Historical Group

NEWSLETTER
and
SUMMARY OF PAPERS

No. 75 Winter 2019

Registered Charity No. 207890

COMMITTEE

https://www.qmul.ac.uk/sbcs/rschg/
http://www.rsc.org/historical/

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From the Editor

Welcome to the winter 2019 RSC Historical Group Newsletter. Two meetings have been organised by the group for the first half of 2018. On Thursday 14 March 2019 the group will celebrate the centenary of the foundation of IUPAC with a meeting at the Royal Society of Chemistry, Burlington House. Full details on how to register for the meeting can be found in the flyer enclosed with the hard copy version of the newsletter and also in the online version. On Saturday 8 June 2019 the group will be holding a joint meeting with the Institute of Physics History of Physics Group in Manchester to mark one hundred years since the publication of "Collision of α-particles with light atoms: I, II, III, IV", by Ernest Rutherford and a programme for this meeting is also included.

This issue contains a wide variety of news items, short articles and reports. It begins with obituaries for two historians of chemistry who were very well-known to many members of the Historical Group and will be greatly missed: David Knight of Durham University and John Rowlinson of Oxford University. The first short article is by Mike Jewess on *"Harwell" old and new: its renaissance as symbolised by the relocation of an RSC "National Chemical Landmark" plaque*. Then Alan Dronsfield, Margaret Hill and John Pring write about *"Bichloride of methylene" – Paint stripper… and anaesthetic* and finally Chris Cooksey explores *Safranine – Mauve's Daughter*. There are book reviews of Patricia Fara, *A Lab of One's Own: Science and Suffrage in the First World War*; Roy MacLeod, Russell G. Egdell and Elizabeth Bruton eds., *For Science, King and Country: The Life and Legacy of Henry Moseley*; and Anthony S. Travis, *Nitrogen Capture, The Growth of an International Industry (1900–1940)*. There is also a report on the group's meeting on The History of Dyes on the 150th Anniversary of the Synthesis of Alizarin which took place in October 2018.

I would like to thank everyone who has contributed to this newsletter, particularly the newsletter production team of Bill Griffith and Gerry Moss and also John Nicholson, who liaises with the RSC regarding its online publication. If you would like to contribute items such as news, short articles, book reviews and reports please do contact me. The guidelines for contributors can be found online at:

https://www.qmul.ac.uk/sbcs/rschg/Guidelines.html

The deadline for the summer 2019 issue will be Friday 7 June 2019. Please send your contributions to a.simmons@ucl.ac.uk as an attachment in Word. All contributions must be in electronic form. If you have received the newsletter by post and wish to look at the electronic version, it can be found at:

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

The Historical Group posts the hard copy version of the newsletter to those members who request it. Printing and posting the hard copy version is expensive, and if you are receiving the Newsletter in hard copy and would be happy to read it online, please send an email to our Membership Secretary, Bill Griffith (w.griffith@ic.ac.uk). Similarly, email Bill if you don't currently receive the hard copy and would like to do so. You should get an automatic email from the RSC when the latest version is available, but for the record the Newsletter appears twice each year – usually in January and July/August. If you don't receive an automatic email from the RSC please contact the RSC membership department to make sure you have opted in to receive electronic communications from the organisation.

Anna Simmons
UCL

Message from the Incoming Chair

It is a pleasure to write my first letter as the chair of the RSC Historical Group. I was one of the founder members of the group back in 1975 (I found my letter to Stephen Mason after he announced the formation of the group when I became Secretary). I joined the committee in 1988 (which means this is my thirtieth-first year serving on it) when I became Secretary alongside the new Chair, John Shorter. I eventually split off the responsibilities of the Secretary, creating the new posts of Newsletter Editor and Membership Secretary. I took on the post of Newsletter Editor and expanded the newsletter into the more substantial publication you are now reading. Having left the Newsletter to take up the Editorship of *Ambix* in 2001, I became Treasurer in 2015. I wish to begin by paying tribute to John Hudson as my predecessor for his sterling work in keeping the show on the road (as he put it in his last letter) during a very difficult period for the group. John has also organised excellent meetings on Chemistry in the First World War. I also wish to thank John Nicholson for his work as our very efficient Secretary and I am glad that he will continue to serve the group in this position as he has done since he took over from Bill Griffith in 2014. As I know from personal experience, the workload of the Newsletter Editor is a heavy one and I am also very grateful for the sterling efforts of our current editor Anna Simmons, who continues produce a first-rate newsletter issue after issue with the help of Gerry Moss.

As the new chair, I am planning to maintain our excellent programme of meetings, to avoid any financial crises and to increase our international activities without incurring major additional financial costs. The Wheeler Lectures, kindly funded by a bequest from a late member Edgar Philip Wheeler, have allowed us to invite eminent speakers from overseas to address our meetings. This year the lecture was given by Roy Macleod from Sydney University on the controversial career of Fritz Haber and his legacy. Please come to our meetings and take part in our activities. The group is for you as a RSC member and we need your contributions. I look forward to meeting fellow members at our meetings and elsewhere.

Peter Morris

ROYAL SOCIETY OF CHEMISTRY HISTORICAL GROUP MEETINGS

Celebrating the Centenary of IUPAC

Thursday 14 March 2019, Burlington House, Piccadilly, London

Programme

10.15 Registration and tea or coffee
10:45 Welcome (Dr Peter Morris, Chairman, Historical Group)
First Session Chair: Gerry Moss
10.50 Fred Parrett (Parrett Technical Developments – SCI London Group Treasurer)
SCI and the origins of IUPAC
11:20 Robert Fox (University of Oxford)
Internationalism on trial: IUPAC and the International Research Council, 1919–1931
12.15 **Lunch.** This is not provided but there are many cafés and bars close by.
Second Session Chair: Peter Morris
13.30 Jeremy Frey (University of Southampton)
Physical Chemistry and IUPAC: The Chemistry of Data
14.00 Jeff Leigh (University of Sussex)
IUPAC, its Commission for the Nomenclature of Inorganic Chemistry and the Periodic Table
14.30 Gerry Moss (Queen Mary University of London)

Organic Chemical Nomenclature and IUPAC
15:00 Phil Hodge (University of Manchester)
Polymers and IUPAC
15.30 **Tea interval**
Third Session Chair: TBA
16:00 Duncan Thorburn-Burns (Queen's University, Belfast)
Analytical Chemistry, born in 1934
16:30 Richard Kidd (RSC, treasurer of InChI Trust)
20 years of InChI – where next?
17.00 Concluding remarks by Gerry Moss (QMUL)
17.10 Close of meeting

REGISTRATION FORM

There is no charge for this meeting, but **prior registration is essential**. Please use the form below and send it to Professor John Nicholson, 52 Buckingham Road, Hampton, Middlesex, TW12 3JG, or email jwnicholson01@gmail.com. **As usual, this is expected to be a popular meeting so, if having registered, you are unable to attend, please notify Professor Nicholson.**
I wish to attend the HG meeting on 14 March 2019 at Burlington House, Piccadilly, London on **Celebrating the Centenary of IUPAC**.

Name……………………………………………………………………………………………………..
Address……………………………………………………………………………………………………
Email……………………………………………………………………Acknowledgement required: Yes/No

Joint Meeting of the Institute of Physics History of Physics Group and the RSC Historical Group

Centenary of Transmutation: A meeting to mark 100 years since publication of "Collision of α-particles with light atoms: I, II, III, IV" by Ernest Rutherford, June 1919
Saturday 8 June 2019, Manchester University
Programme
09.45 Registration Opens
10.45 Professor Sean Freeman, Department of Physics, University of Manchester
Welcome to Manchester
11.00 Dr Neil Todd, Department of Psychology, University of Exeter
The Physical Laboratories of the University of Manchester 1900 – 1919
12.00 Dr John Campbell, Department of Physics, University of Christchurch, NZ
Ernest Marsden, H-particles and work leading up to the 1919 quartet
13:00 Lunch, Video and a Tour of the Laboratories
15.00 Professor Robin Marshall, Department of Physics, University of Manchester
Was the atom first "split" at Manchester?
16.00 Professor Brian Cathcart, Faculty of Arts and Social Sciences, Kingston University
Public impact and perception of the 1919 transmutation experiments
17.00 Dr Michael Jewess, Royal Society of Chemistry Historical Group
Some chemical consequences of induced transmutation
18.00: Meeting Closes
Registration fees: £15 non IoP/RSC members, £10 IoP/RSC members, £5 non IoP/RSC students, Free IoP/RSC students.
For registration please visit:
https://www.iopconferences.org/iop/1333/home.
For further information please contact, Neil Todd
neil.p.todd@manchester.ac.uk

RSCHG NEWS

The Historical Group AGM

Members who attended the Group's symposium on 17 October 2018 at Burlington House will remember that we did not hold a formal AGM this year, and as Chair, I announced that the Committee had decided that the traditional AGM would be discontinued. The principal purposes of the AGM were:

1. To approve the Committee and Officers (Chair, Treasurer and Secretary)
2. To approve the accounts

The RSC has issued new rules governing the conduct of all of its Interest Groups. These rules in effect make an AGM unnecessary for the following reasons.

1. When vacancies arise on the Committee, all members of the Group are contacted by the RSC. Any member can stand for the Committee. If the number of candidates exceeds the number of vacancies, the RSC will organise an election. The Officers are elected by the Committee from its existing members. Under these rules, an AGM cannot elect or approve members or Officers.

2. For some time now, members no longer pay an additional subscription to belong to an Interest Group (unless they belong to more than three Groups). Under the previous system, now superseded, members paid £10 to belong to our Group (each Group set its own membership subscription, the amount approved by an AGM). In those days members rightly needed to see how their money was being spent. All Groups now get a grant from the RSC, the amount being determined by the number of members and the benefits we provide for the members of the Group. The Treasurer and Committee are responsible to the RSC for the financial management of the Group. Under this system, the submission of accounts to an AGM for approval serves no purpose.

The AGM also heard reports from the Chair and Secretary on the year's activities, and members could ask questions of the Officers and other Committee members. Our Newsletter keeps members informed of our recent activities and our plans for the future, and we encourage members to contact the Committee with ideas and suggestions. This can be done directly at a symposium, or by email to Fiona McMillan (RSC Interest Groups Coordinator) on networks@rsc.org who will forward the message to a Committee member. I don't want the demise of the AGM to lessen the interaction between the members of the Group and the Committee.

John Hudson

OBITUARIES

The Nearness of the Past: Remembering the Life and Ideas of David Marcus Knight (1936-2018)

David Marcus Knight was a British historian and Professor of the History and Philosophy of Science in Durham University's Department of Philosophy from 1964 until 2016. In addition to publishing seminal papers and books on the history of modern science, he was a leading expert on the relationship between science and society in Britain during the long nineteenth century. He was especially fond of examining how the values and beliefs of scientists influenced the theories and institutions they created.

A Scientist and Historian

David was born in 1936. He spent his early years in southern England, where he experienced the uncertainty of wartime rationing and witnessed buildings that had been levelled by German bombing raids. The effects of the war left a deep impression on him, leading him to recognise the ethical and social dilemmas that were part and parcel of science and technology.

Upon leaving school, David gave two years of national service to the army artillery, where he learned surveying and familiarised himself with the country life of Salisbury. Ever the adventurer, he hitchhiked to Oxford for his university interview. He was admitted to Keble College and entered Oxford University in 1957, where he read chemistry and wrote his final year dissertation on Humphry Davy's electrochemistry. This was followed by a diploma in the history and philosophy of science and then a DPhil in the history of science. David's undergraduate chemistry training always stayed with him and he sometimes would describe himself as a "lapsed chemist". But he was ultimately driven by an interest in human nature and how it drove the interests of scientists. Later in his career he explained that "What brought me into the history of science was an interest in what made people become scientists" [1].

At Oxford David was supervised by Alistair Crombie, the university's professor of the history of science. When David arrived for the first time at Crombie's office, he was duly handed a set of sheets and asked to find a way to reproduce them on the college's new mimeograph machine. Crombie envisioned science as a grand progression of ideas, but David's experience with the war led him to see it as a grittier, hands-on enterprise that oscillated between hard won discoveries and enticing dead ends. Looking back on his Oxford days, David quipped that he had been supervised by a system of benign neglect. In the end he wrote a thesis on the nineteenth-century theories of matter, especially those used to understand the chemical elements. He received his DPhil in 1964.

Upon leaving Oxford David was appointed to a new Lectureship in the History of Science in Durham's Department of Philosophy. In 1991 he was promoted to Professor of the History and Philosophy of Science. He retired in 2002, but continued to teach until 2016. He led many departmental and university initiatives, oftentimes using humour to break tense moments in committee meetings. When attending exam boards he entertained staff with stories of how a fictitious student named 'Snooks' might react to new policies or changes to the curriculum. His modules were popular with philosophy students and he was instrumental in making the history and philosophy of science a popular option for students reading degrees in physics, chemistry and the natural sciences.

Over the years David gave energetic lectures in modules that addressed the social, artistic and philosophical factors that influenced science. His introductory history of science module was so popular that students who weren't even officially enrolled regularly attended it. He continued to lecture after he retired, leading one student to write, "David Knight gave a stunning lecture yesterday – we were left in an uncomfortable situation not knowing whether to applaud his performance". His lectures were filled with entertaining passages recited from his capacious memory. Near the end of his career he underscored the nearness of the past by observing that his grandparents had been Victorians. He was keenly aware of the importance of place and regularly reminded his students that scientists often learned much about nature when they got out of their house or lab to experience the world around them. Architecture featured in his lectures and he recommended buildings across Britain and Europe that spoke to the history of science and society. In his lectures on Frederick Temple, who served as the Bishop of Exeter before becoming Archbishop of Canterbury, he would mention that his father had been a canon at Exeter Cathedral. He then would say that his father's visage was carved on the face of a gargoyle when the building was renovated.

David won several awards for his teaching, especially for his modules on the history of science and religion, which were recognised by the Templeton Foundation and the Center for Theology and Natural Sciences in Berkeley, California. He genuinely cared for his students as well. When one of his postgraduates could not afford an airplane ticket home, he sent him a cheque with the following note: "Consider this a loan to repay later in life when you find someone in need".

A lover of the theatre, especially Shakespearean and medieval plays, he lectured without notes and, to the delight of his students, passed around antiquarian books to illustrate his lectures and seminars. When he supervised postgraduate students he ensured that they never left his office without several books tucked under their arms. Many of these books were original copies that had been published from the seventeenth to nineteenth centuries. Indeed, when I was writing my PhD thesis, I had so many of his eighteenth-century books on my shelf that my friends jokingly accused me of robbing the local antiquarian bookshop. David felt that his books were thinking tools that needed to be used by his students. When he retired, he very kindly donated many of them to the Durham University History of Science Collection housed in Palace Green Library.

Science as a Social Activity

David began teaching the history of science in an exciting time of social change in Britain. During the 1960s, higher education was rapidly expanding to meet the needs of the baby boom generation and new understandings of the self and society were being developed within the humanities and the social sciences. David found this change stimulating and prided himself on being the first member of Durham's philosophy department to wear a pair of jeans while lecturing. A lifetime member of the Church of England, he valued the role and importance of institutions. But he demonstrated a lifelong curiosity in the response of institutions to social change; an interest that he once attributed to his mother's side of the family, some of whom had been loyalists during the American Revolution. He would sometimes joke that the American branch of his family brought an exotic element to his ancestry.

As a researcher, David embraced the social turn by investigating the individual and institutional factors that influenced the development of experimental science. His early studies did this in relation to chemistry, but, as his career developed, he extended it into the historical sciences, particularly the earth sciences and evolutionary biology. In all these studies, experiments were interactive projects guided by methods and protocols that had been established by a given scientific community.

David's methodological influences were eclectic, but he chose those which allowed him to showcase the fascinating lives of the individuals that he researched. He summed up this orientation in the following way: "Science certainly consists of facts ordered by theory: but such theory makes possible definite explanations and predictions. For the historian, it is particulars which are interesting; and, as Goethe wished scientists would, one looks for the Ur-phenomenon, the shining instance, the representative case" [2]. David identified many such shining cases in his research. He was a firm believer in textual immersion, the practice of reading and rereading historical texts with a view to understanding and reconstructing definitions and problems in a way that would have been recognised by the original author, or by those writing at the time. In this sense, the influence of Crombie, particularly his commitment to styles of reasoning, is apparent.

But David diverged from older historians such as Crombie in the application of the method. Crombie applied his approach to a traditional canon of scientific texts – Bacon, Galileo, Copernicus, Kepler, Newton – and wrote histories that extended over vast periods of time. But David had written a doctoral thesis that focused on chemistry, that is, a topic that was not firmly integrated into the canon that underpinned the Scientific or Darwinian Revolutions. In other words, David had learned to appreciate scientists who had been unduly ignored. He later summarised this orientation in the following manner: "When I entered history of science in 1960 there were in some colleges courses (usually delivered by superannuated scientists) that ran from Plato to NATO, and we Young Turks laughed about the neglect of wider cultural context and of the lives of all but very famous men. There was no room for those who had gone off the 'right track' " [3].

During his Oxford years David had been exposed to what would eventually become the influential field now called the sociology of scientific knowledge (SSK). As a graduate student he met the historian and philosopher Thomas Kuhn at a conference on "Scientific Change" hosted by Crombie in Oxford during the summer of 1961. Kuhn was there to promote the ideas that he eventually would publish as *The Structure of Scientific Revolutions* in 1962, a book that functioned as an important philosophical study for SSK scholars. In David's recollection, Kuhn, who was a young scholar at the time, gave a paper on "Dogma in Science" that electrified the graduate students in attendance. David was certainly receptive to Kuhn's assumption that social factors influenced the development of science.

Nevertheless, like Crombie's work, *Structure* was founded on a familiar canon – one that, once again, had little room for chemistry and other experimental sciences that employed methods and instruments that strayed from the traditional history of physics. David's early years as a historian in a philosophy department led him to investigate the philosophical and methodological underpinnings of modern science in relation to the historical context of practising scientists. Kuhn's work functioned as a reference point, but, in addition to working with philosophers in his own department, David found inspiration in the social and moral issues raised in the work of philosophers such as Rom Harré and Stephen Toulmin.

By the 1970s David had become an active member of the British Society for the History of Science (BSHS). David found himself among scholars who had a firm sense that the Society should function as a college of sorts, as a workshop for examining how science and society operated in a symbiotic relationship. The notion of social 'context' was explored through a number of avenues, but religion, institutions and biography proved popular. Over time, a tradition of 'science and society' emerged within and through the BSHS from the 1970s onwards, one which was influenced by SSK, but which also valued the moral and methodological concerns promoted by philosophers. David promoted this form of contextualism within the Society throughout his career, and when he served as its president and as editor of its signature publication, the *British Journal for the History of Science*, from 1982 to 1988.

Science as a Broad Church

David wrote and published many books and articles over the course of his long career. Like the broad church intellectuals of Victorian times, David saw science as a central element of British culture and he enjoyed tracing scientific concepts and practices across disciplines and through different levels of society. His most widely read books were *The Age of Science* (1986), *Humphry Davy: Science and Power* (1992) and *Science in the Romantic Era* (1998), all of which served as standard references for scholars researching the place of science within modern Britain. His *A Companion to the Physical Sciences* (1989), an invaluable guide to key terms in the history of science, continues to be reprinted. Following from his Oxford thesis, he continued to publish on the history of chemistry throughout his early career, producing key studies such as *Atoms and Elements* (1967), *The Transcendental Part of Chemistry* (1978) and *Ideas in Chemistry* (1992).

David explored the kinds of print and visual culture that could be used as evidence when writing the history of science. His books on this topic include *Natural Science Books in English, 1600-1900* (1972), *Sources for the History of Science, 1660-1914* (1975) and *Zoological Illustration: An Essay towards a History of Printed Zoological Pictures* (1977). These works were based on his own book collecting efforts, and on the rich scientific and medical collections of Durham University [4]. After his retirement in 2002, he extended a number of the biographical and institutional themes from *The Age of Science* in *Science and Spirituality: The Volatile Connection* (2004), *The Public Understanding of Science* (2006), *The Making of Modern Science* (2009), and *Voyaging the Strange Seas: The Revolution in Science* (2014), all of which explored his larger interests in the contextual history of science.

David's impact was also felt as a book editor, particularly through his entertaining and insightful introductions. He held the work of editors in high esteem and once wrote that "Editors, whether of journals or of documents, are midwives of ideas - self-effacingly bringing an author's meaning and style into the world"[5]. He championed this view as the editor, with Sally Gregory Kohlstedt, of Cambridge University Press's *Cambridge Science Biographies* and as the editor, with Trevor Levere, of Ashgate's monograph series on the history of science, medicine and technology.

To make the history of science more accessible, he edited numerous scientific sources for the use of academics and students as well. His first work of this nature was *Classical Scientific Papers, Series 2* (1970). It was followed by *The Development of Chemistry, 1789-1914* (1988), *The Evolution Debate, 1813-1870* (2003) and *Scientific Travellers, 1790-1877* (2004). He co-edited William Paley's *Natural Theology* for Oxford's World Classics Series (2004). It has remained very popular, going through numerous reprintings. Notably, the books that appeared in David's series were often reproductions of originals housed in his personal library, many of which he donated to Durham University's special collections in Palace Green Library. They can be viewed to this day along with catalogues that he wrote about the library's scientific sources.

Later Years and Legacy

The influence of David's work was felt both inside and outside the academy. He wrote in a smooth, oftentimes humorous style that appealed to many readers. Among his many admirers was the neurologist Oliver Sacks, who, being of the predigital era, wrote David letters in his "big sprawling handwriting". David replied in his own "twiddly scribble". Throughout his career David was a diligent correspondent. He had the habit of filing many of the letters he received in the books of his office library. When he lent books to students or colleagues these missives would often spill out, offering a unique insight into a bygone era of blue aerogram stationary and postcards bearing stamps from across the British Empire.

In addition to such admirers, David's career was filled with many honours. As well as serving as president of the BSHS and as a longstanding council member of the Society for the History of Alchemy and Chemistry, he served on committees organised by the Royal Society of London and the European Science Foundation. He was president of the History of Science Section of the British Association for the Advancement of Science in 1993 and he received numerous prizes for his research, including the American Chemical Society's prestigious Edelstein Award for the History of Chemistry in 2003. In 2007 he delivered the Wheeler Lecture at the Royal Society of Chemistry and in 2014 he was given Durham University's Chancellor's medal for his outstanding service.

David remained incredibly active after his retirement. Indeed, he continued to lecture even after having a stroke. When it became apparent that he needed to lecture less, he relented a bit. With characteristic verve he wrote an email to the department indicating this desire, adding: "But all this indicates a winding-down, which is not surprising at eighty I suppose but has taken me by surprise". Though surprised, he continued to write and attend department functions until the last days before his passing. He will be dearly missed by the Durham community and by his many friends, students and collaborators spread across Britain and beyond.

References

1. David M. Knight, *Science in the Romantic Era* (Aldershot: Ashgate Variorum, 1998), ix.

2. Knight, 1998, ix.

3. David Knight, review of *The Oxford Illustrated History of Science*, *Ambix*, **64** (2017), 378-379.

4. David M. Knight, "History of Science in Durham Libraries", *British Journal for the History of Science*, **8** (1975), 94-99.

5. David M. Knight, "Background and Foreground: Getting Things in Context", *British Journal for the History of Science*, **20** (1987), 3-12.

Matthew Daniel Eddy
Professor and Chair in the History and Philosophy of Science
Durham University

John Shipley Rowlinson

Sir John Shipley Rowlinson, the physical chemist and historian of chemistry, passed away on 15 August 2018. He was born in Handforth, near Manchester on 12 May 1926. Even as a pupil at Rossall School in Fleetwood, Lancashire, he was interested in history as well as chemistry. He then studied chemistry at Trinity College, Oxford, at the end of the war at a time when the famous Trinity-Balliol laboratory had just been transferred to the Physical Chemistry Laboratory (PCL) funded by Lord Nuffield. After graduating with first-class honours, he took his D.Phil. in the PCL on energy transfer between gaseous molecules by the study of ultrasonic dispersion under J.D. Lambert following the then usual tradition of doing your postgraduate research under your college tutor (a result of the Part II system at Oxford). Gas kinetics was the major topic at Oxford at the time thanks to the influence of the professor Cyril Hinshelwood. After a postdoctoral year at the Naval Research Laboratory at the University of Wisconsin, Rowlinson became an ICI Research Fellow at the University of Manchester. He was promoted to lecturer in 1954 and to senior lecturer only three years later.

In those days, Manchester was considered to be a (first-class) waiting room for chairs at Oxford and Cambridge. However, Rowlinson was called to Imperial College rather than Oxbridge where he became the Professor of Chemical Technology in 1961 at the early age of thirty-five. He was elected a Fellow of the Royal Society in 1970 and was subsequently Physical Secretary and Vice-President of the society between 1994 and 1999. When Sir Rex Richards, the energetic pioneer of NMR spectroscopy stepped down from Dr Lee's professorship in physical chemistry in 1970 to become Warden of Merton College (and subsequently Vice-Chancellor), he was succeeded by Sir Frederick Dainton (later Lord Dainton). Dainton, although being both eminent and dynamic, left three years later to become chairman of the University Grants Committee. Rowlinson was appointed as his successor because of his international reputation and his publication record, having published three books on physical chemistry, with two more to follow. As a theoretician, he was thus free to manage the PCL - probably the preeminent physical chemistry laboratory in the UK at the time - as a whole without complicating ties to any particular laboratory. Perhaps surprisingly given his own background, Rowlinson was determined to expand the PCL's remit beyond its traditional base in gas phase kinetics and spectroscopy. He was assisted in this respect by the recent arrival of the world-class NMR spectroscopist Ray Freeman who stayed at Oxford until 1987. Rowlinson was a good manager and charted the PCL through rough seas during the funding cuts of the late 1970s and 1980s, and even managed to expand the number of lecturers in the laboratory. While he was kind to students, he spoke softly and was rather shy. Always formally dressed at a time when most chemists had abandoned suits and ties, he seemed a throw-back to an earlier era, however unfair that impression may have been. With the benefit of hindsight it is surprising that the chair had not been offered to John Albery, a charismatic electrochemist at University College, Oxford, who left for Imperial College (to become professor of physical chemistry) in 1978. It is also ironic that the leading American physical chemist (or physicist) John Goodenough was appointed Professor of *Inorganic* Chemistry at Oxford only two years later. Rowlinson retired at the then statutory age of sixty-seven in 1993. He was knighted in 2000 for his services to chemistry, chemical engineering and education.

In marked contrast to his mild demeanour as a professor, Rowlinson was a skilled and daring mountain climber especially in the Alps, thus maintaining the tradition of chemists being intrepid mountaineers. He was also a competitive chess player. Between 1956 and 1959, he was a Liberal Party councillor on Sale Borough Council in the days when Liberal Councillors were few and far between. However, it is as a historian of chemistry that he will be rightly remembered by the Historical Group. He was a leading member of the group in its early years, helping to organise conferences and supporting John Shorter, his friend from Oxford days, while he was chairman of the group. Rowlinson's initial interest in the history of chemistry was the work of the Dutch physicist Johannes Diderik van der Waals. An early paper in 1973 was followed by a translation of van der Waals's thesis in 1988 and a biography (with A. Ya. Kipnis and B.E Yavelov) in 1996. He then broadened his research to produce *Cohesion: A Scientific History of Intermolecular Forces* in 2002. Perhaps his most important contribution to the history of chemistry was his co-editorship of *Chemistry at Oxford: A History from 1600 to 2005* (2009) with Robert Williams and Allan Chapman. While Williams was very much the driving force behind the volume, Rowlinson's editorial skills and deep knowledge of chemistry at Oxford were crucial to its success. He also contributed two of the seven chapters. He was given the Edelstein Award of the American Chemical Society in 2008 for "the breadth and quality of his research publications in the history of physical chemistry and his contributions over the last three decades to the development of the history of chemistry at the University of Oxford".

Peter Morris

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.

Chris Cooksey, "The red insect dyes: carminic, kermesic and laccaic acids and their derivatives", *Biotechnic & Histochemistry*, published online: 24 October 2018.

https://doi.org/10.1080/10520295.2018.1511065

Three groups of insect dyes are described: three cochineal dyes, the kermes dye and the lac dye. The major colour components are carminic acid, kermesic acid and laccaic acids, respectively. These dyes are red anthraquinone derivatives. The chemical structures are described. All of these dyes have extensive histories that are related briefly; however, only American cochineal is of commercial importance today. Two manufactured derivatives of cochineal, carmine and acid-stable carmine (4-aminocarminic acid) are described in some detail including the chemical identity, toxicity, stability, and staining and non-staining applications.

Robert Bud, Paul Greenhalgh, Frank James and Morag Shiach eds., *Being Modern: The Cultural Impact of Science in the Early Twentieth Century* (London: UCL Press, 2018).

In the early decades of the twentieth century, engagement with science was commonly used as an emblem of modernity. This phenomenon is now attracting increasing attention in different historical specialties. *Being Modern* builds on this recent scholarly interest to explore engagement with science across culture from the end of the nineteenth century to approximately 1940. Addressing the breadth of cultural forms in Britain and the western world from the architecture of Le Corbusier to working class British science fiction, *Being Modern* paints a rich picture. Seventeen distinguished contributors from a range of fields including the cultural study of science and technology, art and architecture, English culture and literature examine the issues involved.

Available as a free pdf download from UCL Press:

http://discovery.ucl.ac.uk/10057847/1/Being-Modern.pdf

PUBLICATIONS OF INTEREST

The following issues have been published since the summer 2018 *Newsletter* went to press.

***Ambix:* The Journal of the Society for the History of Alchemy and Chemistry**

Ambix, vol. **65**, issue 3, August 2018

Andrew Campbell, Lorenza Gianfrancesco and Neil Tarrant, "Alchemy and the Mendicant Orders of Late Medieval and Early Modern Europe".

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Mark A. Griep, "Forgotten Chemistry Time Capsule Revealed the Stories of Two Early Female Chemistry Professors".

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Jeffrey I. Seeman, "Profiles, Pathways and Dreams: From Naïveté to the HIST Award".

G.J. Leigh and Carmen J. Giunta, "The Scientific Publications of Alexander Marcet". João Paulo André, "Frederick Accum: An Important Nineteenth-Century Chemist Fallen into Oblivion".

C.H. Delegard, V.F. Peretrukhin, and S.I. Rovny "The Contributions of Radiochemistry to Mastering Atomic Energy for Weapons".

Jessica Epstein, "Drugs That Shaped the FDA: From Elixir Sulfanilamide to Thalidomide".

M.R.V. Sahyun, "Melville Sahyun: A Life in Biochemistry".

Eric R. Scerri, "Response to Review of A Tale of Seven Scientists".

NEWS AND UPDATES

Division of History of the American Chemical Society

2018 HIST Award

The History of Chemistry Division of the American Chemical Society has announced that Professor David E. Lewis of the University of Wisconsin - Eau Claire is the winner of the 2018 HIST Award for Outstanding Lifetime Achievement in the History of Chemistry. This international award has been granted since 1956 under sequential sponsorships by the Dexter Chemical Company, the Edelstein Foundation, the Chemical Heritage Foundation, and the History of Chemistry Division

Professor Lewis earned tenure and the rank of Associate at Baylor University in 1988, but moved on to South Dakota State University, where he became a Full Professor in 1993. He was called to the University of Wisconsin- Eau Claire in 1997 as Chair of the Chemistry Department, where he continues a very active program in synthetic organic chemistry. The area of interest for Professor Lewis has been organic chemistry in Russia, especially at Kazan Chemistry School. Not only has he become the leading scholar in this area, he is recognized by the Russians as the author of "a wonderful series of works devoted to the history of Russian chemistry". His collected works were translated and published in Russian in 2016. His 2012 book, *Early Russian Organic Chemists and their Legacy* has been hailed as the most important contribution to this previously understudied area.

SHORT ESSAYS

"Harwell" old and new: its renaissance as symbolised by the relocation of an RSC "National Chemical Landmark" plaque

AERE, The Glory Years

Many mathematicians, physicists, chemists, and engineers now aged over fifty-five will remember when "Harwell" was a name to conjure with. They may also recognise the building in Fig. 2, but not for what it is today (*see the final section of this article*) but rather as the Directorate building of the high-security Atomic Energy Research Establishment (AERE) at Harwell in Berkshire (after boundary changes in 1974, in Oxfordshire). Not only was AERE a major employer of "STEM" graduates but also it allowed visiting academics and research students to use the neutron beams from the research reactors "DIDO" and "PLUTO" for neutron diffraction and scattering experiments (though the reactors' prime purpose was testing materials for power reactors).

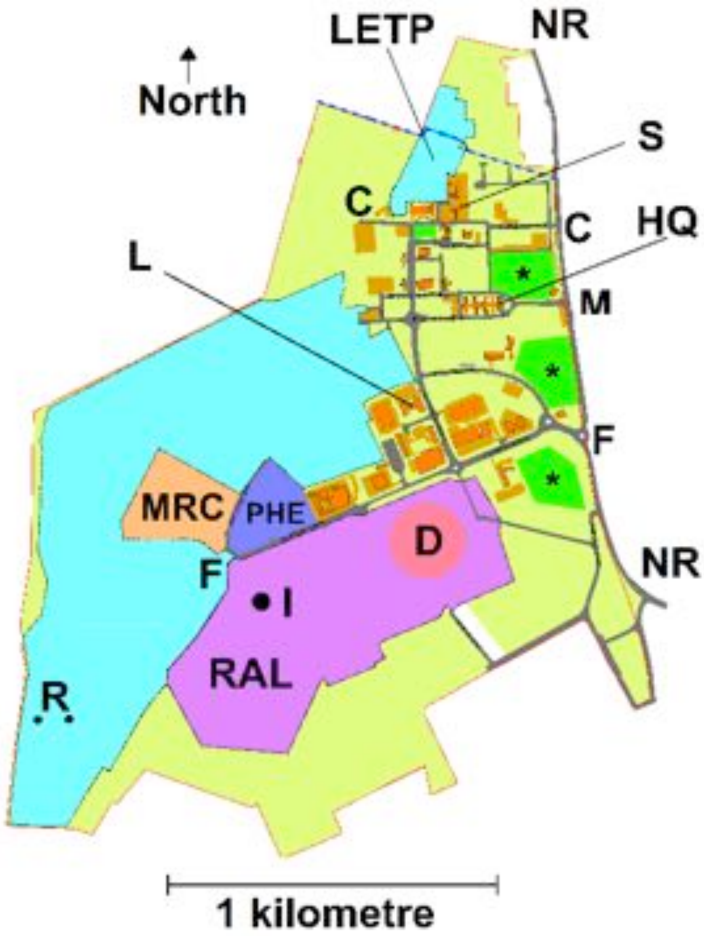

Fig. 1. Harwell Campus, August 2018 (courtesy Harwell Campus, adapted): NR-NR, Newbury Road (A4185); C-C, Curie Avenue; F-F, Fermi Avenue; HQ, Campus HQ see Fig. 2; R, reactors Dido and Pluto (final decommissioning *ca* 2025); LETP, liquid effluent treatment plant (remediation near completion); S, Curie Avenue shops; *, sports field; M, Thomson Entrance of Campus (formerly AERE main gate); RAL, MRC, PHE, see text; D, Diamond Light Source; I, ISIS.

On 29 October 1945 the Prime Minister, Clement Attlee, announced the setting up of "a research and experimental establishment covering all aspects of the use of atomic energy at [the Royal Air Force] Harwell airfield near Didcot". (The airfield was on a chalk plateau, 2 km from the "Domesday" village of Harwell and 6 km from the town of Didcot.) The airfield had served well in World War II, including in the invasion of Normandy in June 1944, so the RAF were displeased – as might be agricultural locals, according to Giles in the *Daily Express* [1, 2].

For about forty years thereafter, "AERE" and "Harwell" were used synonymously by scientists and engineers. AERE, initially part of the Ministry of Supply, became in 1954 a component of the United Kingdom Atomic Energy Authority (UKAEA) [3].

The first AERE Director, 1946-1958 [4], was John Cockcroft (1897-1967), previously Director of the Montreal and Chalk River Laboratories in Canada, which had been part of the Manhattan Project producing the nuclear fission weapons used against Japan in 1945. The UK and the USA had collaborated on nuclear technology under the secret Quebec agreement of 1943, but collaboration was terminated by the US McMahon Act of 1946. Independent UK nuclear research became of strategic importance [5]. In 1947, "GLEEP" at AERE became the first nuclear reactor in Western Europe to achieve criticality [6], and the UK's own atom bomb project was commenced. For many years AERE was central to the nuclear power and weapons programmes.

Fig. 2. Harwell Campus HQ (author, February 2018), previously the RAF commander's office, then the AERE Directorate building, then the AEA Technology HQ, and then temporarily abandoned. In 2017, the RSC plaque (blue) was relocated to the right of the entrance.

The use to which AERE put the former RAF station can still be traced in the modern site plan (Fig. 1).

UK Power Reactors [7]

The UK's "Magnox" reactors were named after the magnesium-aluminium-beryllium alloy invented at AERE in 1950 [8] for cladding metallic uranium fuel, inert to the uranium at reactor temperatures. Magnox reactors produced electrical power and also Pu^{239} for weapons. The reactors relied on fission of U^{235}, constituting only 0.7 % of natural uranium, like the later advanced gas cooled and pressurised water reactors.

Chemistry was peculiarly central to the "fast breeder reactor". Based on AERE research, a prototype in Dounreay, Scotland delivered power to the UK grid until 1994. Indirectly, *via* a chemical reprocessing step, the reactor "burnt" U^{238} (99.3 % of natural uranium):

(1) Pu^{239} in fuel rods undergoes fast-neutron fission chain reaction (generating heat).

(2) Surplus neutrons bombard a "blanket" containing U^{238} converting it to Pu^{239} (after two β-decays).

(3) The blanket is removed and chemically reprocessed to create new fuel rods containing Pu^{239}, recycled to step (1).

In Fig. 1, the larger of the two areas in light blue was in AERE days used for large-scale nuclear operations including for reactors DIDO and PLUTO, and the smaller light blue area for a liquid effluent treatment plant ("LETP"). Laboratories and other working buildings (including repurposed RAF buildings such as "HQ") were in the light green area between Fermi Avenue and Curie Avenue. All three areas had security fencing and were guarded by policemen routinely carrying firearms. Workers presented passes to the police both on entering secure areas and on leaving them. Visitors were required to pass through the police guardhouse at the main gate "M". Such measures prevented unauthorised access – but were not proof against spies on the staff [9, 10]. One British Manhattan Project veteran, Alan Nunn May, had already in 1946 been imprisoned for spying. Two other Manhattan veterans (both naturalised British) transferred to AERE and were exposed in 1950: Klaus Fuchs (a Division Head, one of Cockcroft's most senior people), who was imprisoned; and the extremely talented, popular Bruno Pontecorvo, who defected to the USSR.

In 1964, after further spy scandals, the government produced for employees in sensitive posts, such as in AERE, a somewhat sensational booklet *Their Trade is Treachery* [10], with photographs of convicted spies including May and Fuchs. Among other things, the booklet told employees to seek advice from Security in respect of even social contacts with people from Iron Curtain countries. The author duly received his copy when he joined AERE in 1980.

Despite the security, there was a university atmosphere at AERE. The scientist and novelist C.P. Snow portrayed AERE's "men of fission" as new classless intellectuals [11].

AERE was a pleasant and convenient place to work [12]. Cockcroft had rose beds and thousands of trees planted. Outside the security fencing, along Curie Avenue and to the north, brick-built ex-RAF houses and two ex-RAF messes provided accommodation for employees and temporary visitors, and there were shops, a Post Office, a Lloyds Bank, a dentist's surgery, and a nursery (Fig. 3). Sports fields were created (Fig. 4). Two hundred prefabricated houses ("prefabs") were erected for workers. Works buses ferried many hundreds daily from nearby towns and villages to a large bus park outside the security gate on Fermi Avenue.

Fig. 3. Shops and a Post Office in Curie Avenue surviving from the AERE time (author, 2017).

Fig. 4. Sports field (author, 2018).

AERE grew to 6200 employees in 1959 [13]. By 1959 two further public laboratories had become established on parts of the site not needed by AERE, and a third was to follow (MRC, RAL, and PHE on the plan) [14].

Decline of AERE and Failure of AEA Technology

By 1973 AERE had shrunk to 4,500 employees [13]. When the present author worked at AERE (1980-81), it was still a dynamic organisation, but there was unease over the likely attitude of the UK government to commercial nuclear fission power. This unease was justified [15]: the "Magnox" reactors were progressively switched off (the last, Wylfa 1 in Anglesey, in 2015); the last advanced gas cooled reactor became operational in 1989, followed by a single pressurised water reactor in 1995 (Sizewell B); and for years no further reactors were authorised. No further nuclear power reactors will become operational in the UK before 2025.

AERE diversified into non-nuclear commercial fields by deploying its skills in materials, testing, separation technology, heat transfer and fluid flow, strategic planning, and project management, but this was not sufficient to compensate for the loss of core nuclear business [16]. DIDO and PLUTO were switched off in March 1990 because they were loss-making. This left GLEEP as the last operational reactor on the site, having been also the first; it was switched off in September 1990. The number of employees fell to 2,000. The post of Director ceased in 1992 when Peter Iredale vacated it. In 1996, all non-fusion research of the UKAEA was privatised as AEA Technology plc, with no "national mission", at a value of £224 million. Its successor as a quoted company, AEA Technology Group plc, went into administration in 2012; a remnant of the business including a few hundred Harwell-based employees was purchased by engineering consultants Ricardo for £18 million, free of pension liabilities [17-19].

The UKAEA has continued to do work on nuclear *fusion* at Culham in Oxfordshire, 10 km north-east, and still owns the land of the former AERE site.

The Present – "Harwell Campus"

The building of Fig. 2 ("HQ" in the modern site plan Fig. 1) symbolises the renaissance of "Harwell". After AEA Technology failed, it was closed up with yellow danger signs, looking all the more dismal because of the bare flagpole. But in September 2017, with refurbishment, it became the "Harwell Campus" HQ Building. Moreover, the RSC "National Chemical Landmark" plaque (Fig. 5), previously at "M" in Fig. 1, was moved to the front of the building.

This renaissance has been favoured by the following factors. The three publicly-owned laboratories on the former RAF site have continued to operate: the Rutherford Appleton Laboratory (RAL) with its Diamond Light Source (primarily used for its X-ray beams) and its ISIS Neutron and Muon source; the Medical Research Council (MRC); and Public Health England (PHE). The trees, rose-beds, and sports fields were well-maintained through the decline and failure of AERE/AEA Technology. Contrary to possible expectation, most of the shops and the dentist's surgery have survived, and a new nursery has replaced the original one. The surrounding district, though still with considerable agriculture, has attracted other laboratories and scientific enterprises. And communications are good; Didcot railway station on the Paddington – Bristol line is 6 km away, and the nearby A34 dual carriageway links to the M40 and M4.

Fig. 5. RSC "National Chemical Landmark" plaque in its new location (author, 2018).

The "Harwell Campus" is a new concept covering the entirety of the original RAF station [20-25], both the former AERE areas and the three publicly-owned laboratories. The light blue areas of Fig. 1, still enclosed by security fencing, are under remediation – for instance, DIDO and PLUTO, though now without their fuel rods, await final decommissioning *ca* 2025 [26]. But the formerly secure light green area between Fermi Avenue and Curie Avenue is now publicly accessible and houses an increasing number of non-nuclear science-based operations, mutually supportive and taking advantage of the three publicly-owned laboratories.

Fig. 6. DIDO and PLUTO – the notices on the fence indicate that it is the boundary of a Nuclear Licensed Site on which trespassing is a criminal offence (author, 2015).

In addition to the HQ building, the 1950s-built former AERE Library has been refurbished for office use, still bearing the name "The Library". But many working buildings of AERE days – and also all the prefabricated houses – have been demolished, and new working buildings have been constructed.

Already, over 200 organisations, including thirty universities, have a presence on the Campus. Eighty of these organisations form a "Space Cluster" including the European Space Agency, RAL Space, the UK Space Agency, Satellite Applications Catapult, Airbus, and Boeing. There are also an "EnergyTec Cluster" (including the Faraday Institution for battery technology) and a "Health-Tec Cluster". A long-standing resident is Element Six's Global Innovation Centre, working on synthetic diamond.

Six thousand people now work on the Campus, with great scope for continued expansion. Angus Horner (Director, Harwell Campus) envisages "millions more square feet of commercial and technical accommodation". Existing eating facilities and the existing 123-room guesthouse, it is planned, will be complemented by a new café and restaurant and a hotel. Up to one thousand new homes are proposed in the north of the Campus, including on LETP land once remediated; the three sports fields will be preserved.

The original mission of "Harwell" as announced by Clement Attlee has vanished though it is commemorated by the RSC plaque. But key features of Cockcroft's original vision are being retained: a collaborative spirit, and a pleasant and convenient environment with trees and sports fields, on-site retail facilities, and even accommodation for workers.

The author thanks Dr John Hudson and Professor Keith McEwen for commenting on this article in draft.

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1. Nick Hance, *Harwell – The Enigma Revealed* (Oxfordshire: Enhance Publishing, 2006), Chapters 6 and 7.

2. Giles, "I don't think the boy Tom quite likes the idea of 'em building this 'ere atom bomb works at Didcot", *Daily Express*, 31 October 1945. The cartoon (taking some liberties with local geography) shows "Tom", an agricultural labourer, cycling with his spade towards "Didcot" as indicated on a finger post – wearing protective gear.

3. Hance, 42 and 58.

4. Hance, 42 and 149. While Director, Cockcroft was knighted, and with E.T.S. Walton awarded the Nobel Prize for Physics for "pioneer work on the transmutation of atomic nuclei by artificially accelerated atomic particles", http://www.nobelprize.org/nobel_prizes/physics/laureates/1951/. In 1932, they had bombarded lithium with accelerated protons, effecting the reaction $Li^7 + H^1 \rightarrow 2\ He^4$.

5. For a summary of Anglo-American nuclear cooperation and non-cooperation, with references, see https://www.atomicheritage.org/history/british-atomic-bomb-project (16 March 2017).

6. Hance, Chapter 10.

7. Numerous articles on the reactor types mentioned can be found on the internet, ranging from Wikipedia to technical reports on Magnox reactors and on the Dounreay reactor in https://www.iaea.org/resources/databases/inis.

8. Hance, 65-66.

9. Hance, Chapter 14.
10. *Their Trade is Treachery* (Central Office of Information, 1964 for official use only; London: Beautiful Books facsimile, 2010). At a time when the booklet was still not publicly available, the title was copied by Chapman Pincher for his own book *Their Trade is Treachery* (London: Sidgwick & Jackson, 1981) – a deliberate provocation, see Foreword at ix.
11. C.P. Snow, "The men of fission", *Holiday*, April 1958, 95, 108-115, reprinted in Stanley Weintraub, *C.P. Snow: A Spectrum* (New York: Charles Scribner's Sons, 1963), 42-47.
12. Hance, Chapters 9, 16, and 25.
13. Hance, 162.
14. Hance, 50; ref [20] at 12-13.
15. World Nuclear Association, *Nuclear Power in the United Kingdom* (updated June 2018), http://www.world-nuclear.org/information-library/country-profiles/countries-t-z/united-kingdom.aspx, and Appendix 1 thereto (updated October 2016) http://www.world-nuclear.org/information-library/country-profiles/countries-t-z/appendices/nuclear-development-in-the-united-kingdom.aspx.
16. Hance, Chapters 21 to 24 and 30, especially at 264, 267-8, 271, and 272.
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24. Vale of the White Horse District Council, planning application P18/V1059/SCO, Scoping Opinion request (application submitted 26 April 2018, decision issued 15 June 2018).
25. Harwell Campus Management, communications to author February-June 2018.
26. Hance, 81 and 275.

Michael Jewess

"Bichloride of methylene" – Paint stripper… and anaesthetic

"Bichloride of methylene", known today as dichloromethane, is most commonly encountered in the laboratory as an eluant for chromatography and was used in the twentieth century workshop as a constituent of *Nitromors* paint stripper. But it enjoyed twenty-five years of popularity in the preceding century as a general anaesthetic [1].

The potential of volatile agents to dissociate pain from surgical procedures can be traced back to Humphry Davy who wrote in 1800 "nitrous oxide [N_2O]…. appears capable of destroying physical pain [2] (and) it may be used with advantage during surgical operations in which no great effusion of blood takes place" [3]. However, the application of this notion took over forty years. In the meantime, operations were rare - interventions of last resort, on account of the pain which would terrify the patient and distress the more sensitive surgeons. Fanny Burney, the novelist, describes the operation for the removal of a tumour in 1811 "Yet – when the dreadful steel was plunged into my breast – cutting through veins – arteries – flesh – nerves – I needed no injunction to restrain my cries. I began a scream that lasted intermittently during the whole time of the incision…so excruciating was the agony. When the wound was made and the instrument was withdrawn, the pain seemed undiminished, for the air that suddenly rushed into those delicate parts felt like a mass of sharp and forked poniards, that were tearing the edges of the wound…..I thought I must have expired"[4]. Soon after the twenty-minute operation she saw her surgeon, Dr Larrey "…pale nearly as myself, his face streaked with blood & its expression depicting grief, apprehension, and almost horrour *(sic)*".

Early History of Anaesthesia

Various people are credited with the introduction of anaesthesia [3]. Briefly, an American, Crawford Long, successfully used diethyl ether in 1842, but did not publish his results. Horace Wells in 1844 used N_2O as a dental anaesthetic and William Morton gave the first public, successful, demonstration of "etherisation" in the General Hospital in Massachusetts in 1846. Chloroform was first used as an anaesthetic by James Simpson of

Edinburgh in 1847. Ether, nitrous oxide and chloroform remained the principal anaesthetic agents until the mid-1950s. Nitrous oxide was safe, but in the absence of added oxygen, only rendered the patient unconscious for 1 - 1½ minutes, sufficient for a tooth extraction but little more. Ether was perceived as safe for more extensive operations, but the period of induction (of anaesthesia) was relatively long for patients, some of whom found it distressing. Recovery was often accompanied by vomiting and was prolonged. Ether was also flammable and formed explosive mixtures with air. This was not a drawback with chloroform and induction was less stressful. But it was a riskier agent than ether, with a relatively high proportion of inexplicable deaths "on the table". Various figures are quoted: typically, 1 in 3258, compared with 1 in 14,987 for ether [5].

Coal Gas?

The search was on from the late 1840s for agents which might combine the advantages of both chloroform and ether. Table 1 lists the alternative agents that were found to have anaesthetic potential [3].

Enter "Methylene"

The first substance in the table, often known simply as *methylene*, enjoyed considerable popularity. First prepared by Henri Victor Regnault in 1840 by the action of chlorine on CH_3Cl, it was introduced to anaesthetic practice in 1867 by Benjamin Ward Richardson (Fig. 1), who reported that "in its action it is more gentle but as effective as chloroform. It produces less struggling… and excitement" [6]. One of its strongest advocates was Sir Spencer Wells, who recounted his removal or an "enormous ovarian tumour…..The patient was very weak and I much preferred methylene. I showed an intelligent nurse how to administer it, and she did it quite effectually and safely….Since 1872 I have preferred methylene to any other anaesthetic" [7]. He ends his account with another resounding endorsement "Accordingly, until some better anaesthetic is brought forward, I shall remain content with bichloride of methylene…I have never known it to fail and have never once been alarmed, or even made uneasy, by its effects in any one of more than 2,000 operations, many of them of unusual severity or duration".

Compound	Dates	Comments
Bichloride of methylene (dichloromethane)	1867? – 1888?	Probably fourth in popularity after N_2O, ether and chloroform
Ethyl bromide	1849-1891	Used mainly in dentistry. Like $CHCl_3$, associated with inexplicable deaths
Ethidine dichloride (1,1-dichloroethane)	1879 - 1900	Thought to be midway in safety between ether and chloroform. Little post-operative vomiting
Amylene (a crude mixture of mono-alkenes, based on C_5)	1856 –1858, then again around 1893, in more purified form	Unpleasant odour. Swift recovery. High fatality rate (2 in 238 operations)
Nitrogen (or N_2 with a little added air)	1890 - 1891	Seemed to work by partial asphyxiation. No advantages over N_2O
Ethylene	1849	Described as "unsatisfactory", it was later used with some success 1923 – 1960's
Coal gas (typically 32% methane, 48% hydrogen, 8% carbon monoxide)	1849	"A safe and effective agent", its use held back by its unpleasant odour
Carbon tetrachloride, benzene, carbon disulphide, ethyl nitrate, bromoform, Dutch liquid (1,2-dichoroethane), turpentine, methyl chloride	1849	Attended by various drawbacks and not actually used to any extent in anaesthetic practice

Table 1: Nineteenth century agents proposed for use in general anaesthetic Table 1: Nineteenth century agents proposed for use in general anaesthetic practice

Figure 1: Benjamin Ward Richardson

Image courtesy of Wikimedia Commons
https://commons.wikimedia.org/wiki/File:Portrait_of_Benjamin_Ward_Richardson.jpg

But what exactly was Wells and his contemporaries administering? Richardson correctly positioned his bichloride of methylene in the sequence CHHHCl, *CHHClCl*, CHClClCl and CClClClCl, however the boiling point of his material suggests it might have still contained some dissolved CH_3Cl as an impurity (Richardson's dichloride boiled at 31ºC, in contrast to today's accepted figure of 40ºC. Its density was 1.34 g/cm^3, quite close to today's 1.33 g/cm^3). But it is clear that within a few years, two types of anaesthetic grade bichloride of methylene were in circulation. One sort had a tendency to cause a "snow" to develop on the exit tube of the Junker's inhaler used to administer to vapour (Fig. 2). This we presume to be the genuine CH_2Cl_2, the "snow" (frozen water vapour from the air) arising from the cooling effect of this very volatile agent. The other type of "methylene" never yielded this "snow". That supplied by Messrs Robbins & Co boiled at 53ºC and smelt strongly of chloroform, and was believed to have been a mixture of methanol and chloroform. Confirmation came when a sample was analysed: fractional distillation indicated it consisted of 4/5th chloroform and 1/5th methanol. The unfractionated mixture distilled over at 49-53ºC (chloroform itself boils at 61ºC and methanol, at 65ºC).

Spencer Wells admits some uncertainly. He quotes the opinion of John Tyndall, Professor of Chemistry at the Royal Institution, that no chemist could make genuine CH_2Cl_2 at under ten shillings an ounce (= £1,400 per litre at 2018 values) making it a prohibitively expensive anaesthetic. Wells acknowledges the possibility of methylene being a mixture and records "Others said that a mixture of chloroform and methylic alcohol would act as well, but on trial it did not". He sums up his position "I wish I could speak as confidently of the chemical composition of the fluid sold as bichloride of methylene as I can of its anaesthetic properties: but whatever its chemical composition, whether it is or is not chloroform mixed with some spirit or ether, or whether it really is bichloride of methylene, I am still content with the effects of the liquid sold under this name, when properly administered" [7].

But Wells was a minority voice, and the tide was turning against his favourite anaesthetic, whatever it was. As early as 1876, an opinion was voiced by the Surgical Registrar of Guy's Hospital: "During the last five years, all the anaesthetics, old and new, ether, chloroform, nitrous oxide, bichloride of methylene, and the mixture of alcohol/chloroform/ether have all been used to a considerable extent at Guy's, but chloroform has again become the anaesthetic of common use" [3].

And thus it was. "Etherists" and "chloroformists" continued to debate the relative efficacy of their particular anaesthetics over the next eighty years. Bichloride of methylene gradually disappeared from the textbooks on anaesthetic practice, only to reappear in the twentieth century as an agent for stripping off old paint [8]. We wonder, toxicity notwithstanding, would a mixture of methanol and chloroform have served equally well?

Figure 2: The inhaler devised by Ferdinand Junker for administering bichloride of methylene. Air is hand-pumped using the rubber bulb through the CH_2Cl_2 contained in the small bottle clipped to the anaesthetist's breast pocket. The vapour is delivered to the patient's nose and mouth through the loosely fitting mask on the right.

Image courtesy of http://www.mushinmuseum.org.uk/junkerinhaler.html and also illustrated in reference five.

Postscript - Take a bottle down: give it a sniff

The dramatic effect of ether as an anaesthetic agent prompted searches for even better alternatives. Chemicals, old and new, were tested, initially on animals but sometimes on the researchers themselves. Thus, chloroform was first shown to be an anaesthetic from its action on dogs in experiments carried out by Pierre Jean Marie Flourens in France (1847). His work just preceded that of James Young Simpson who is generally associated with its use on human patients. Simpson describes his search for the ideal anaesthetic "Latterly, in order to avoid, if possible, some of the inconveniences and objections pertaining to sulphuric ether (= diethyl ether) … I have tried on myself and others the inhalation of different other volatile fluids, with the hope that some of them might be found to possess the advantages of ether without the disadvantages. For this purpose, I selected for experiment and have inhaled …..the chloride of hydrocarbon (or Dutch Liquid) [= 1,2-dichloroethane], acetone, nitrate of oxide of ethyle (nitric ether) [= ethyl nitrate], benzin [= benzene, probably, but might have been petroleum ether], the vapour of iodoform, etc". The most effective agent was chloroform "(I) have exhibited it with perfect success in tooth-drawing, opening abscesses, … (and) also in obstetric practice with entire success" [3]. Other workers who searched for alternatives to ether and nitrous oxide were John Snow (1813-1858) and Thomas Nunnerley (a Leeds surgeon, who reported his results, 1848-1849).

Further Reading

Interested readers may wish to join the *History of Anaesthesia Society*. The annual subscription is £20 (details from John Pring at J.Pring@talk21.com). Members are entitled to purchase the 640-page Duncum text [3] at the remarkably low price of £7.00 + postage. This authoritative work should be the starting point for anyone interested in researching the history of inhalation anaesthesia.

References and Notes

1. This article is a revised version of our 2005 *Education in Chemistry* paper on this subject (**42**, 133) and is republished here with permission of the present editor.
2. Actually Davy was reporting on *analgesia,* rather than *anaesthesia*. The latter is the process of conducting the patient into a reversible state of *unconsciousness* during which he or she is insensible to pain.
3. M. Duncum, *The Development of Inhalation Anaesthesia* (London: The Royal Society of Medicine Press, 1994).
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7. T.S. Wells, *Brit. Med. J*., 9 June 1888, 1211.
8. Nitromors paint stripper was reformulated in 2009 in accordance with EC regulations and no longer contains dichloromethane.

Alan Dronsfield, Margaret Hill and John Pring

Safranine – Mauve's Daughter

William Henry Perkin (1838–1907) first produced mauveine by oxidizing an aniline + toluidine mixture with potassium dichromate in 1856 [1]. He noticed that "there is always a small quantity of a second colouring matter produced, of a rich crimson colour, similar to that of safflower". [2] He recalls: "Several years ago I examined this substance, and found it to dye silk a remarkably clear colour, but owing to the press of other matters, and the very small quantities in which it could be obtained, I did not give it any further attention. By a new process, however, it can now be produced in somewhat larger quantities, and endeavours are being made to introduce it to the arts, as it produces beautiful tints of pink upon silk and cotton". The new process could have been the production of safranine by heating commercial aniline, i.e., a mixture of aniline and toluidines, dissolved in acetic acid with lead nitrate, first used by Felix Duprey in 1865 [3]. It has been suggested that the red dye was first isolated by Greville Williams in 1859 [4]. But his publication, if any, of this experiment seems difficult to locate. Charles Hanson Greville Williams FRS (1829 – 1910), was an English scientist and analytical chemist who published many scientific papers from 1853 onwards [5].

In the early days, Perkin favoured the name aniline pink for the red dye. But others used the term safranine, about which Perkin thought "this name properly belongs to the colouring matter of saffron" [6]. But safranine soon became a much more popular name than aniline pink. When Perkin found time to study safranine, he found that it could be obtained from the oxidation of a hot solution of mauveine in aqueous acetic acid with lead dioxide. This observation could suggest a reason for the low yields of mauveine. He determined the molecular formula of aniline pink from elemental analysis of the chloride to be $C_{20}H_{19}N_4Cl$. This formula was confirmed in 1879 by Dale and Schorlemmer who obtained the same safranine by using manganese dioxide as the oxidant of mauveine dissolved in boiling dilute sulfuric acid [8]. In the same year Perkin noted that his safranine differed from the safranine prepared from o-toluidine which had a formula $C_{21}H_{21}N_4Cl$ [7]. Consequently, Perkin renamed his safranine parasafranine [9].

By the early twentieth century, the commercial production of safranine from aniline and o-toluidine was well established [10]. This product is a mixture of di- and tri-methyl compounds, shown in Fig. 1, and is now called safranine O. The di-methyl compound is called safranine T and is the product currently available. The structure of Perkin's parasafranine could not be correctly identified before the correct structures of the two major components of mauveine were revealed in 1994 [11]. The most likely candidate is mauveine B (Fig. 2). The oxidation of mauveine A would give a product with one less methyl group which, due to its greater solubility, could be lost in the purification process.

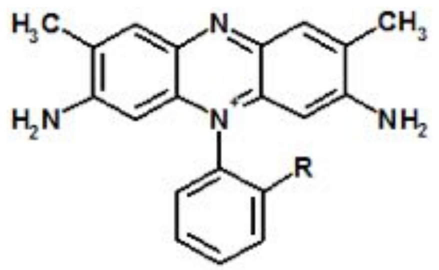

Fig. 1. Safranine T (R = H) and Safranine O (R = H and R = CH_3)

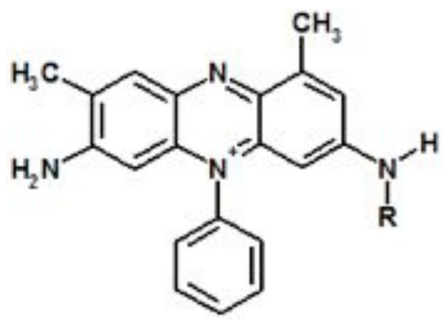

Fig. 2. Mauveine B (R = 4-methylphenyl) and Perkin's parasafranine (R = H)

Despite the toxicity of safranine being revealed in the nineteenth century and later allegations of carcinogenicity, in the twenty-first century "[s]afranin is … widely used as food dye in flavouring and colouring candies and cookies, textile industries, leather, paper ..." [12]. In contrast, mauveine is now only available on some UK Victorian 6d postage stamps issued between 1867 and 1880.

Chris Cooksey

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BOOK REVIEWS

Patricia Fara, *A Lab of One's Own: Science and Suffrage in the First World War,* (Oxford: Oxford University Press, 2018), ISBN 978-0-19-879498-1, Pp. xiii +334, Hardback: £18.99.

The dual centenaries marked in 2018, the end of the First World War and women over thirty obtaining the right to vote, are commemorated in Patricia Fara's excellent book on the extraordinary lives of female scientists. Through the use of biographical accounts, Fara demonstrates how these women overcame seemingly insurmountable challenges to contribute significantly to the war effort and the fields of science and medicine. The suffragist movement had already aligned itself with scientific and technological progress before the outbreak of war and the first two parts of the book explore this move away from domesticity towards the vote. The life of the pioneering campaigner and mathematician Ray Costelloe/Strachey who encouraged suffragists to fight for their country as well as the vote, receives particular attention. Rae and her sister Karin lay at the centre of the Bloomsbury set, but the lives of the two sisters are often overlooked.

It is in bringing the biographies of neglected scientific women before a wider audience that Fara's book is particularly strong. Although secrecy shrouded women's roles in locations such as the Gretna munitions factory, Fara discusses little-known contributions in fields as diverse as code-breaking and the production of wire nets to capture submarines. Relatively new medical sciences such as physiotherapy, radiology and psychotherapy flourished during the First World War due to the work of female practitioners. Medical work on the Eastern Front receives particular attention, notably the doctors Isabel Emslie Hutton and Elizabeth Ross. Their contributions are commemorated in Serbia today, but remain overlooked in the UK.

Given the centrality of chemistry to the war effort and existing studies of women chemists, it is not surprising that the careers and contributions of female chemists receive thorough examination. Many of the biographies included will be familiar to members of the Historical Group but Fara's work brings the lives of women in chemistry before a much wider audience. Ida Smedley and Martha Whiteley's campaign for admission to the Chemical Society is the focus of one chapter. Of the all the forms of discrimination experienced, exclusion from professional societies was most keenly felt. According to Smedley's research supervisor, Henry Armstrong, the main duty of female chemists was to pass on their abilities to the next generation by producing baby chemists!

Although the war transformed perceptions of women's abilities and their social roles, when soldiers returned from the Front and reclaimed their jobs, conventional hierarchies were re-established. Women in responsible scientific positions were forced into accepting low-status posts. A frustrated graduate commented how for women in the chemical industry magnificent health and a thick skin were more important that a knowledge of chemistry. The career of the chemist Katherine Culhane which spanned the twentieth century highlights how such problems persisted. Culhane went to university in 1918 but, after graduating, she could only obtain an interview for a research position by disguising her gender and signing herself as K. Culhane. When employed, her salary was always lower than a man's, expenses were paid for third not first-class travel and her appearance rather than scientific results were the subject of journalistic comment.

Whilst wartime brought working conditions unrecognisable today and differentiation on the grounds of gender is no longer legal, there remain continuities from the life histories that Fara discusses. Women in STEM continue to face significant challenges and Fara argues that it is essential to understand why more men than women work at the top of the field in the sciences. This book does not exist to inspire young women into careers in science and medicine, although this may be a by-product. It is essential reading for all those working in STEM, regardless of gender or career stage. As a scientific community we need to understand the prejudices that may be unwittingly inherited from the past and which enable discrimination to persist. Fara's absorbing and thought-provoking book urges us to do this and deserves to be widely read.

Anna Simmons
UCL

Roy MacLeod, Russell G. Egdell and Elizabeth Bruton, eds., *For Science, King and Country: The Life and Legacy of Henry Moseley,* (London: Unicorn Press Publishing Group, 2018), ISBN: 9781910500712, Pp. 316 + ix pp. illus., paperback £24.00 (Amazon).

Killed by a Turkish sniper at Gallipoli in the Dardanelles Campaign of 1915, aged just twenty-seven, the death of Henry Gwyn Jeffreys Moseley is one of the most pathetic events (in the true sense of the word) in the history of science. On one hand, here was a promising British scientist cut down in the flower of his youth, a feeling accentuated by the iconic photograph of the almost boyish Moseley standing with a cathode ray tube in the Balliol-Trinity laboratory in Oxford in 1910. On the other hand, his discovery of the atomic number was both simple - in contrast to the bewildering development of quantum mechanics and relativity - and yet profound. At last the total number of possible elements was known, at least below Uranium. His early death immediately raises two questions: would he have won the Nobel Prize if he had lived and what would he have achieved as a mature scientist? This book is a spin-off of an exhibition entitled "Dear Harry… Henry Moseley: A Scientist Lost to War", at the Museum of the History of Science, Oxford, in 2015-2016 and is the first major historical work on Moseley since John Heilbron's *Life and Letters* published in 1974. While it does not completely replace Heilbron's important work, it certainly adds to it.

There are eleven chapters which cover his time at Eton and Oxford, his work in Manchester, his military service; and the reception of his work by the scientific community; and the impact of his work upon X-ray spectroscopy in physics, chemistry, and materials science. In this short review, I can only mention a few things which I found particularly interesting. It is striking how Moseley's work in X-ray spectra ran in parallel with the Braggs' work on X-ray diffraction, both drawing on similar equipment and similar mathematics. The Braggs set off in one direction and Moseley in another. X-ray crystallography took years to establish whereas the key aspect of Moseley's work was settled in a few months. What if it had been the other way round, Moseley's genius would not have been as obvious and the development of X-ray crystallography might have taken longer. How fortunate was the division of labour! Similarly Russell Egdell shows that the use of X-ray spectroscopy was a mixed blessing for element discovery. In theory, the new technique should have been an unambiguous test of a new element while also helping to find new ones. But in practice difficulties in recording the spectra and interpreting them, as well as a certain amount of skulduggery, meant that X-ray spectroscopy was less useful in practice than one might have hoped. It is clear that the technique would have been much more useful if it had been discovered earlier when there were more elements to be discovered but it was not to be. The issue of whether Moseley would have won the Nobel Prize is difficult to answer, given the idiosyncratic behaviour of the Swedish Academy of Sciences, but leading Nobel Prize historian Robert Marc Friedman shows that there were two prizes (Charles Glover Barkla and Manne Siegbahn) that were effectively proxy prizes for Moseley. Even more interesting is the account given here of the posthumous award of the Italian Matteucci Medal in 1919 which has not been given to all Nobel laureates. Finally, I must mention the two chapters by Elizabeth Bruton, one being a very poignant account of Moseley's military career, showing how he was very much a product of his time and Eton in particular, and an absorbing account (with her former colleagues Silke Ackermann and Stephen Johnston) of how the exhibition at the Museum of Science was put together.

For Science, King & Country will appeal to all members of the group, combining personal history, history of science, chemistry and museology to create a very attractive volume which has been well produced with clear illustrations, an index and a good binding.

Peter Morris

Anthony S. Travis, *Nitrogen Capture, The Growth of an International Industry (1900–1940)*, (Cham [Switzerland]: Springer International Publishing AG, 2018). Pp. 411 + xxi. ISBN 978-3-319-68962-3 and 978-3-319-68963-0 (eBook). $189.00 (eBook $149.00 or €118.99).

Much has been written about the history of nitrogen capture but books and journal articles have focused on individual technical developments, the contributions of individual scientists or engineers or the part played by companies in different countries. Tony Travis's *Nitrogen Capture* is the first book to provide an almost complete survey of the developments across the industrialised world, and is the culmination of nearly thirty-eight years of research starting in early 1980s when the author published *The High Pressure Chemists* as part of a programme of the London Borough of Brent to introduce the application of science into the school classroom. Interim publications have continued, including *The Synthetic Nitrogen Industry in World War I: Its Emergence and Expansion* (2015), and *Nitrogen, Novel High-Pressure Chemistry, and the German War Effort (1900–1918)* (2015); the latter was the Seventh Wheeler Lecture of the RSC Historical Group.

Nitrogen Capture focuses on the industrial-scale capture of atmospheric nitrogen and its transformation into fertilizers in the drive to increase agricultural yields and thereby feed the rapidly rising world population. The Haber-Bosch process developed by BASF in 1913 that brought about the fixation of nitrogen with hydrogen to yield ammonia, relied on the chemical research of Fritz Haber in 1909 and the engineering skills of Carl Bosch at BASF. Its development gave Germany a huge technical and economic advantage over other countries who were still reliant on Chilean saltpetre for nitrogen compounds. The German advantage became crucial during World War I since the manufacture of explosives also depended on the nitric acid derived from ammonia by catalytic oxidation. Other technologies and processes were also used including hydroelectric power for the production of cyanamide and the electric arc process for oxides of nitrogen, but the BASF ammonia process remained the process other companies and countries wanted to replicate. However, BASF refused to license their process, prompting other countries to undertake major R&D programmes (often government funded at least in part) to develop equivalent processes over the period to 1940. *Nitrogen Capture* reviews these developments across many different countries including Britain, France, Italy, Russia, Japan, the Soviet Union, Eastern European countries and the USA (which was slow to develop synthetic ammonia and relied on coke oven nitrogen and Chilean nitrates until the late 1920s), as well as exploring the significance of the Haber-Bosch process on the development of other high pressure processes for the production of methanol and polythene.

The book draws on extensive research and scholarship, is well written and illustrated, and provides an easily accessible narrative through the various episodes comprising this intriguing story. It is thoroughly recommended to all historians of chemistry and the chemical industry, while those interested in the emerging role of technology and engineering in industrial manufacture will also find plenty of interest. Hopefully the high price of both the hardback and eBook will not prevent this excellent book from being widely read, though most readers will probably have to rely on libraries.

Peter Reed

MEETING AND CONFERENCE REPORTS

The History of Dyes on the 150th Anniversary of the Synthesis of Alizarin

Royal Society of Chemistry, Burlington House, 17 October 2018

This meeting was held to acknowledge three anniversaries, namely the 150th anniversary of the synthesis of the red dye alizarin by Carl Graebe and Carl Liebermann in 1868, the 150th anniversary of the birth of Fritz Haber and the 100th anniversary of the controversial award of the Nobel Prize in chemistry to Haber in 1918 (although he not actually receive the award until 1919). It was well-attended with sixty-five people registering for the meeting. The synthesis of alizarin was in many respects more important than William Henry Perkin's accidental discovery of mauveine twelve years earlier, both as a feat of organic synthesis and for its impact on the development of the synthetic dye industry. The meeting considered the history of the natural alizarin-containing dye madder, alizarin itself and other synthetic dyes. It offered three viewpoints, namely the chemistry of these dyes (and especially their analysis), the history of the dyes and the economic history of dye production. The meeting concluded with the Wheeler Lecture, which was delivered by the eminent Anglo-Australian historian of science Roy Macleod who is an expert on the role of science in the First World War.

Pigment from Natural Dyes: Their Manufacture and Use in Paintings at the National Gallery

David A. Peggie, National Gallery

Lakes are a specific category of pigment for which the source of the colour is a natural dyestuff of plant or animal origin. The dyestuff can be obtained directly from the source material or by alkaline extraction from dyed textile shearings, with the exact hue of the resulting pigment dependent on factors such as the biological source chosen and the precise conditions used during manufacture of the pigment. These lake pigments were especially prized for their translucency when used in an oil binder, but are also particularly light-fugitive and prone to fading. Establishing the precise biological source of the dyestuff and obtaining information on the way the lake pigment was prepared presents a number of analytical challenges, particularly when working with microsamples taken from paintings.

This presentation summarised the results from the analysis of a number of paint samples taken from paintings by Titian and Rembrandt in the collection of the National Gallery, London using High Performance Liquid Chromatography (HPLC) and attenuated total reflectance – Fourier transform infrared (ATR-FTIR) spectroscopy. These indicated the use of red lake pigments derived from a variety of sources, including both plant (madder and brazilwood) and insect (cochineal species, kermes and lac) sources, and in many cases confirmed the use of textile shearings in the production of the lake pigment. Changes in the use of particular dye sources over time were observed and the different ways in which red lake pigments were used by artists such as Titian and Rembrandt was explored.

Dye Chemistry and Substitutes: Sir Robert Robinson between Industry and Government, 1922-1947

Mat Paskins, LSE

This talk discussed some of the chemical activities of Sir Robert Robinson, examining his contributions to academic chemistry, as an industrial consultant to the ICI dyestuffs research group, and as an advisor to government during World War Two. Robinson has been characterised as among the last of the “classic” organic chemists. By pursuing him through the diverse realms in which he was active, we can grasp how his understanding of the vocation of chemical science shaped his official advice and his vision of how chemistry should contribute to government. Of particular note is his desire, during wartime, to develop a general overview of chemical supply and the systematic study of possible material substitutes. This overarching and ultimately unrealised ambition was coupled with a detailed knowledge of the formulations of mundane chemical goods.

In the footsteps of Perkin’s and Caro’s (synthesis of) Mauveine

J. Sérgio Seixas de Melo, University of Coimbra

A short account about what is mauve and Perkin’s mauve was made. The presentation focussed on the recent discoveries on the analysis of historical mauveine museum samples, which showed to consist of a blend of more than thirteen different methyl derivatives (C_{24} to C_{28}) of 7-amino-5-phenyl-3-(phenylamino)phenazin-5-ium compounds, differing in the number of methyl groups, ranging from none (pseudo-mauveine) to four (mauveine D). The synthesis of the historical mauveine was reproduced and showed to be obtained from the oxidation of a mixture of aniline, p-toluidine and *o*-toluidine in a ratio of 1:2:1. From LC-MS analysis, evidence was established for the presence of residual traces of toluidine (with retention time at 4.4 min and detection at 260 nm) in all museum samples of mauveine. It was unequivocally established that the mauveine acetate sample of Science Museum cannot be considered the original Perkin’s sample. Mauveine obtained from at least two different recipes (Perkin and Caro) can still be found nowadays on UK Victorian 6d postage stamps from 1867–1880.

Turkey Red Industry in the Nineteenth Century: Transition from Natural Madder to Synthetic Alizarin

Mohammad Shahid, Centre of Textile Conservation and Technical Art History, University of Glasgow

Turkey red, a process used to create bright and fast reds on cotton during the eighteenth and nineteenth centuries, evolved tremendously over the period of more than two centuries of its commercial existence in the European textile industry. Since its early days until the 1870s, different varieties of madder (*Rubia tinctorum*) were used as a dyeing material. Garancine, a concentrated madder product, was introduced into the Turkey red industry in the 1840s, which served as a transitional product overlapping the use of both madder and alizarin. The synthesis of alizarin in 1868 led to the gradual transition from natural madder to synthetic alizarin. A dyestuffs ledger belonging to Archibald Orr Ewing and Company, held in the University of Glasgow archives, beautifully captures this transition, between madder, garancine, and synthetic alizarin during the period 1873-1892. The ledger provides concentrations, prices and amounts of material used for Turkey red dyeing at three different dyeworks: Levenbank, Milton and Dillichip. This dyestuffs ledger has the last entry for madder in 1874 for the Levenbank works. The two other works at Milton and Dillichip had already abandoned the use of madder. The last entry for garancine appears in 1877 for the Levenbank works and in 1886 for the Milton and Dillichip works. Three contracts of the United Turkey Red Co. for synthetic alizarin, one with the British Alizarine Company (1898) and two with Meister Lucius & Brüning (1899 and 1900), held at University of Glasgow archives indicate that the alizarin used in the Scottish Turkey red industry came from both British and German sources. Another related development was the introduction of Turkey red oil (TRO), patented by Wurth in 1872, in place of the rancid olive oil and the introduction of a short Turkey red process by the use of the alizarin on TRO.

Mysteries of the Madder Vat

Vincent Daniels, British Museum

Field madder (*Rubia tinctorum*) has been used to make pigments and to dye textiles for millennia. Modern analytical methods have shown that in addition to alizarin over twenty other hydroxyanthraquinones (HAQs) may be present. There are several other plants related to *R. tinctorum* which may be used for dyes and pigments and these have different proportions of the HAQs; some have negligible alizarin-content. The HAQs in the water-extract of madder undergo several transformations in a dye or pigment vat making it difficult to predict the chemical content. Red/pink pigments from the Classical world (Egyptian, Grecian and Roman objects) often contain pigments with low alizarin content but a high proportion of pseudopurpurin. It is possible that a plant naturally containing a high proportion of pseudopurpurin may have been used or alternatively a method of selectively extracting pseudopurpurin from *Rubia Tinctorum*. By measuring the solubility of alizarin, purpurin and pseudopurpurin in water and alum over a range of temperatures, a method for producing pigments similar to those made in Classical times has been devised. This method involves the preferential extraction of pseudopurpurin into alum solution. Using the solubility data some predictions can be made about the composition of pigments made from saturated solutions of HAQs. However, they do not easily translate into predictions about madder extracts, possibly due to the large amounts of dissolved plant material present.

Madder Root to Synthetic Alizarin - Transformations that changed the World

Alan Dronsfield, University of Derby

Madder, the root of the shrub *Rubia Tinctorum*, dyes mordanted silk and wool a rusty red. On cotton it is used in the multi-stage process to dye the fabric a fiery red shade. In the middle of the nineteenth century it was a significant commercial export from hotter climates to the UK and other northern European countries. At this time chemistry was developing into the subject we know today, both in terms of techniques and chemical theory. In the mid-1860s, the young William Henry Perkin was well on his way to making a fortune from his "accidental" synthesis of *Mauveine*, a dye of non-natural origin. Carl Graebe and Carl Liebermann, working in Adolf Baeyer's Berlin laboratory, decided to apply their chemistry to profit from the manufacture of Alizarin, the tinctorial constituent of madder. To do this they had to establish its structural formula and then come up with a means of synthesis, ideally from cheap starting materials. Pierre Jean Robiquet in 1826 had devised a method for obtaining the pure dye from the powdered madder root and his combustion analysis, interpreted today, pointed to it being a fourteen carbon chemical structure. Unfortunately others believed it was a C-10 system derived from naphthalene and directed their researches accordingly. Crucially, Graebe and Liebermann applied a method recently devised by their chief to de-oxygenate oxygenated species to yield their parent hydrocarbons. Thus their distillation of alizarin with zinc dust afforded anthracene, a species cheaply available from coal tar distillation. They devised a profitable synthesis and this led to Germany becoming the focus for the world's synthetic dyestuffs industry. In turn, this stimulated the country's nascent organic chemical industry, which from 1914 enabled it to produce "organic" high explosives and propellants in tonnage quantities, changing the face of warfare. Moreover its chemical industry, pre-eminent in the world, could scale up Fritz Haber's 1908 process for making ammonia from hydrogen and nitrogen (and thence to huge amounts of nitrated explosives). The Allies had anticipated that an effective blockage would deprive Germany of sodium nitrate imported from South America, used both as a fertilizer and source of nitric acid. Shortages of both in Germany would bring the war to a swift conclusion. It was not to be, millions of lives were lost and the world was changed for ever.

From Madder to Alizarin: The Transition from Natural to Synthetic Dyes in Practice

Ernst Homburg, Maastricht University

Since the fourteenth century the Netherlands had been a major production centre of madder. During the early-nineteenth century France emerged as a major competitor. Especially when during the 1830s a new product entered the market: garancine – produced by treating madder with sulfuric acid – which had a four times stronger colouring power. By the end of the 1860s there were about 130 small factories in the Netherlands where madder was dried and pulverized, and circa fifteen large garancine works. Garancine was mainly exported to long-distance destinations.

After the discovery of synthetic alizarine in 1868, alizarine production developed mainly as part of the new synthetic dye industry, which had emerged since 1857. In 1869 three producers entered the market (two in Germany and Perkin in the UK), followed by two German companies in 1870, and three companies from Germany, France and Britain in 1871. The French company Thomas frères was the only producer of madder and garancine that succeeded in making the transition to synthetic alizarine. The total global number of producers rose to twenty-one in 1873 and then declined to fifteen in 1879.

Until about 1873 the Dutch madder and garancine industry did not really suffer from competition from the synthetic product for three reasons: (1) it took some time before the dyers and calico printers adapted their recipes; (2) the price of alizarine was higher than the price of garancine and madder until about 1874; and (3) countries such as the USA had a high import tariff for synthetic alizarin, and remained markets for Dutch garancine and madder for years.

Between 1874 and 1878 the number of hectares cultivated with madder plants in the Netherlands dropped from circa 2700 to 124. Before 1880 all Dutch large garancine works closed their doors. The decline of the small madder factories had a longer tail though. From circa 150 production units around 1870, twenty-nine were still in production in 1897. In 1893 still 193 hectares of madder were cultivated. The natural product had found niche markets in certain segments of wool dyeing, partly under the influences of the arts-and-crafts movement. During the First World War the last two madder factories closed down and were never revived.

Wheeler Lecture, 2018

Chemistry in War and Peace: Reflections on the Life and Legacy of Fritz Haber

Roy MacLeod, University of Sydney

For many years, and especially since the Second World War, the life and legacy of Fritz Haber (1868-1934) have been much studied and widely debated. The memory and image of a man whose work was to produce such contrasting outcomes – in the enduring economic benefits of nitrogen fixation, and in the lasting consequences of chemical weapons – continue to concern many who today read the history of chemistry, and many more who look to history for guidance and information about the social consequences of science.

Presentation by John Hudson of the Wheeler award to Roy MacLeod

Recalling the growing literature on this subject, this lecture took advantage of the opportunity presented by the commemoration of the sesquicentenary of Haber's birth in 1868 and the centenary of his award of the Nobel Prize in 1918, to assess what we have come to know of Haber the man, the scientist, and the master of modern methods, both in science-based industry and in its military applications.

During Haber's lifetime, we can trace the marriage between theoretical and applied chemistry, chemical engineering, and State-directed industrial capitalism, that was to emerge during the Great War and dominate the rest of the twentieth century. From Haber's experience, both during and after the War, we have inherited not only a memorable legacy, but also a formidable challenge, in the need to understand the results of science as ultimately receptive to the demands of 'dual-use'. Today, around the world, we wrestle with this challenge, as we search for an ethical framework to embrace the conduct and application of scientific research in such ways as respond with integrity to the deepest hopes and highest ambitions of our time. This lecture will outline some of the historical features of this moral landscape, and will reflect upon some of the considerations it presents.

Dyes in History and Archaeology Meeting Repor`t

The 37th Dyes in History and Archaeology meeting took place on 25-26 October 2018 in Portugal. The oral and poster sessions were held at Caparica Campus, NOVA University of Lisbon. The usual format was followed: a welcome cocktail on the Wednesday evening prior to the serious business involved tasting the delicious Azeitão sheep cheeses, with a selection of wines from the same region (Setúbal), and traditional bread. Later "Torta de Azeitão" was sampled with a Moscatel wines selection!

On the Thursday and Friday there were sixteen oral presentations and twenty-seven poster displays by authors from fifteen countries. The range of subjects covered is illustrated by just three titles, chosen at random: In Antoine Janot's blue steps; Early synthetic dyes in Romanian red-yellow-blue ethnographical textiles decoration and historical flags; Photo-degradation of triarylmethane and β-naphthol dyes in different matrices. The gala dinner was on Thursday evening.

Following the serious part of the conference, the Saturday outing was to the Monastery of Santa Maria de Alcobaça in the morning, a Unesco World Heritage site, which is considered to be a masterpiece of Cistercian Gothic art, founded in 1153. After lunch there was a visit to Santarém, for the Gothic art to the Europa Nostra awarded Diocesan Museum. The next meeting, DHA38 will, most likely, be held in November 2019 in Amsterdam.

Since I was not able to attend this event, this report is based on documents available before the meeting and on remarks received from delegates who did manage to attend.

Chris Cooksey

FORTHCOMING RSCHG MEETINGS

Royal Society of Chemistry Historical Group William Crookes Meeting

Saturday 19 October 2019, Royal Institution, 21 Albemarle Street, London, W1S 4BS

This meeting, held jointly with the Royal Institution and the Society for the History of Alchemy and Chemistry will commemorate the 100th anniversary of the death of the British chemist and physicist, William Crookes. The programme will appear in the summer 2019 *Newsletter*.

OTHER MEETINGS OF INTEREST

Society for the History of Alchemy and Chemistry Spring Meeting

Friday 14 and Saturday 15 June 2019, Durham University

This meeting, held jointly with the Department of Philosophy, Durham University, will commemorate the life and work of David Knight.

Details of the programme and how to register will be available on the SHAC website in due course: www.ambix.org.

History of Anaesthesia Society: Annual Meeting,

13-15 June 2019, Madingley Hall, near Cambridge

For further details please see: http://www.histansoc.org.uk/events.html

FORTHCOMING CONFERENCES

British Society for the History of Pharmacy Annual Conference

29-31 March 2019, Portsmouth

The annual conference will be held in Portsmouth with a theme of pharmacy and the sea. For further details please visit:

https://www.bshp.org/events/ShowEvent.asp?E=18

12th International Conference on the History of Chemistry (ICHC12)

29 July – 2 August 2019, Maastricht, the Netherlands

Every two years the Working Party on the History of Chemistry (WPHC) of the European Chemical Society (EuChemS) organizes an international conference on the history of chemistry, open to colleagues from all over the world. The 12th International Conference on the History of Chemistry (12ICHC) will take place from 29 July to 2 August 2019 in Maastricht, one of the oldest cities of The Netherlands, which still has preserved much of its historical charm. The dates of the conference are chosen in such a way that those who are visiting the Annual Meeting of the History of Science Society (HSS) in Utrecht, The Netherlands, from 23 to 27 July 2019, can easily combine this with participation in 12ICHC.

The Conference will be hosted by Maastricht University (UM), a young university, founded in 1976, with a very international student population, and a strong research group in Science, Technology and Society (STS), including the history of science and technology. The conference will be sponsored by UM, the Royal Dutch Chemical Society and several other organizations.

The conference programme will include scientific sessions, key-note lectures, the Working Party business meeting, as well as social events such as excursions, receptions, and a conference dinner banquet. Key-note lectures will be given by Marco Beretta (Bologna University), Carsten Reinhardt (Bielefeld University) and Lissa Roberts (Twente University).

The Steering Organizing Committee consists of Christoph Meinel, Universität Regensburg, and Ignacio Suay-Matallana, Universidad Miguel Hernández (chairs of the committee), Cyrus Mody, Maastricht University (Steering Organizing Committee), Brigitte Van Tiggelen, Science History Institute (chair of the WPHC), and Ernst Homburg, Maastricht University (chair of the Local Organizing Committee).

Important Dates:

Deadline for submitting proposals (both panels and individual papers): 15 January 2019.

Notification of acceptance: 15 March 2019.

Early bird registration: by 15 May 2019.

More information about session or paper submission, deadlines and practical arrangements can be found on: www.ichc2019.org

Contact email for practical questions: ICHC2019MAASTRICHT@gmail.com