovative analysis of the emerging role of nitric oxide and cGMP in controlling blood flow in the penis, coupled with opportunistic observations in volunteers, suggested that sildenafil would have a beneficial effect on male erectile dysfunction. This hypothesis was confirmed by extensive clinical trials in nearly 5,000 patients and sildenafil (Viagra) was approved in 1998 for the treatment of male erectile dysfunction. Viagra became one of the most widely prescribed medicines worldwide, has been used successfully by hundreds of millions of patients globally, and is a compelling example of Pasteur's Dictum "that chance only favours the prepared mind".

These research programmes were discussed from a personal perspective that highlighted the importance of scientific excellence and innovation within multidisciplinary project teams, successful resolution of significant medicinal chemistry challenges, and factors that influenced key decisions.

RSC HISTORICAL GROUP WEBINAR REPORTS

Tyrian Purple: New Ground-Breaking Insights

Zvi Koren (September 2024)

This talk not only reviewed the history of "Tyrian Purple", but it also highlighted some of the first-hand "revolutionary" discoveries that Professor Koren made after more than three decades of chemical analyses of archaeological colourants. In doing so he endeavoured to answer the following colourful questions:

What is the meaning of "purple"?

What is "Tyrian Purple"

Who really discovered "purple"?

Was Pliny's description of the molluskan dyeing process accurate?

Which sea-snail species was used for purple-dyeing in the Mediterranean?

How many snails are needed for a king's cloak?

Which snails were used for dyeing the biblical colours – red-purple (Argaman) and bluish-purple (Tekhelet)?

When *The Red Boy* was Wearing Yellow Clothes: New Insights into Lawrence's Painting Materials and the Genesis of a British Art Masterpiece

Marta Melchiorre (October 2024)

The *Portrait of Charles William Lambton* (known as *The Red Boy*), painted in 1825 by Sir Thomas Lawrence, is one of the most loved images of British art. It was recently acquired by the National Gallery, where it underwent conservation treatment and thorough technical investigation. The analytical work revealed the unexpected presence of a chrome yellow-based paint layer underneath the boy's iconic red clothes. This not only provided evidence to back up historical accounts recording how Lawrence had initially depicted the boy wearing yellow clothes, but also initiated new research into Lawrence's painting materials. Chrome yellow was introduced between 1804 and 1809, but more widely used from the second quarter of the nineteenth century. Lawrence was interested in new pigments, but cautious about their stability and had a collaboration with George Field to examine and test them. Field's journal books note indeed the analysis of two yellow samples received from Lawrence which both proved to be chrome yellow. Lawrence's collaboration with Field is of particular interest also considering the array of lake pigments identified in this work.

The Long Industrial Road to Synthetic Indigo

Matthijs de Keijzer and Maarten van Bommel (November 2024)

This talk covered the various ways, problems and solutions for the industrial production of indigo. Surprisingly, although numerous synthetic dyes were already on the market by the late 1860s, no synthetic substitute for indigo had been found. In the early days of synthetic dyes, chemistry was largely empirical, with vague ideas about how atoms in a molecule were linked. In 1865, Adolf Baeyer began investigating the structure and synthesis of indigo, but it took him eighteen years to reveal the formula. Between 1878 and 1882, he succeeded in establishing three indigo synthesis routes, the first starting with isatin, the second from cinnamic acid (propiolic acid process) and the last synthesis using *o*-nitrobenzaldehyde (Baeyer-Drewson process). However, these routes were not attractive from a commercial point of view. A new impulse was given in 1890, when Karl Heumann discovered two new processes. In the first Heumann synthesis, *N*-phenylglycine was fused with potash. Unfortunately, the high temperature led to a low yield of indigo. The second Heumann synthesis, based on *N*-phenylglycine-*o*-carboxylic acid, was the economically viable process. Between 1890 and 1897, many methods were developed to obtain the basic materials for the synthesis of indigo. In 1897, BASF produced synthetic indigo on an industrial scale applying an improved process based on *N*-phenylglycine-*o*-carboxylic acid. At the same time Farbwerke Hoechst also produced synthetic indigo using different processes. By 1900, four different commercial routes to synthetic indigo were in use.

In 1901, Johannes Pfleger, working for Degussa, discovered a more efficient way of producing indigo on an industrial scale. This process used the condensing agent sodium amide for the ring closure to form indoxyl at a lower temperature, resulting in a 90% yield of indigo. Hoechst acquired the patent and together with Degussa exploited the Pfleger process. Although this process was advantageous, the inexpensive blue sulfur dyes of the German factories Cassella, Kalle and Bayer were strong competitors to synthetic indigo, and BASF created its own competitor with the discovery of indanthrone blue BS by René Bohn in 1901. After the price of synthetic indigo fell to seven German marks per kilo in 1904, BASF and Hoechst shared the Pfleger-process and then formed the Second Indigo Convention to control the indigo market. Over time, the demand for synthetic indigo decreased and many companies ceased production, and by the mid-1960s, even BASF wanted to stop the production. In the late-1960s, however, the demand increased significantly, as it was used to dye fabrics for blue jeans, even today.

Michael Faraday's *Chemical History of a Candle*

Frank James (December 2024)

Faraday's *Chemical History of a Candle,* first published in 1861, has remained in print in English ever since and has been translated into more than a dozen languages which must make it one of the most popular science books ever. It was based on a set of six lectures that he delivered three times between 1848 and 1861 as the Christmas lectures at the Royal Institution.

His enthusiasm for communicating science shines through as he drew out the fascinating science behind the familiar candle flame out of which he effectively created a universe. This seasonal talk discussed how the lectures came to be delivered, their content, their publication and subsequent legacy.

RSC YouTube Channel

The recordings of a number of previous online lectures can be found at the Historical Group's playlist on the RSC YouTube Channel: https://www.youtube.com/playlist?list=PLLnAFJxOjzZu7N0f5-nVtHcLNxU2tKmpC

MEMBERS' PUBLICATIONS

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

P.E. Childs, "The Seaweed Industry in Guernsey and Jersey and the Extraction of Iodine, Part 2", *The Review*, 2024, LXXX(1), 16-29.

Building on the general overview of the seaweed industry as a source of iodine in the Channel Islands published in *The Review* of the Guernsey Society in winter 2023/2024, the second article looks in more detail at the production of iodine by two of the leading producers, both from Guernsey: Adolphus Arnold, a chemist and druggist in St Peter Port and Albert Best, a butcher and farmer of Sunnyside, Ruette Braye. Arnold's production was small compared to Scottish and Irish producers and the scale of the enterprise would not have been profitable elsewhere. Best had a factory in Steam Mills Lane and also later on the small island of Lihou, off the west coast of Guernsey. Many questions remain about Best's production, including where he obtained the knowledge to run a chemical works. The article also notes evidence of a short-lived experiment to produce iodine from seaweed on Jersey, although little is known about this venture.

Frank A.J.L. James, "Moving Scientific Knowledge from the Laboratory to the Theatre: Humphry Davy's Lecture Practice at the Royal Institution, 1801-1812", *Notes and Records*, 2024, 78, 571–96.

During the first decade of the nineteenth century, it was (almost) universally acknowledged that Humphry Davy's lectures at the Royal Institution on chemistry, electro-chemistry and geology, among other subjects, were by far the most attractive scientific spectacle in London. Much has been written about the popularity, the fashionability, the attractiveness and the patriotism (in time of war) of Davy's lectures. When Davy, aged twenty-two, arrived in London in March 1801 he had never previously delivered a lecture, but within two months he had made his mark in the Royal Institution's new large lecture theatre, so much so that he immediately repeated his first course. How did his experimental demonstrations, full of spectacular sensory experience (noise, smell, light, touch) convey his scientific rhetoric? What resources, material and human, did he draw on? This paper seeks to understand how Davy constructed his practice as a lecturer and how it related to his chemical researches. As well as using Davy's lecture notes (now available through the Davy Notebooks Project), it draws on the notes taken by some of his auditors, their comments in diaries and letters as well as administrative records and contemporary newspaper accounts.

The article is available open access at:

https://royalsocietypublishing.org/doi/epdf/10.1098/rsnr.2023.0086

PUBLICATIONS OF INTEREST

New Publication from *Lives in Chemistry*

The summer 2024 RSCHG Newsletter showcased the series of Chemical Biographies published by our equivalent German Chemical Society Historical Group. The most recent publication is Hubert Schmidbaur, *From Chemical Craftsmanship to the Art of Gilding Atoms* (Berlin: GNT, Verlag, 2024).

A momentous decision was made by Hubert Schmidbaur, born in 1934 in Landsberg, Bavaria, when he applied for a top-notch scholarship in 1953 choosing chemistry and thus starting his seventy-year journey in science. He began his studies in the post-war ruins of Munich's Ludwig Maximilian University chemistry buildings, and embarked on industry internships abroad to finally choose the sulfur laboratories of Max Schmidt for his PhD in 1960. He then left sulfur and Munich and went off to take care of silicon and many other elements, first in Marburg and Würzburg and finally in Munich's Technical University in 1973. Hubert Schmidbaur's first visiting professorship was in the UK in 1970. He was awarded the Centenary Lectureship of RSC in 1983 and he received the Ludwig Mond Medal of the RSC in 1994. For free sample pages and further information visit: https://l-i-c.org/hubert-schmidbaur.html

The following journal issues have been published since the summer 2024 *Newsletter* was completed.

***Ambix*, The Journal of the Society for the History of Alchemy and Chemistry, vol. 71, issue 3, August 2024**

Special Issue, The Chymistry of Life guest edited by Carmen Schmechel.

Introduction: Carmen Schmechel, "Medicine, Life, and Transformations of Matter".

Carmen Schmechel, "Leaven of Dough, Ferment of Gold: The Breadmaking Analogy in Medieval Metallic Transmutation".

Georgiana D. Hedesan, "Fire, *Vulcanus*, *Archeus*, and Alchemy: A Hybrid Close-Distant Reading of Paracelsus's Thought on Active Agents".

Antonio Clericuzio, "The Emergence of Chemical Medicine in Early Modern Naples (1600–1660)".

Justin Begley, "Distilling the Art of Distillation in an Unstudied Manuscript of "Chymicall Notions".

Charles Wolfe, "Diderot's Vital Materialism".

***Ambix*, The Journal of the Society for the History of Alchemy and Chemistry, vol. 71, issue 4, November 2024**

Jill Burke and Wilson Poon, "Renaissance Goo: Senses and Materials in Early Modern Apothecary Taxonomies and Soft Matter Science".

Rafael Marqués García, "New Research on the Origin of Mosaic Gold".

Amy Fisher, "Why Do Things Burn? Elizabeth Fulhame's Challenge to the Antiphlogistic Theory of Combustion".

Mark I. Grossman, "Stirring the Pot: Antoine Baumé, Josiah Wedgwood, Pierre-Louis Guinand, and the Development of Optical Glass".

Notes and Communications

Rainer Werthmann, "Michael Maier's Medicament Coelidonia – A Possible Explanation of its Composition and Production".

***Bulletin for the History of Chemistry*, vol. 49, number 2, 2024**

Carmen J. Giunta, "In Memoriam, William B. Jensen and E. Thomas Strom".

William B. Jensen, “Ask the Historian: The Origin of the Hybrid Orbital Concept”.

Robert B. Heimann, “Gert Schmidt and Joachim Ulbricht, The Invention of European Hard-Paste Porcelain: Did It Happen As Shaw Relates?”

Seth C. Rasmussen, “Edward Frankland and the Birth of Organometallics”.

Carmen J. Giunta, “J.A.R. Newlands: Beyond the Law of Octaves”.

Howard D. Dewald, “American Chemical Society Anniversary Banquets and Diamond Jubilee and Centennial Commemorative Stamps”.

Tor Erik Kristensen, “New Chemical Technology at a Time of National Emergency: Wartime Mass Production of the ‘Super-Explosives’ RDX and HMX”.

Book Reviews

Three titles from the GDCh series of autobiographies *Lives in Chemistry*:

Stephen B.H. Kent, *Inventing Synthetic Methods to Discover How Enzymes Work*.

Gerhard Ertl, *My Life with Science*.

Larry E. Overman, *Designing Synthetic Methods and Natural Product Synthesis*.

Bernard J.T. Jones, Vicent J. Martínez and Virginia L. Trimble, *The Reinvention of Science: Slaying the Dragons of Dogma and Ignorance*.

Peter Wagner, *Carbon Societies: The Social Logic of Fossil Fuels*.

The Back Story: Jeffrey I. Seeman, “It’s Really About People”.

Back issues of the Bulletin through to 2021 are available open access on: https://acshist.scs.illinois.edu/bulletin_open_access/bull-index.php

SOCIETY NEWS

Society for the History of Alchemy and Chemistry

Brock Award

The Society for the History of Alchemy and Chemistry (SHAC) has decided to establish the Brock Award which honours Professor William ‘Bill’ Hodson Brock, one of the leading historians of chemistry of the last fifty

years. For most of that time he was based at the University of Leicester, where he also directed the Victorian Studies Centre between 1966 and 1990. His *Fontana History of Chemistry* (1992) is a masterly summary of the field, while his biographies of Justus Liebig (1997) and of William Crookes (2008) continue to provide invaluable insights into the subtleties of nineteenth-century chemistry. In terms of SHAC, he served as editor of *Ambix* between 1968 and 1983 and then as Chair from 1993 to 2007. He contributed extensively to *Ambix* and served on SHAC Council for fifty years from 1967 until 2017. He has given extensive support to the history of chemistry community, always ready to share his expertise and insights and creating a welcoming environment for new scholars, particularly through his service to *Ambix* as editor and as a frequent reviewer.

The Brock Prize consisting of £500 and an appropriate framed image will be awarded every three years beginning in 2025. This will dovetail with the Society’s other two awards, the Partington Prize for an unpublished essay on any area covered by SHAC written by an early career researcher to be next awarded in 2026 and the Morris Award given for outstanding achievement in the history of post-1945 chemistry or the history of the chemical industry to be awarded next in 2027.

The Brock Award will be for outstanding contributions in the fields of the history of alchemy and chemistry. The individual’s impact on the community of historians of alchemy and/or chemistry, through historical research, publication, support and encouragement of students and fellow researchers and contributions to the wider promulgation of the subject will be significant criteria for selection.

The awardee will be determined by a panel appointed by SHAC Council; serving members of Council are ineligible for the award. Nominations, including a cv and at least two letters of support, should be sent by 30 June 2025 to Professor Annette Lykknes: annette.lykknes@ntnu.no.

It is expected that the announcement of the first Brock Prize winner will be made in the autumn.

FUTURE MEETINGS AND CONFERENCES

Society for the History of Alchemy and Chemistry

Biographies of Alchemists and Chemists

Saturday 29 March 2025, University College London

Over the last few years a number of excellent biographies of alchemists and chemists have been published and more are in preparation. So, now seems an appropriate juncture to consider the genre and content of such biographies as well as how they relate to the evolving historiography. In addition to reflective papers devoted to specific people, this meeting will explore collective biographies of alchemists and chemists, autobiographies, the market for such texts, and the value of the biographic genre. As 2025 marks the ninetieth anniversary of the founding of SHAC, there will be an associated round table at this meeting where attendees will be able to recollect their connection(s) with SHAC. For a programme and further information visit: www.ambix.org.

International Conference on the History of Chemistry – 14ICHC

11-14 June 2025, Valencia, Spain

Every other year the EuChemS Division on the History of Chemistry (formerly the Working Party on the History of Chemistry) organizes an international conference on the history of chemistry, open to colleagues from all over the world. The general aim of the conferences organised by the WPHC is to facilitate communication between historically interested chemists, museum curators, science educators and historians of chemistry, and to gather the community on a regular basis. The 14th International Conference on the History of Chemistry (14 ICHC) will be hosted by the Lopez Piñero Inter-University Institute – University of Valencia, an academic institution which supports research projects and outreach activities on historical and social studies on medicine, technology, science and the environment. The general conference theme is Chemistry and Capitalism, with the aim to foster debates about the relationship between chemistry broadly constructed, industry, environment, and regulations through a historical perspective. The conference will also feature an early career information session, the Commission for the History of Chemistry and Molecular Sciences (CHCMS) Early Career Lecture, the John and Martha Morris Award Ceremony, the Division's business meeting, as well as social events such as a welcome party, a conference dinner, and a visit to the blast furnace and other industrial heritage sites in the city of Sagunto, which also preserves a Roman castle and theatre.

The deadline for submitting proposals has passed on 7 January 2025. A provisional programme will be available in March 2025. The deadline for early bird registration is before 15 April 2025. For further information, please visit the conference website:

https://esdeveniments.uv.es/116631/detail/14th-international-conference-on-the-history-of-chemistry-14ichc.html