

RSC | Advancing the
Chemical Sciences

Historical Group

NEWSLETTER and SUMMARY OF PAPERS

No. 61 Winter 2012

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From the Editor

Welcome to the winter 2012 RSCHG Newsletter which will be the final issue to be delivered to all members by post. As has been discussed in previous newsletters, 2011 saw the introduction of changes to the RSC's system of charging for group membership, something which has substantially increased our group's size and therefore costs. Accompanying this letter is a flyer which members are asked to return by **20 March 2012** if they wish to continue receiving a hard copy of the newsletter by post. Otherwise you will receive notification of future newsletters electronically. Full details are given on the flyer. Given our move to electronic distribution, the winter online edition of the newsletter will showcase some of the advantages of online distribution. It contains colour photographs and a new section called Historical Reminiscences with an article and photographs by David Leaback on social changes in chemistry and industry in Tower Hamlets. Even though readers will have received a hard copy version of the newsletter I would urge them to look at the online version which can be found at:

<http://www.rsc.org/Membership/Networking/InterestGroups/Historical/index.asp>
or <http://www.chem.qmul.ac.uk/rschg/>

This issue contains a wide variety of articles, book reviews and reports. There are two short essays: one by Chris Cooksey on the copperas works at Tankerton; and the second by Henry Rzepa and Chris Cooksey continues an occasional series of articles on mauveine. There are book reviews of Bill Brock's *The Case of the Poisonous Socks: tales from chemistry* published by the RSC; Frank James' new edition of Michael Faraday's *The Chemical History of a Candle* and the American Chemical Society's *Atoms in Chemistry: From Dalton's Predecessors to Complex Atoms and Beyond* which is edited by Carmen J. Giunta. Two RSC Chemical Landmark plaques have been unveiled: one to mark the centenary of Rutherford's nuclear atom at Manchester University and a second for halothane at the Catalyst Science Discovery Centre and Museum in Widnes and reports appear on both of these. There are also reports of the 8th International Conference on the History of Chemistry, two RSCHG meetings, the Society for the History of Alchemy and Chemistry's meeting on Careers in Chemistry and the 250th Anniversary of Smithson Tennant's birth.

Finally I would like to thank everyone who has sent material for this newsletter, with particular thanks to the newsletter production team of Bill Griffith and Gerry Moss. If you would like to contribute items such as news, articles and book reviews to the newsletter please do contact me. The deadline for the next issue will be 23 June 2012. Please send your contributions to (a.simmons@ucl.ac.uk) as an attachment in Word or rich text format, or on CD-Rom (post to Epsom Lodge, La Grande Route de St Jean, St John, Jersey, JE3 4FL).

Anna Simmons
University College London

ROYAL SOCIETY OF CHEMISTRY HISTORICAL GROUP NEWS

RSCHG Meetings: 2010 and 2011

As in previous winter Newsletters here is a summary of the group's activities.

1. Meetings in 2011. There were three, all well-attended and well-received by their audiences. Unusually they were all joint meetings with other societies or RSC Groups.

(i) *Marie Curie and Aspects of the History of Radiochemistry*, Friday 18 March 2011, organised by Alan Dronsfield and Bill Griffith. A one-day meeting in the Chemistry Centre, jointly with the RSC Radiochemistry Group; reported in the August 2011 *Newsletter* pp. 36-43. It was opened by the French *Chargé d'Affaires*, M. Poimboeuf and by Prof. David Phillips, President of the RSC, and was full, with an RSC-sponsored reception afterwards.

(ii) *Dyes in History and Archaeology*, 12 to 15 October 2011 (joint meeting with the Dyes in Archaeology Group), University of Derby. Organised by Alan Dronsfield and Chris Cooksey. A report appears in this newsletter.

(iii) *Environmental Chemistry – a Historical Perspective*. Wednesday 26 October 2011. A joint meeting with the RSC Environmental Chemistry group, organised by Rupert Purchase and Peter Reed. A report appears in this newsletter.

2. RSC Landmark Plaques in 2011

The Group had been represented at all of the following: at Unilever Port Sunlight Research, Port Sunlight, Cheshire on 30 March 2011 (August 2011 *Newsletter*, pp. 35-6); for Sir Ernest Rutherford at Manchester University on 8 August 2011 (report in the current

Newsletter); at the Catalysis Science Discovery Centre, Widnes, Cheshire on 22 October 2011 marking the discovery of the anaesthetic Halothane (report in the current *Newsletter*). The Group was also represented at an English Heritage blue plaque to Sir William Ramsay at his house at 12 Arundel Gardens, Notting Hill, London on 9 February 2011 (August 2011 *Newsletter*, pp. 36-7).

Meetings in 2012 Two have been arranged so far.

(i) Where there's muck there's brass! – the decontamination of chemical sites. Chemistry Centre, Burlington House, **Friday 23 March 2012**. Organised by David Leaback and Peter Reed.

(ii) Under the Influence – famous textbooks and their authors. Chemistry Centre, Burlington House, organised by Peter Morris. **28 September 2012** (the AGM will also be held then).

We have plans for meetings extending into 2013 and 2014; the Group will also be represented at RSC Landmark plaque unveilings.

Bill Griffith

IDENTIFICATION QUERY

In his *Science in the Dock: Guilty or Not Guilty?* the 77-year old Frederick William Westaway (1864-1946), a former HMI for secondary education, blamed himself for encouraging specialization in science and mathematics in schools to the detriment of students' social, cultural and moral education. As an example of dedication and obsession to research that blinded scientific workers (Westaway intensely disliked the word 'scientist') Westaway referred to a friend of his as follows:

“A former colleague of mine, who had distinguished himself in many ways as a young man and had been on the staff of the Imperial College for some years, decided to follow up a particular line of research that might eventually lead to his election to the Royal Society. His special subjects were chemistry and mineralogy. A necessary piece of apparatus for his research was an extremely sensitive (and very costly) chemical balance, and he was lucky enough to find at Oxford, where he lived, an old house with very solid foundations. He rigged up the cellar as a laboratory and his balance was fixed on a heavy stone slab in such a way that it was virtually vibrationless, despite the not very distant traffic. He managed to finish off his weekly professional work by Friday afternoon, and then went straight away to his laboratory, where he stayed until Monday morning. He slept, so far as he slept at all, on a convenient ‘shake-down,’ but an alarm clock often called him up, inasmuch as some of his experiments, which proceeded all night long, required periodic inspection. One night I spent a couple of hours with him, but his normally friendly self had become quite changed. I had never seen a man so concentrated on his work and he simply could not tolerate the slightest interruption. I could see I was an interloper, and I stole silently away. Some six years later his research was pronounced to be ‘brilliant,’ and he was given the coveted Fellowship. Was that distinction dearly bought? His work had not the slightest bearing on industrial processes, on human welfare, or war. It was all ‘pure science’ – a slight lifting of the veil that had hidden away some of nature’s secrets.” (1)

Can any reader identify this twentieth-century chemist/mineralogist? The main requirements are that his early career was spent at Imperial College, that either before or after Imperial College he became a ‘colleague’ of Westaway’s (that is, an inspector of

schools) based in Oxford, and that his weekend research involved delicate gravimetric measurements.

F.W. Westaway, *Science in the Dock: Guilty or Not Guilty?* (Science Book Club, 1942; reprint 1944), p. 44.

If you can identify this chemist/mineralogist please email the editor at a.simmons@ucl.ac.uk who will pass on your suggestions to Professor Bill Brock.

W. H. Brock
University of Leicester

MEMBERS' PUBLICATIONS

If you would like to contribute anything to this section please send details of your publications to the editor. As you can see from this issue, anything from the title details to a fuller summary is most welcome. In this issue we shall highlight an article published by Eric Banks on research at UMIST which was tested at Porton Down. There are also brief details of some recent publications by Historical Group Members.

Disclosed at last

“ Synthesis of some fluorine-containing pyridinealdoximes of potential use for the treatment of organophosphorus nerve-agent poisoning,” Christopher M. Timperley, R. Eric Banks, Ian M. Young, and Robert N. Haszeldine, *Journal of Fluorine Chemistry*, 2011, 132, 541-547. This paper is based on preparative work carried out during the period 1963-1966 at UMIST; it could not be published earlier owing to British national security restrictions. Biological testing was carried out at the then Chemical Defence Experimental Establishment at Porton Down.

As far as I am aware, the first non-restricted communications dealing with research on aldoximes of the fluoropyridine class as antidotes for nerve-agent poisoning appeared only recently (2009, 2010). They related to collaborative Czech-Korean work on derivatives of 3-fluoropyridine-4-aldoxime, a compound first synthesized nearly 50 years ago by Ian Young as part of his PhD project.

Eric Banks

Recent publications by Historical Group Committee Members

“Drug discovery: Metformin and the control of diabetes,” Alan Dronsfield and Pete Ellis, *Education in Chemistry*, 2011 (November), **48**, 185-187. This is an account of the discovery of the drug that is used as the first-line treatment of type 2 diabetes when dietary changes and exercise regimes have failed to control it. In the UK there are presently two million diagnosed sufferers from this condition with an estimated 750,000 who have the disease but are undiagnosed. This then is a widely used and important drug in maintaining the nation's health.

John Hudson, “Chemical Research in the Pre-Grouping Railway Industry and its Impact on Railway Engineering and Practice,” *International Journal for the History of Engineering and Technology*, 2011, 81, 244-263.

Colin A. Russell and John A. Hudson, *Early Railway Chemistry and its Legacy*, RSC Publishing, 2012, ISBN 978-1-84973-326-7. Following two earlier papers by John Hudson on railway chemistry, this book gives a survey of all aspects of the subject from 1835 to

1923, with some references to more recent developments. A review of this book will appear in the summer 2012 edition of the RSCHG Newsletter.

NEWS AND UPDATES

Society for the History of Alchemy and Chemistry

2011 University of Oxford Undergraduate History of Chemistry Prize

The Society for the History of Alchemy and Chemistry is pleased to announce that the first winner of the prize is Caroline Fargher for her study "From Deficiency to Discovery: The Origins of Fat-soluble Vitamin Chemistry, 1900-1945." The prize is awarded to a final year Chemistry student at the University of Oxford for an outstanding dissertation in the history of chemistry. The prize was presented to Caroline at SHAC's autumn meeting in Oxford.

2012 Morris Award: Call for Nominations

The Society for the History of Alchemy and Chemistry solicits nominations for the 2012 John and Martha Morris Award for Outstanding Achievement in the History of Modern Chemistry or the History of the Chemical Industry. This award honours the memory of John and Martha Morris, the late parents of Peter Morris, the editor of *Ambix*, who has contributed the endowment for this award. The recipient chosen to receive the Morris Award will be expected to deliver a lecture at a meeting of SHAC, where the awardee will be presented with an appropriate framed photograph, picture or document and the sum of £300. The award is international in scope, and nominations are invited from anywhere in the world. The first Morris Award was given to Professor Raymond Stokes (University of Glasgow) for his path-breaking work on the German chemical industry.

A complete nomination consists of

- a complete curriculum vitae for the nominee, including biographical data, educational background, awards, honours, list of publications, and other service to the profession;
- a letter of nomination summarising the nominee's achievements in the field of history of modern chemistry and/or the history of the chemical industry and citing unique contributions that merit this award; and
- two or more seconding letters.

Only complete nominations will be considered for the award and the nomination documents must be submitted in electronic form. All nomination materials should be submitted by e-mail to Peter Morris at peter.morris@nmsi.ac.uk and a separate email which indicates that the material has been submitted should be sent to the same address (a precaution in case of incomplete transmission of documents) for arrival no later than 1 May 2012.

Society for the History of Alchemy and Chemistry Award Scheme 2012

The Society offers two types of award: support for research into the history of chemistry or the history of alchemy by new scholars and support for subject development of either history of alchemy or history of chemistry. Applications are expected to open in March 2012 and close in May 2012. See: www.ambix.org

News from the Chemical Heritage Foundation (CHF)

The Chemical Heritage Foundation would like to encourage applications for long-term and short-term fellowships in residence at CHF for the academic year 2012-13. These fellowships are for scholars working in some area of the history of science, technology,

medicine, or related industries in all periods and geographical areas. All fellowships should be in topics appropriate to the collections in the CHF library and museum. The deadline for applications, which are to be completed online, is 15 February 2012. For further information visit www.chemheritage.org

A new series on the History of Chemistry

The Chemistry editor of the publisher Springer, Elizabeth Hawkins, has asked us to mention *Springer Briefs in Molecular Science: History of Chemistry*. This summary is for information only and does not constitute an endorsement or advertisement. The series will present summaries of all aspects of the history of chemistry, alchemy, and chemical technology, with a format between that of journal articles and full monographs. It is intended for authors who may wish to expand on topics previously presented in journals, but with less detail than a full monograph. Individual titles would be 50-125 typeset pages and produced in soft-cover print and eBook formats. All volumes are priced at €49.95, with the author of each volume receiving a flat fee of €500. The first volumes should be published at the beginning of 2012. Prof. Seth C. Rasmussen (N. Dakota State University) is the series editor, and ACS HIST will hold a launching symposium at the 2012 ACS meeting in San Diego, with initial authors giving talks highlighting their volumes. For more details see:

<http://www.springer.com/series/10127>. Proposals for future volumes are currently being sought and authors interested in discussing potential topics should contact Seth Rasmussen (seth.rasmussen@ndsu.edu).

ACS Division of the History of Chemistry

The ACS Division of the History of Chemistry (HIST) is making access to back issues of the *Bulletin for the History of Chemistry* openly available at no charge. While access to the most recent three years of the *Bulletin* remains exclusively for HIST members and subscribers, access to earlier numbers is freely available at http://www.scs.illinois.edu/~mainzv/HIST/bulletin_open_access/bull-index.php

USEFUL WEBSITES AND ADDRESSES

American Chemical Society Division of the History of Chemistry

<http://www.scs.uiuc.edu/~mainzv/HIST/index.php>

The British Society for the History of Science

<http://www.bsbs.org.uk>

Chemical Heritage Foundation

<http://www.chemheritage.org/>

CHEM-HIST: History of Chemistry Electronic Discussion Group

http://www.uni-regensburg.de/Fakultaeten/phil_Fak_I/Philosophie/Wissenschaftsgeschichte/CH.htm

Chemist of the Month

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

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

Club d'Histoire de la Société Chimique de France

<http://www.societechimiquedefrance.fr/fr/club-histoire-de-la-chimie.html>

The Commission on the History of Modern Chemistry (CHMC)
<http://www-wissenschaftsgeschichte.uni-regensburg.de/CHMC.htm>

Digital library of the Conservatoire National des Arts et Métiers
<http://cnum.cnam.fr>

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

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

For details of how to join the Society, please see the on-line form (follow the links from the main page), or contact the Treasurer and Membership Secretary: John Perkins, 19 Nethercote Road, Tackley, Oxfordshire, OX5 3AW. (shacperkins@gmail.com).

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

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

The Working Party on History of Chemistry (WP)

Information on the activities of the WP can be found on its website:
<http://www.euchems.org/Divisions/History/index.asp>

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

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

Website based lecture course by Georges Bram, professor of chemistry and history of chemistry at the Faculty of Science, Paris Sud-Orsay
<http://histoirechimie.free.fr/>

Website of the Bibliothèque Nationale de France
<http://gallica.bnf.fr>

Website of the Historical Centre of the Ecole Polytechnique
<http://www.polytechnique.edu/home/about-ecole-polytechnique/history-and-heritage/the-major-periods/>

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

Russian Academy of Sciences. Website of the Institute for the History of Science and Technology

<http://www.ihst.ru>

An English version is available in test mode.

<http://www.ras.ru/en/index.aspx>

Selection of English-language papers relevant to the history of chemistry

<http://web.lemoyne.edu/~giunta/papers.html>

Website for the Nobel Prizes

<http://nobelprize.org/>

SHORT ESSAYS

The Copperas Works at Tankerton

Early on a drippy June morning, members of the Watford Bowls Club assembled for the coach to take them to Whitstable for the traditional annual meeting. On arrival at Whitstable, greetings were exchanged and old friends renewed. Hangers-on, like me, had other plans. Across the road from the Whitstable Bowling Club on the slope leading to the sea, are the Tea Gardens, opened in 1948. At the entrance is a plaque, erected by the Whitstable Improvement Trust in 1992, which describes *Processing Copperas*. In this area the first industrial scale chemical production began in England. Why here? There was a source of marcasite nodules (FeS_2) on the beach, extruded by erosion from the Eocene London Clay and which were found all along the north Kent and south Essex coasts. Coal, scrap iron and lead could be imported by sea and the product (copperas, green vitriol, ferrous sulfate) exported by sea to the London markets.

Making copperas

The marcasite nodules, gold stones or copperas stones, were collected from the beach by men, women and children. The nodules were placed in copperas beds, some very large, 116 feet long, 15 feet wide and six feet deep and sealed with clay. Here, open to the weather, a combination of water, air and bacterial action oxidised and dissolved the nodules to give a dilute solution of sulfuric acid and ferrous sulfate, the *liquor*, which was collected and stored. The process could take up to four years and needed regular raking. The next stage took place in a copperas house: the *liquor* was concentrated in a lead boiler with the addition of scrap iron and when judged to be done, run off into a separate lead vessel to cool and crystallise over 14 days. The crystals, the *copperas*, were removed, melted, and cast in a mould to give cakes which were packed into a barrel for export, and the mother liquor recycled. Daniel Colwall described the process used at Deptford in 1677 (1). For testing the *liquor* – “Within one minute after an egg is put in, the ambient liquor will boil and froth; and in 3 minutes the shell will be completely worn off. A drop of this liquor falling on the manufactures of hemp, flax, or cotton wool, will presently burn a hole through it; as also in woollen and leather.” He says that the steam which comes from the boiling is of an “acrimonious smell.” It was certainly a most dangerous and unpleasant business.

Copperas houses

Proceeding down the hill through the Tea Gardens leads you to the beach. Now the beach is covered with large shingle and dissected with groynes. The copperas was first manufactured at Tankerton in 1588, where a remarkable shingle bank, *the Street*, goes out to sea, and on what is now the beach. The site was first occupied by Cornelius Stephenson, originally from Liege, then under Spanish rule, and like all the early manufacturers, a rogue. Rising sea levels forced the abandonment of this site fifty years later and the copperas houses were moved up the slope. A survey in about 1760 lists six copperas houses with different owners. By 1790, all of these had been acquired by Charles Pearson who, as befitting a very wealthy business man, purchased Tankerton Farm at the top of the hill and added an octagonal Gothic style tower to provide splendid views of the estuary. But the copperas industry here was declining, being replaced by more efficient operations in the north of England, and by the late 1820s, it had vanished.

Uses of copperas

Major uses of copperas were as a mordant for dyeing, where it gives dark colours compared to the more usual alum, as a component of iron-gall ink, now much depreciated by paper conservators, as a reducing agent for indigo in the copperas-lime vat, and in later

years as a source of Nordhausen sulfuric acid. It has been suggested that the marcasite nodules could have been used as a source of sulfur which was used at the nearby gunpowder manufactory, dating from 1573, at Faversham, just 11 km away.

Whitstable Castle

Following Charles Pearson, a subsequent owner, Wynn Ellis, renamed the house Tankerton Tower and there were a succession of wealthy owners who made additions and alterations, while retaining the Gothic style. The final private owner, Albert Mallandain, sold the building to Whitstable Urban District Council in 1935 for £10,500 who promptly renamed it *Whitstable Castle*, opened the gardens to the public, and laid out a bowling green in the grounds in the following year. Since 1974 the Castle has been owned by Canterbury City Council and it is now managed by the Whitstable Castle Trust (2).

Recent history

The marine erosion which forced the closure of the early copperas houses is still evident today. Storms in February 1996 removed much shingle from the beach and exposed an extraordinary array of wood posts set in bright orange-red mortar. Before the damage was repaired (3), the site was investigated by the Canterbury Archaeological Trust and shown to be the remains of the early copperas houses. The subsequent report (4) was reviewed in *Chemistry World* by Bill Griffith (5).

What remains

The beach exposure has now been covered with shingle. The copperas houses have been replaced by the tea gardens and the bowling green. The North Lodge, which incorporated the last surviving building of the copperas works, was demolished in 1960 to make way for a car park. Some bricks, it is suggested, used to build the original tower of Whitstable Castle were obtained from an abandoned copperas works. Otherwise, only the documentary evidence remains. Returning to Watford was a cheerful, even merry, affair. Whether because of the result of the match or due to the refreshment provide by the Shephard Neame Brewery at Faversham, I do not recall.

References

1. Daniel Colwall, "An Account of the Way of Making English Green-Copperas," *Phil. Trans.* 1677, **12**, 1056-1059; doi:10.1098/rstl.1677.0071; *The English Green Copperas*, The Philosophical Transactions of the Royal Society of London from their commencement in 1665 to the year 1800, Vol II (1809), 461-463.
2. Tankerton Conservation Area Appraisal, Canterbury City Council, 2 March 2010, <http://www.canterbury.gov.uk/authority/assets/conservation/consareaappraisals/Tankerton%20CAA%202.3.pdf>
<http://www.whitstablecastle.co.uk/whitstable-castle-history.php>
3. Tankerton Bay Sea Defences - the contract
<http://www.canterbury.gov.uk/main.cfm?objectid=323>;
Tim Allen, *The Copperas Works at Tankerton*, Canterbury Archaeological Trust, Annual Report 1998-1999, 13-17.
<http://www.canterburytrust.co.uk/annreps/pdfs/1999/002.pdf>
4. Tim Allen, Mike Cotterill and Geoffrey Pike, *Copperas: an account of the Whitstable Works and the first industrial-scale chemical production in England*, UK: Canterbury Trust Occasional Paper No. 2, Canterbury Archaeological Trust, 2004, 64 pp.
5. <http://www.rsc.org/chemistryworld/restricted/2005/february/copperas.asp>

Further reading

Geoffrey Pike, *Copperas and the Castle*, Friends of Whitstable Museum & Gallery, 2000, 73 pp. An invaluable summary with 163 references.

Tim Allen, *The Forgotten Chemical Revolution*, British Archaeology, Issue 66, August 2002.

<http://www.britarch.ac.uk/ba/ba66/feat2.shtml>

Chris Cooksey

Mauveine - the final word? (3)

Interest in the iconic dyestuff mauveine remains high. Some recent developments since the last mention (1) here are reviewed and related to the publications of William Henry Perkin (1838–1907) in the 19th century.

Synthesis

That the synthesis is “laborious and tedious” (2) seems to be a recurring conclusion. Christoph Heichert and Horst Hartmann (3) declare “Although the procedure of Mauvein production was rather simple – a sulfuric acid solution of crude aniline is to treat with potassium bichromate – it has several malices making it difficult to handle and demands of the producer a great deal of skillness and engagement.” In 2011 John Plater (4) thought “At first we anticipated it would be easy to reproduce Perkin’s patented work” but only one experiment in ten succeeded.

Perkin’s 1856 patent (5) is vague about nearly every aspect. One of the many parameters of the synthesis is the temperature. The brief specification (6) suggests mixing hot solutions -

Equivalent proportions of sulphate of aniline and bichromate of potassa are to be dissolved in separate portions of hot water, and when dissolved, they are to be mixed and stirred, which causes a black precipitate to form. After this mixture has stood for a few hours it is to be thrown on a filter, and the precipitate to be well washed with water

But the full patent specification (7) favours mixing cold solutions -

I take a cold solution of sulphate of aniline, or a cold solution of sulphate of toluidine, or a cold solution of sulphate of xyloidine, or a cold solution of sulphate of cumidine, or a mixture of any one of such solutions with any others or other of them, and as much of a cold solution of a soluble bichromate as contains base enough to convert the sulphuric acid in any of the above-mentioned solutions into neutral sulphate. I then mix the solutions and allow them to stand for 10 or 12 hours, when the mixture will consist of a black powder and a solution of a neutral sulphate. I then throw this mixture upon a fine filter, and wash it with water till free from the neutral sulphate.

There seems to be no consensus about the optimum temperature and experimenters use 20–25 °C (8), 50 °C (9) or 75 °C (10). Likewise, the composition of the anilines used and the ratio of dichromate to anilines used show a similar wide variation.

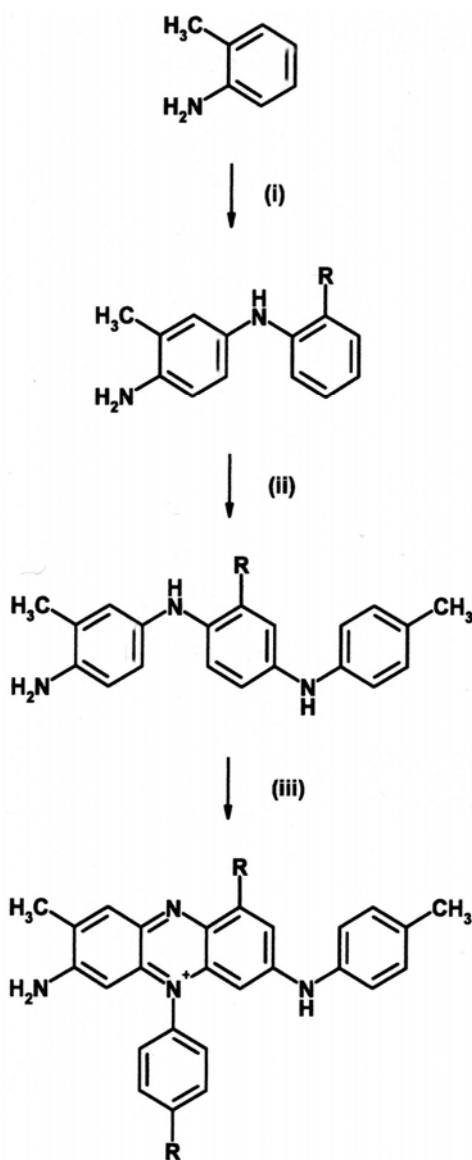
Reaction mechanism

Heichert and Hartmann (11) suggest that several different coupling reactions take place simultaneously starting with the primary product, the aniline radical cation, which reacts with a neutral aniline *via* C-C coupling to give a biphenyl derivative, C-N coupling to give ortho- and para-phenylaminoanilines or N-N coupling to give azobenzenes. That azo

compounds are a major product was first mentioned by Perkin (12). Further coupling leads to trimers, tetramers and polymers, with mauveines constituting only a minor (5%) part of the product. The sequence of events leading to the most abundant mauveines could be as follows:

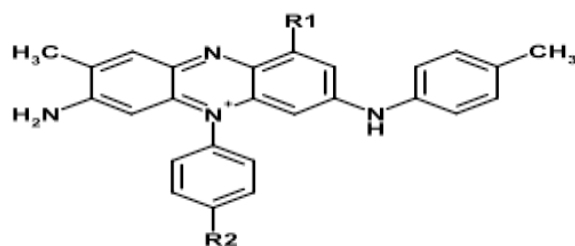
- (i) *o*-toluidine is coupled with the aniline or *o*-toluidine radical cation to give a dimer.
- (ii) The dimer is coupled with the *p*-toluidine radical cation to give a trimer.
- (iii) The trimer reacts with the aniline or *o*-toluidine radical cation to give the phenazinium cation.

This is illustrated below:



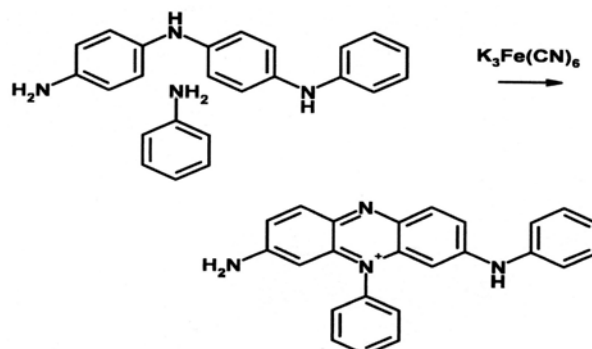
Synthesis of mauveines, R = H or CH₃

The coupling of the trimers with the aniline radical cation leads to mauveine and this was demonstrated by the synthesis of pseudomauveine, isolated as the tetrachlorozincate salt, in 40% yield from *N*-(4-aminophenyl)-*N*-phenyl-benzene-1,4-diamine and aniline using K₃Fe(CN)₆ to generate the radical cation.

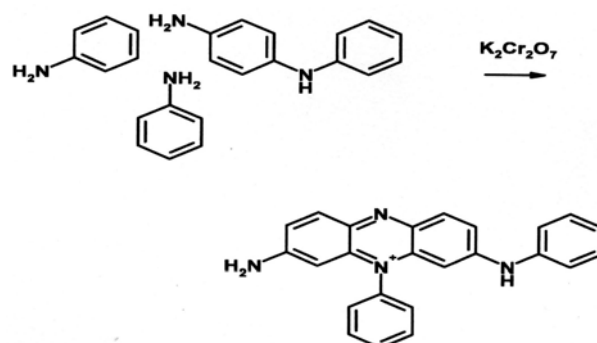


mauveine	R1	R2
e		
A	H	H
B	CH ₃	H
B2	H	CH ₃
C	CH ₃	CH ₃

Plater (13) achieved the same synthesis from a dimer, *N*-phenyl-*p*-phenylenediamine, using aniline and dichromate, in 5% yield. An improved work-up, suitable for small amounts of product, is described which involved loading a silica gel column with the product in methanol, washing out the brown impurities followed by elution with 20% aqNH₃/MeOH, which gave an unidentified blue product, followed by the purple pseudomauveine.



Synthesis of pseudomauveine (Heichert and Hartmann, 2009)



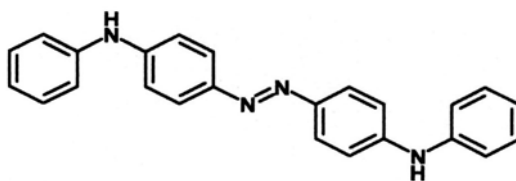
Synthesis of pseudomauveine (Plater, 2011)

Analysis

Following the preliminary report mentioned last time (14), the Anglo-Portuguese consortium has published the full details of their investigations (15). Samples of seven historic mauveine salts and seven dyed textiles were analysed by HPLC and shown to

contain at least thirteen different components. Separation by preparative HPLC was followed by extensive characterisation by NMR (^1H , ^{13}C , HMBC and NOESY), MS and UV/Vis which provided an exact identification of the structures of seven of them. A further seven mauveines could only be characterised by HPLC-MS.

All the mauveine salts contained very little pseudomauveine, 1% or less, except one. This was a sample from the (Henry) Edward Schunck (1820–1903) collection of chemicals at the Museum of Science and Industry in Manchester which was labelled “mauveine $\text{C}_{27}\text{H}_{24}\text{N}_4$ ”: it contained 49% pseudomauveine (C24), 41% monomethylated pseudomauveines (C25) and smaller amounts of the C26 and C27 derivatives. In addition, the anions found were acetate (68%), chloride (13%) and sulfate (17%). But Schunck was a natural dye chemist and published nothing about synthetic dyes, so it seems likely that this sample was a gift and most likely from Perkin. In 1879 Perkin (16) published a recipe for isolating pseudomauveine from commercial mauveine which involved precipitating the less soluble mauveine sulfates, adding ether to the filtrate to precipitate pseudomauveine sulfate, then repeatedly dissolving the product in concentrated sulfuric acid followed by adding water. Boiling the product with potassium hydroxide solution gave a free base which analysed as $\text{C}_{24}\text{H}_{20}\text{N}_4$ from which salts, the hydrochloride and hexachloroplatinate, could be made. Schunck’s sample appears to be from a partially successful separation, followed by an incomplete conversion to the acetate. Perkin suggested structural formulae for pseudomauveine and related compounds, but warned “I bring these forward merely as suggestions; experiment alone can settle the true constitution of these bodies.”



Proposed structure of pseudomauveine (Perkin, 1879)

Experiment, well, at least physical methods, have achieved the goal of structure elucidation.

The colour

Mauveine is an iconic colour, instantly recognised by most chemists certainly. So it is rather odd that little attention has been paid to the molecular chromophore responsible for this colour. What can be said is that there is general agreement that the visible absorption spectrum comprises an intense single band centered at about 549nm, relatively unperturbed by the methyl groups present in the sample (by no more than about 10nm). In recent times, great advances have been made in predicting colour from quantum mechanical first principles (driven largely it has to be said by the need to assign chiroptical spectra in terms of absolute configuration (17).

One such method is known as time-dependent density functional theory (TD-DFT) and it would be expected to predict λ_{max} to an accuracy of around 20nm or less. Whilst this may not sound especially accurate, this value is not based on any pre-parametrisation. Quantum mechanical effects such as electron correlation, solvation and other erstwhile difficult aspects of these calculations are included in the theory, one now accessible in general purpose computer codes such as Gaussian 09 (18). Armed with such a tool, the visible spectrum of mauveine A was calculated for the four tautomers shown below. The model comprised the chloride salt of the cation (Figure 1 (below), an ion-pair), with an additional two solvent molecules bridging the ion-pair in an attempt to get the most realistic model in

which the rotational conformations of the aryl substituents can be determined in part by this solvation.

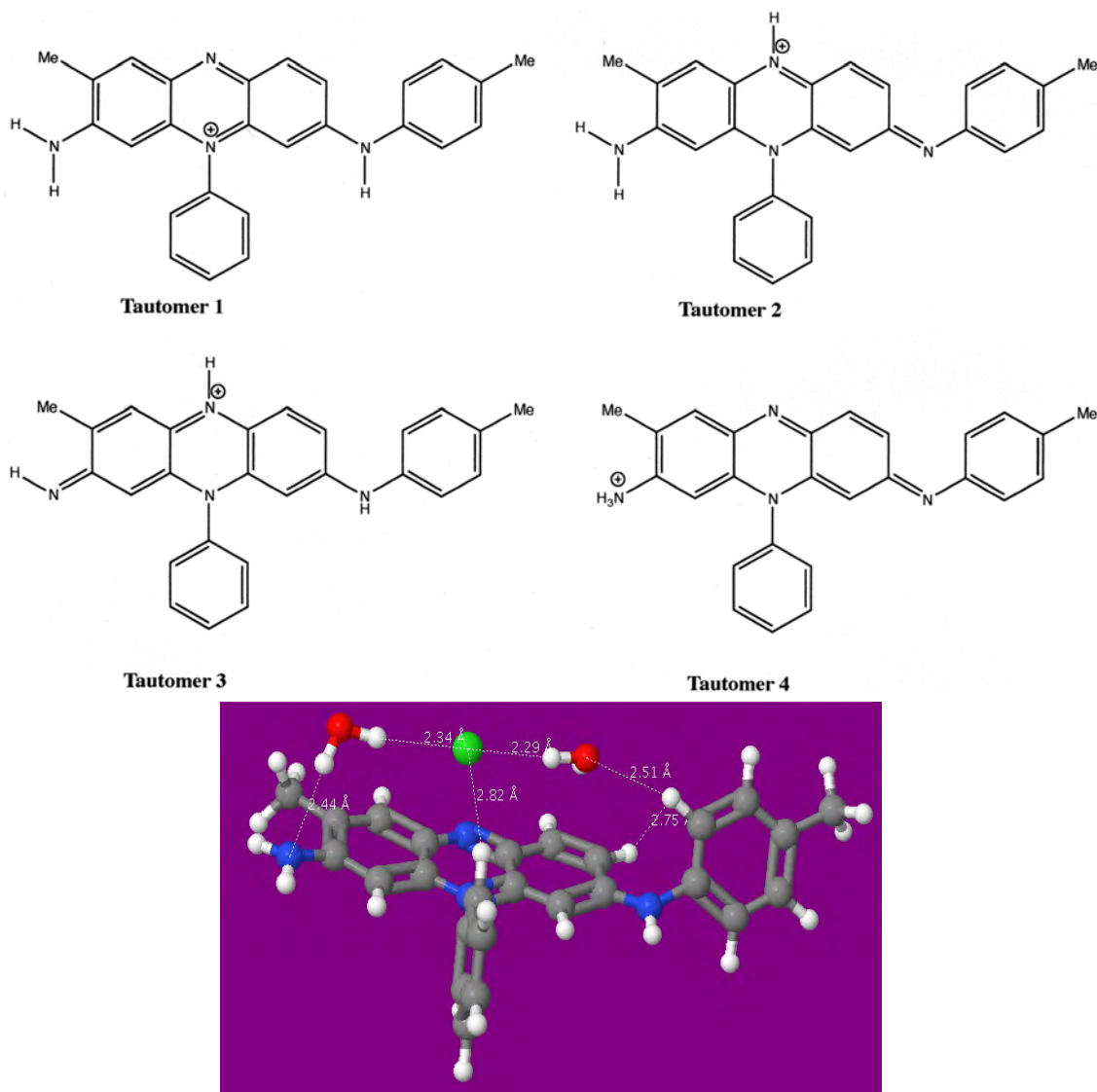
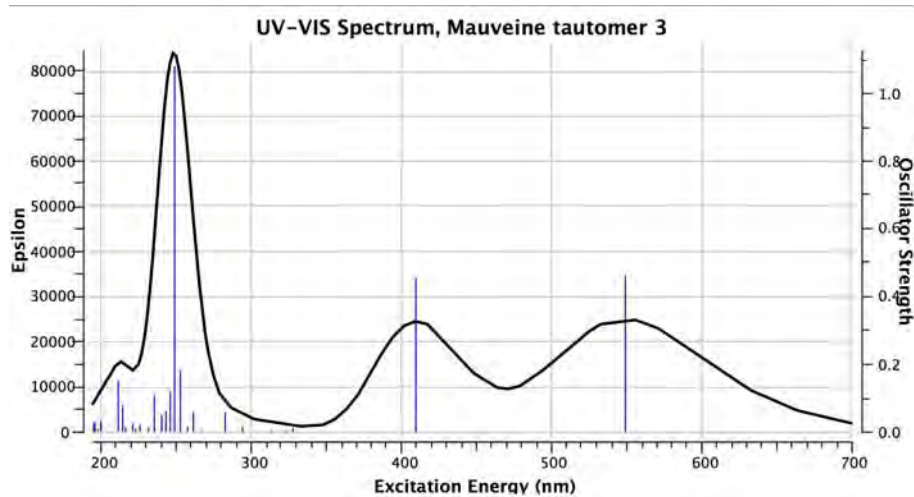
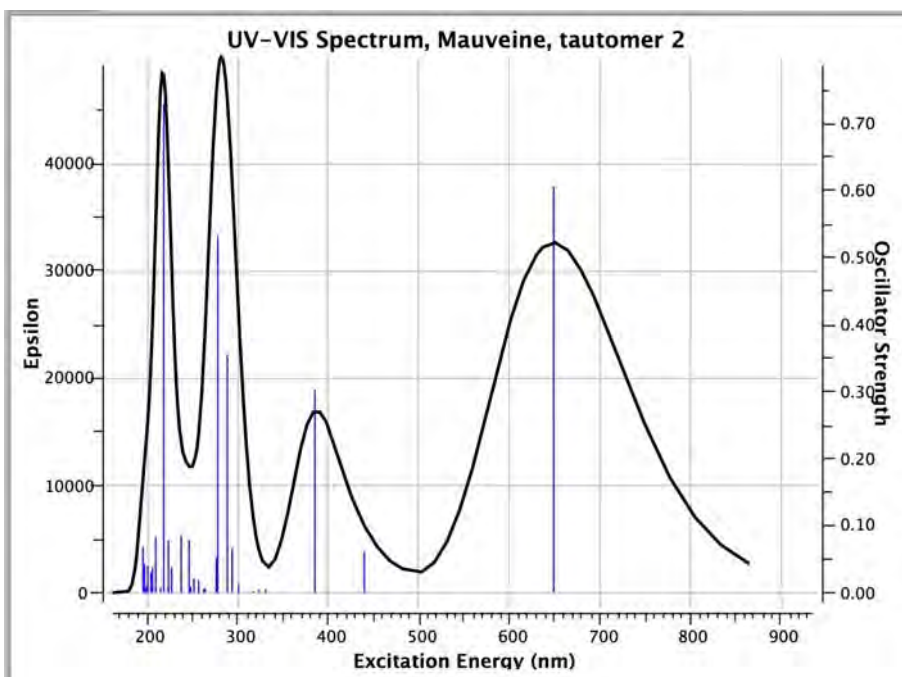
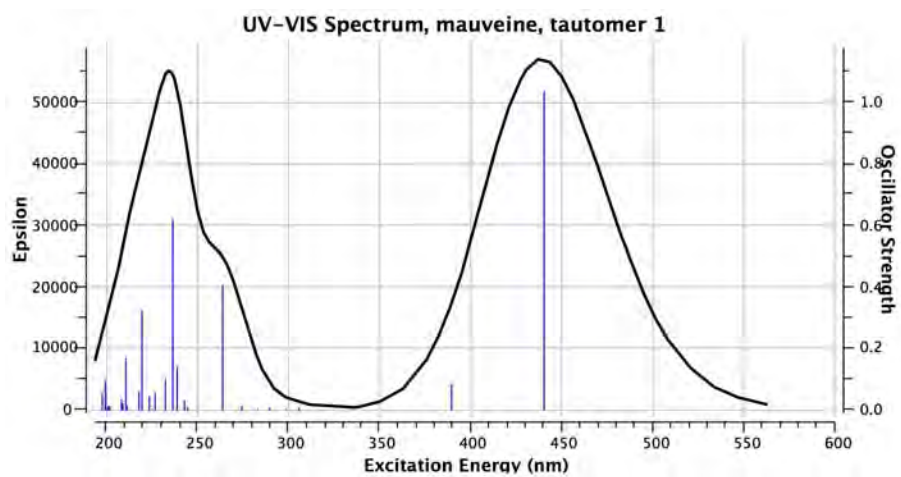


Fig 1

The calculation details are summarised as:

ω b97xd/6-311g(d,p)/scrf(cpcm,solvent=methanol) (19), which decoded means that a long-range correlated ω b97xd density functional was used (20) as shown to be appropriate for prediction of visible spectra (21), employing a large basis set and including both a continuum solvation correction for methanol as solvent and discrete solvent molecules (methanol modelled by water). This model was used to obtain a fully relaxed molecular geometry, and then TD-DFT theory applied at the larger 6-311++g(d,p) basis set level.

The calculated electronic spectra are shown in Figure 2. The predicted λ_{\max} is ~ 440 nm for tautomer 1, subject to a maximum error of about 20nm (up to ~ 460 nm). This corresponds to the colour orange, and not mauve! The extinction coefficient is calculated to be particularly large. An error of ~ 100 nm in λ_{\max} is considered well outside the normal errors to be expected for this theoretical quantum mechanical procedure and must cast a suspicion that the hitherto accepted structure may still need modification. A more extensive discussion of alternative models, including the role of the counter-ion, is to be



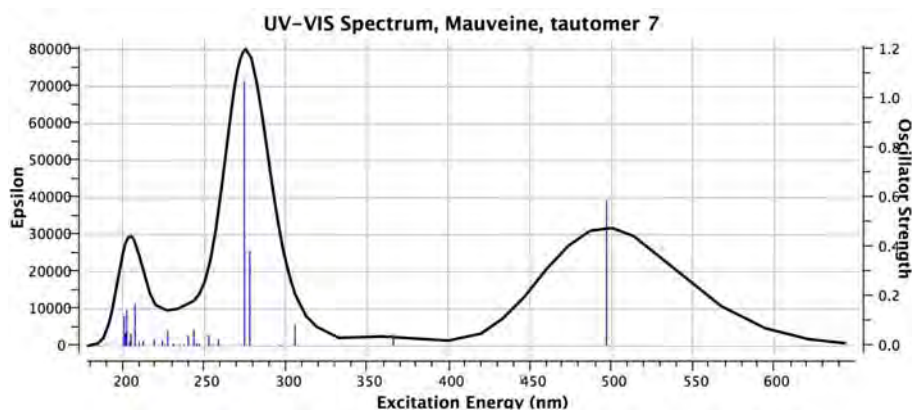


Figure 2: TD-DFT calculated spectra

(as $\omega b97xd/6-311++g(d,p)/scrf(cpcm,solvent=$ methanol) for four tautomers of mauveine.

found at this blog (22). Not previously considered in the literature is what the colours of other tautomers might be. Tautomer 2 (which has a rather different resonance structure with a more quinoidal form) shows a dramatically different λ_{\max} at $\sim 670\text{nm}$, which would give the compound a clear blue colour, although the extinction coefficient is rather lower. but tautomer 4 in particular may benefit from additional hydrogen-bonded solvation. Tautomer 3 is intermediate, with $\lambda_{\max} \sim 550\text{nm}$, and a second peak at 410nm , which indeed gives a mauve colour. Tautomer 4 is the most promising, with a single band of $\lambda_{\max} \sim 500\text{nm}$. The energies of tautomers 2-4 relative to tautomer 1 are respectively 23.4, 24.2 and 23.8 kcal/mol higher in energy, but tautomer 4 in particular may benefit from additional hydrogen-bonded solvation.

So it is indeed somewhat ironic that a modern theoretical explanation of the colour of such an iconic substance is causing such problems! In this regard it is worth noting that Perkin himself reports getting the substance in crystalline form, and yet despite this, no X-ray crystal structure has ever been reported, even for the phenazinium base (23). One might hope that a single-crystal x-ray structure will in the future at least establish the tautomeric identity of this system, and perhaps by this means cast more light on why it has the colour mauve.

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Chris Cooksey and H. S. Rzepa

HISTORICAL REMINISCENCES

This is a new section of the newsletter which begins with a contribution from David Leaback in which he discusses chemistry and industry in Tower Hamlets, his family's links to the area and the plaque commemorating William Henry Perkin. The editor would welcome chemical reminiscences from members on suitable subjects such as former colleagues or laboratories they have worked in for this section.

Capturing Some Social Changes Linked to Chemistry & Industry in Tower Hamlets

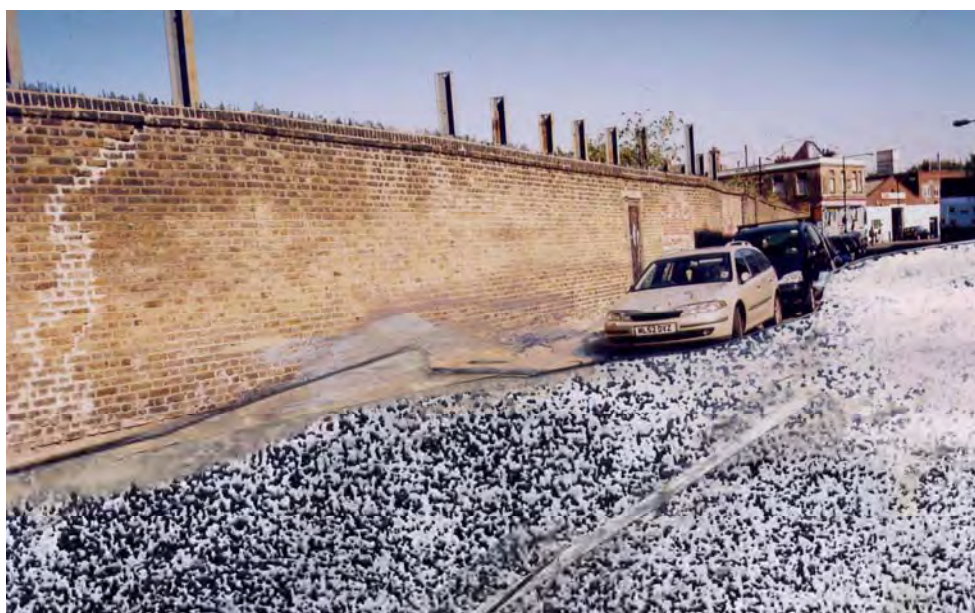


Figure 1: A current view of the remains of The Hope Chemical Works, E9

My entry to this begins with the recent photograph in Figure 1, a significant but forgotten remnant of an influential enterprise appropriately called the ‘Hope Chemical Works,’ set up in the 1850s by an ex-surgeon named Carless, in the top north-eastern corner of Tower Hamlets. It had been driven out of the Bow Common part of the London Metropolis because it practised a ‘noxious chemical trade’ contrary to new local Medical Health regulations (1). Carless had abandoned his former chemical experiments to make artificial leather, when he discovered the growing demand for the lighter coal tar components, and so he started fractionating coal tar naphthas using pot stills at that site in Figure 1. This was then an isolated dry spot on a soggy White Post Lane that snaked its way eastwards across Old Ford Marsh towards Stratford. As time went by, Carless found his chemical workplace increasingly surrounded by many complementary new enterprises needing his products, such as the Atlas Synthetic Dyeworks, manufacturers of waterproof cloths, synthetic plastics etc., as well as useful other trades for building and running what amounted to London’s first chemical science park (4). Thus his enterprise grew with mergers and acquisitions and a gradual transition to the use of petroleum feedstocks for the production for refined fuels. Long after Carless and others had to move out of the Bow Common area on medical health grounds the mammoth gasworks on Bow Common Lane

that he used (2) was still allowed to pollute the area, as my brother and I found when visiting our grandparents in the late 1930s. Indeed our grandparents' small house on the corner of Robeson Street was almost in the shadow of the clanking, hissing structures which continuously belched sulfurous, dirty fumes. In this neighbourhood, our grandmother had raised ten children in a house and atmosphere where there was scarcely space to hang out clean washing to dry (2).

Recently my wife and I visited that Bow Common Lane location and found that at last those gasworks had disappeared and the air was good to breathe. It seems that health regulations had not been sufficient to make life better there and it needed Hitler's bombs and the shift to petroleum which Carless pioneered to complete the clean-up. We took another photograph (Figure 2) from exactly the same spot as that illustrated earlier (2) showing the railway arch where my brother and I played ball all those distant Sundays ago. That arch survives in Figure 2, but where my grandparents' house once stood, it is now a leafy green open space. There my wife and I sat near the maturing sycamore which marks a place with so many memories of childhood: family gatherings where Uncle Fred entertained us all at Christmas (2); my Aunt Jean stood all dressed to go dancing 'Up West' but most momentous of all, was where I heard my Scottish mother exchange a few words in what turned out to be schoolgirl German with my grandfather (2).



Figure 2: A current view of Robeson Street corner, Bow Common Lane, E3

While the War ended such family events, I sometimes accompanied my father on his visits to Uncle Fred's subsiding house at 174 Bow Common Lane. There, the attractions hinged partly on whether he had had to saw more off the legs of his bed so he could sleep level, or whether he was serious when he asserted that his fearsome catfish could be made to smile. However he always urged me to keep on with my studies on chemistry at school because he had missed the opportunity to qualify in chemistry in his youth. He had to work to help out with family finances and then was conscripted into the army, along with my father, Gus. After both of them were wounded abroad in the First World War, they ended up in an East End where work was hard to find, especially for ex-soldiers in their twenties with no

advanced skills.* Fortunately, Fred got a messenger job in the Pharmacy at the Mile End Hospital (see Fig. 3) and later helped my father secure a porter's job there where he met a young Scottish nurse without whom my brother and I would not have happened!



Figure 3: A current view of Bancroft Road Buildings, E1, showing from the left, the former Marriage Registry Office; the entrance to Mile End Hospital, and the Public Archives and Local Studies Library, standing in front of Queen Mary and Westfield College.

This account of chemistry in Tower Hamlets would not have happened until I eventually found out from my mother that the exchange in German with grandfather arose from his father having come from Hanover to St. George's East in about 1850, to live and work in the sugar refineries (2, 6). I asked Uncle Fred and my father about that, but they knew very little. Having learned to do laboratory research, I squeezed odd moments to investigate and found a death certificate of that grandfather, and showed it to my father, who was very excited and soon took it to show Uncle Fred. He was so delighted that I suggested that the two of them did more research on our forebears' lives, but I found them reluctant to do so. This puzzled me because that single certificate had excited Uncle Fred and my father just like children. Recalling that I had witnessed similar resistance in elderly people unwilling to venture into unfamiliar skills for fear perhaps of looking stupid, I named this new, unrecognised phenomenon 'The Fred and Gus Syndrome.' I continued feeding them with the delights of discovering where their grandparents lived in Shadwell/St George's East.

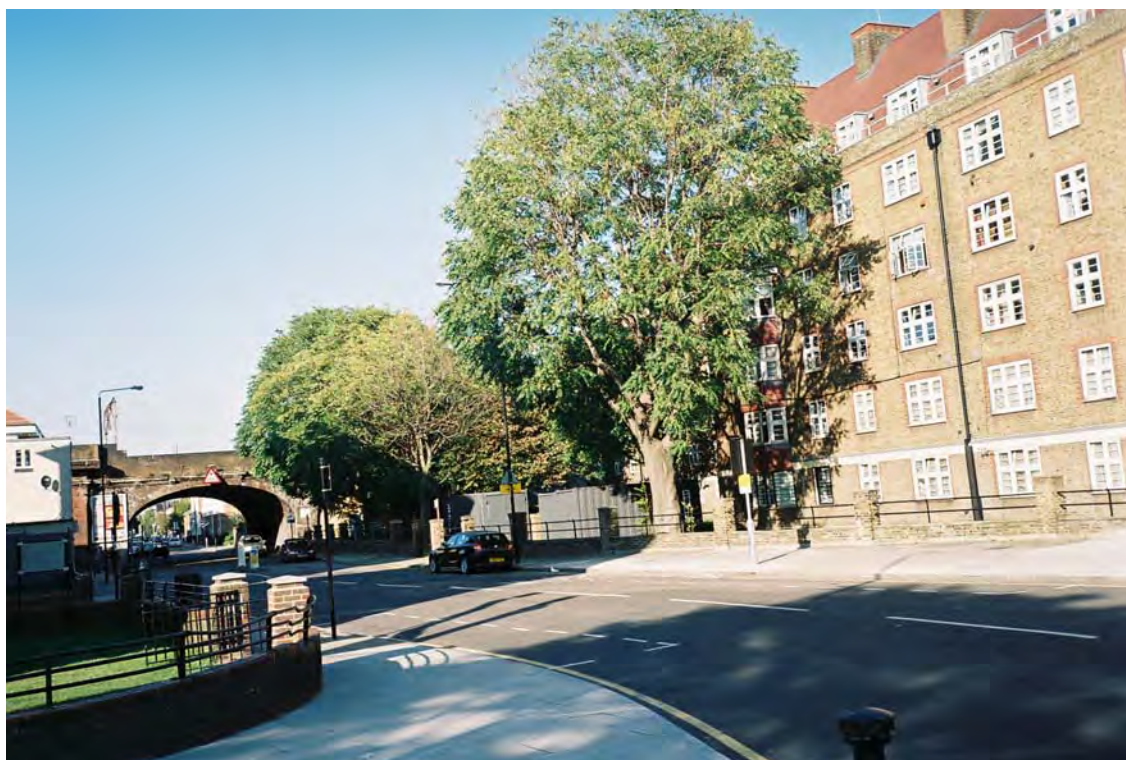


Figure 4: A current view of the Council block of flats in Sutton St, E1 and the Perkin memorial plaque I initiated there in 1991 (See ref. 3).

One day in the library, something totally unexpected happened! I read that the very part of St. George's East to the left of the scene in figure 4 where my forebears had come to live was directly opposite a block of Council flats on the site where the famous chemist Sir William Perkin had lived. Here as a youth, had he discovered how to make the world's first synthetic dyestuff. From that discovery and mine, I went on to find out not only new aspects of that romantic Perkin science story (refs. 1 to 7), but also how to use the story as a tool to show ways to promote science among underprivileged communities in Tower Hamlets and elsewhere (6, 7). I found that this approach worked well generally, but there were exceptions. For instance, I have yet to find any resident in that block of flats to the right of Figure 4, who knows anything about the story of that Perkin plaque attached to its southern Cable Street wall. Also when I mentioned that matter to the Tower Hamlets' mayor who had once kindly come to the unveiling of the very same plaque (3), he or his successor could recall nothing thereof. I suspected symptoms of the above 'Fred & Gus Syndrome' at the Town Hall!

David Leaback

* A depressingly parallel situation for the million or so youngsters currently without jobs or any prospect of 'Gladwell type' skills like Chemistry (7), or others opting out of expensive but appropriate further education, skills and qualifications.

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Acknowledgements: I thank particularly my wife Judith and my sons for their help in this work.

BOOK REVIEWS

William H. Brock, *The Case of the Poisonous Socks: tales from chemistry* (RSC Publishing: Cambridge, 2011); £19.99. ISBN 978-1-84973-324-3, pp. 348.

Well, part way through this book I put it down and burst out laughing – a first for me, at least with respect to books on the history of chemistry. Bill Brock’s delightful book is in sharp contrast to those authors who combine scholarship and rigour with a deathly prose style and whose efforts, I have to say, are marvellous antidotes to insomnia. (Make a sufficiently large donation to the Historical Group, and I’ll name names).

Professor Brock will be known to all readers of this Newsletter. Indeed some five of the 42 essays that make up this book were originally published here. The others have appeared over the past 40 years in *Education in Chemistry*, *Chemistry in Britain*, *Ambix* and a few other places and average about eight pages each. Typical of Bill’s writing is the first one that gives the title of the book and which was first published in these pages in 2006. In the late 1860s it became fashionable to sport brightly coloured socks, however some of the wearers began to suffer from itchy rashes on their feet, that were sometimes localised in patterns that matched the patterning of the socks. The greatest chemists of the time applied themselves to identify the dyes responsible for the outbreak. Notable amongst these was William Crookes, who connected it to the use of the recently discovered azo dyes and to wearers who had the unusual propensity to exude alkaline foot-sweat.

From Bill’s writing we get insights into many eighteenth and nineteenth century chemists – there is a pleasing biographical aspect to the book and we get glimpses of Liebig, Hofmann, Kekulé, Ida Freund, Avogadro and Henry Crookes. Twentieth century chemists are not neglected and we encounter Sir Stafford Cripps (later to find fame as a politician) and C. P. Snow (later to find fame as a novelist).

I have been critical in these pages, and elsewhere, of the RSC’s pricing policy for “historical” books. It is refreshing to record that this really excellent volume has been priced at less than £20. “Well done” to Bill for the substance of this book and to the RSC for pricing it so it is in reach of the private individual. Buy it, and you will not be disappointed. And the page that caused me so much mirth? – Have a look at the final paragraph of page 39. With our editor’s permission I’ll reveal all in the next edition of our Newsletter.

Alan Dronsfield
University of Derby

Michael Faraday, *The Chemical History of a Candle* (with an introduction by Frank James), (Oxford University Press, Oxford 2011); £14.99. ISBN 978-0-19-969491-4, pp. 152.

It is just over 150 years since Michael Faraday’s famous text was published – it appeared in March 1861, his lectures being edited up into book form by William Crookes. The work has been in continuous publication since then with 2011 seeing the production of a Portuguese translation and a Japanese one the previous year. This sesquicentenary edition is published by the Oxford University Press and has a scholarly and readable introduction

provided by Frank James, Historical Group committee member and, appropriately enough, Professor of the History of Science at the Royal Institution. It was here, in the famous lecture theatre, on 25 December 1860, that Faraday gave the first of a series of six lectures that form the text of *A Chemical History of a Candle*. Interestingly, he attracted an audience of 720 young(ish) people and even exceeded this number in the penultimate one. His charge for giving the lectures was 50 guineas (=£52.50). Frank happily provides us with a means of converting this sum into today's figures. It would provide for 1050 visits to Mme Tussauds or the services of a good cook for a year. I do not know the going rate for a good cook, but a single adult entrance to the waxworks now costs an unbelievable £31.30. Thus 1050 visits amount to almost £33,000...

Most Newsletter readers will be familiar with the famous Faraday text, but for those who are not, it starts out with a detailed look at the candle and its flame, and then branches out to encompass topics such as capillarity (the ascent of molten wax up the wick), oxygen, hydrogen and CO₂, with sidelong glances at potassium metal, electrolysis, the mass of air, the Madeburg hemispheres experiment and much more. Potassium metal and its reaction with water clearly appealed to Faraday. He definitely had an eye for the more spectacular experiments!

Naturally he uses the chemical names common in the mid-nineteenth century, but Newsletter readers will have no problems (typically) in equating carbon dioxide for carbonic acid and KClO₃ for chlorate of potassa.

This present edition concludes with 46 facsimile handwritten pages in Faraday's handwriting which serve as notes for his lecture course. They act as his "memory joggers" and also as a guide for his long-time R.I. assistant, Charles Anderson, as to the sequence of experiments that are integral to the lectures. The notes are here reproduced for the first time, albeit rather faintly. But they are readable, nevertheless.

Faraday's *Chemical History of a Candle* well deserves its sesquicentennial publication, placed into context by Frank James. It's a well-bound, hard cover book with a retail price of £14.99. I view this as a bargain, and even more so at its present "Amazon" price (at the time of writing £7.49 including postage). Astonishing value, and strongly recommended.

Alan Dronsfield

Ed. Carmen J. Giunta, *Atoms in Chemistry: From Dalton's Predecessors to Complex Atoms and Beyond*, (ACS Symposium Series 1044), (ACS: Washington, 2010). £95. ISBN 978-0-8412-2557-2. Pp.116.

This collection of seven papers derives from a symposium on "200 Years of Atoms in Chemistry: From Dalton's Atoms to Nanotechnology" held at a 2008 ACS meeting to celebrate the 200th anniversary of Dalton's *A New System of Chemical Philosophy*. The editor Carmen Giunta introduces the volume, and in the first of seven subsequent chapters William Jensen presents *Four Centuries of Atomic Theory – an Overview* which considers ancient atomism, seventeenth and eighteenth century views. As is often the case in books like this with contributed papers there is some overlap and this occurs here particularly between Jensen's article and Leopold May's *Atomism before Dalton*. David Lewis, in the longest piece, writes an excellent article on *150 Years of Organic Structures* covering, amongst others, Kekulé, Couper and Butlerov. Bill Brock's *The Atomic Debates Revisited* considers Brodie's *Calculus of Chemical Operations* and is a typically concise but thorough essay well described by its title. In *Atoms are Divisible – the Pieces have Pieces* Carmen Giunta writes mainly on the particular contribution of radioactivity concentrating on Rutherford's work on atomic particles. Gary Patterson's *Eyes to See: Physical Evidence for Atoms* disappointed me because although he reviews well the contributions to this topic

provided by thermodynamics, kinetic theory, spectroscopy, scattering, X-rays and radioactivity he does not bring his history up to date – we now really can ‘see’ atoms. In a short but endearing final chapter, Jim and Jenny Marshall in *Rediscovering Atoms: an Atomic Travelogue* show some photographs of their many and fascinating journeys across the world at sites linked to the discovery of elements and hence of importance to the history of atoms.

This is a nicely produced, informative little book in which a number of themes loosely linked by atomism jostle for space; it is however absurdly priced at £95.

Bill Griffith
Imperial College, London

RSC NATIONAL HISTORICAL CHEMICAL LANDMARKS

Chemical Landmark plaque to mark the centenary of Rutherford’s nuclear atom

The presentation took place in the Conference Centre, University Place, Manchester University on Monday 8 August 2011 as the opening part of the Rutherford Centennial Conference organised by the Institute of Physics to celebrate the centenary of the publication of Rutherford’s paper describing the discovery of the atomic nucleus. The conference marked one hundred years of the atomic nucleus by addressing the wide range of current topics characterizing modern nuclear physics, including nuclear structure and astrophysics, hadron structure and spectroscopy, weak interactions and relativistic heavy-ion collisions. The historical aspects of his discovery were dealt with as part of the RSC’s Landmark event.

The conference itself was opened by Mr Derek Leask, High Commissioner for New Zealand, an appropriate choice given that Ernest Rutherford was a New Zealander by birth and lived there until he took up his postgraduate studentship in the Cavendish Laboratory, Cambridge, in 1895.

Jeff Hughes of Manchester University gave an address outlining Rutherford’s life and scientific achievements. This was an amplification of the talk which he gave to our Group in March 2011 as part of our Mme Curie conference. Rutherford was appointed Macdonald Professor of Physics at McGill University, Montreal, Canada in 1898 where he quickly became an authority on the new science of radioactivity. In 1907 he moved to Manchester University and in 1908 he was awarded the Nobel Prize in Chemistry for his McGill work on radioactive decay. As he regarded himself primarily as a physicist, he remarked that this was the greatest transformation in his career! At Manchester, Rutherford and co-worker Hans Geiger, together with their student Ernest Marsden, used α -particles to bombard gold foil. They observed an unexpected back-scattering of the particles and this led Rutherford to propose his theory of the nuclear atom. The results upon which his theory was based were, in fact, published in 1909 but it was at a meeting of the Manchester Literary and Philosophical Society on 7 March 1911 that his conclusions as to the nature of the atom with its nuclear “core” were given a public airing. The hypothesis was given a mathematical interpretation by Niels Bohr in 1913 into its now familiar form.

The second speaker was John Schiffer, emeritus professor at the University of Chicago who spoke on the development of nuclear physics post-Rutherford. This proved an ambitious aim for what was a lecture of less than an hour’s duration, but John managed valiantly and not only drew attention to the other landmarks that map out this field but also

found time to speculate which of the current researches might be identified as the most promising ones.



The Landmark Plaque was presented to Professor Rod Coombs, Deputy Vice-Chancellor of Manchester University by RSC President Prof. David Phillips. The text on the plaque reads:

Ernest Rutherford
on the occasion of the 100th anniversary
of the discovery of the atomic nucleus
by Ernest Rutherford,
a Nobel Laureate in Chemistry
and pioneer in nuclear physics, at
the University of Manchester

Professor Sean Freeman, of the Nuclear Physics Research Group School at the University of Manchester said: “It is a real pleasure for the Royal Society of Chemistry to be involved in the celebrations of the centenary of Rutherford's discovery of the atomic nucleus. His genius uncovered the structure of the atom and effectively initiated the whole area of nuclear physics. It is particularly nice for the RSC to join us in the opening ceremony of the conference as Rutherford won the Nobel Prize for Chemistry *'for his investigations into the disintegration of the elements and the chemistry of radioactive substances.'* The University is particularly proud to receive a Chemical Landmark plaque to mark this anniversary.”

Alan Dronsfield

Chemical Landmark Plaque for Halothane, Catalyst Science Discovery Centre and Museum, Widnes

Halothane was nominated for a plaque by the RSC Liverpool Local Section, and the Historical Group was represented at the presentation on 22 October 2011 by Bill Griffith and John Hudson. The plaque commemorates the 1951 synthesis and subsequent commercial development and use of halothane, the first inhalation anaesthetic designed by chemists. The ICI General Chemicals Widnes Research Laboratory, where the synthesis was achieved, has since been demolished, so the plaque was placed on the nearby Catalyst Centre, which occupies the site of the former ICI Tower laboratory. Catalyst now has a permanent display relating to halothane, and is also the repository of the ICI General Chemical Archive which contains the original documentation relating to halothane.

The proceedings commenced with a welcome from Dr Jenny Clucas, a Trustee of Catalyst. She outlined the role of Catalyst, which is the only science discovery centre in the country devoted to chemistry, as well as being a museum of the chemical industry. There then followed a presentation by Professor Colin Suckling, son of Dr Charles Suckling who led the team which synthesised and developed halothane. Several other members of the family were present, but Professor Suckling reported that sadly his father was too infirm to be at the event, but was extremely proud that he and his team were being honoured in this way.

Professor Suckling briefly outlined the history of anaesthetics. He referred to the fact that the first attempt to establish the scientific basis of anaesthesia had been made by Dr John Snow in the nineteenth century, and that in 2008 the RSC had erected a Landmark Plaque to Snow to commemorate his demonstration of the mode of transmission of cholera. The halothane story commenced when Dr John Ferguson, ICI Head of Research, suggested to Charles Suckling that he investigate a range of fluorinated hydrocarbons as possible anaesthetic agents. The most widely used compounds at the time were chloroform, diethyl ether, nitrous oxide, and cyclopropane. The ICI research resulted in the compound 2-bromo-2-chloro-1,1,1-trifluoroethane, which was found to be far superior to the anaesthetics then in use. It was safer, non-inflammable, and had a relatively low toxicity. Known as halothane, and trademarked as Fluothane, it was used worldwide in millions of operations between 1956 and the 1990s. It still finds some application in the third world, although it has largely been superseded by halogenated ethers such as enflurane and isoflurane. Professor Paul O'Brien, Vice-President of the RSC and Professor of Inorganic Materials at Manchester University, then spoke about the Landmark Plaque scheme. He pointed out that the scheme helps to bring to the attention of the general public the role that chemistry has played, and continues to play, in advancing human wellbeing. The RSC normally erects three or four plaques per year, but a larger number will be unveiled in 2011, the International Year of Chemistry. Halothane was a perfect subject for a plaque, and Catalyst was the ideal location for it. He then presented the plaque to Jenny Clucas. The wording on the plaque reads:

ICI General Chemicals
Widnes Research Laboratory
In recognition of the outstanding
scientific contribution made by
Charles Suckling and others, close to
this site in 1951, in the synthesis
and subsequent commercial
development of halothane,
the world's first synthetic
inhalation anaesthetic.



Professor Colin Suckling (left) and Professor Paul O'Brien presenting the plaque to Dr Jenny Clucas

We then made our way to the outside of the building, to find that in the space of a few seconds the plaque, now covered by a curtain, had been fixed to the wall. Professor Suckling then unveiled the plaque. Among the many guests present was Professor Martyn Poliakoff, who earlier in the day had given a series of chemical demonstrations to children belonging to the very popular Catalyst Saturday Science Club and their parents. Thanks are due to Meryl Jameson (Catalyst) and Pauline Meakins (RSC) for organising a very successful and enjoyable event.

John Hudson

The Catalyst Science Discovery Centre

The Catalyst Science Discovery Centre (or 'Catalyst' as it is simply called on the building) is on Mersey Road, Widnes, Cheshire (WA8 0DF; e-mail info@catalyst.org.uk, website www.catalyst.org.uk, tel. 0151 420 1121. It is open from 10.00-17.00 on Tuesdays to Fridays and from 10.00-17.00 on Saturdays and Sundays; closed on Mondays (except during local school holidays). There is an admission charge of £4.95 for adults and £3.95 for children.

I visited it on Saturday 22 October as part of the unveiling of the RSC plaque to the centre (see previous report by John Hudson). Remarkably it is the only science and discovery centre in the country devoted to chemistry. It was opened on its current site in 1986 and is run by a charitable Trust. The building was originally built as offices for John Hutchinson's alkali works (probably in 1862). After the absorption of Hutchinson's by the United Alkali Company, in 1891 the building was leased in 1893 (and then subsequently sold in 1898) to Barnett Dutton, Auctioneers of Widnes, later becoming part of the Gossage soap works, founded by William Gossage (1799-1877) in 1908. Finally, with the rest of the Gossage estate, it was acquired by Imperial Chemical Industries Ltd, on 5 October 1948, and adapted for use as laboratories. After it closed in 1961 the Gossage Building was used by several companies including Hughes and Treleaven, who were the last owner before Catalyst was established.

There are five floors in the centre. The ground floor contains a reasonably priced, comfortable café, and a large exhibition area of mainly interactive exhibits on a wide range

of topics and materials, e.g. soaps, dyestuffs, autocatalysts, photovoltaic cells, batteries etc. There is a Periodic Table near the entrance where there is still space to sponsor your own element. On the first floor there are two lecture theatres and a working laboratory where no less than 900 presentations of chemical experiments were conducted last year. Various chemical processes are covered here too in the well-lit and well-arranged galleries, e.g. on the Leblanc, Solvay, Castner-Kellner and other processes; materials such as penicillin, DDT, polythene, halothane (discovered in 1951 in the nearby ICI Widnes laboratory) etc. are shown. On the second floor there are exhibits on plastics. Don't miss the top floor called the Observatory: this glass-covered structure gives magnificent, panoramic 360 degree views of the surrounding Merseyside area, most of which had housed some of the world's largest chemical industry (ICI and other firms); some are still there of course, much has gone.

A visit to Catalyst is highly recommended: it is possible that, sometime in the future, we will hold a meeting of the group in this exciting space.

Bill Griffith

MEETING AND CONFERENCE REPORTS

8th International Conference on History of Chemistry

The 8th international conference on history of chemistry organized by the History of Chemistry Working Party of the European Association for Chemical & Molecular Sciences was held at Rostock, 14-16 September 2011. The aim (like previous meetings held at Lisbon, Leuven and Sopron) was to bring together historians and historically-minded chemists. The new campus of the University of Rostock, where the conference was held in the Chemical Institute, is south of the railway station and the old city centre. One of the two lecture theatres was steeply raked like an old anatomy theatre, but unlike those observation laboratories, high-backed seats and huge folding writing tables meant that it was not possible to see the speaker from the seats. We all wondered how staff and students coped with such a venue.

The theme chosen for the meeting was on "Pathways to Knowledge" – an apt one, given Rostock's historical significance as a Hanseatic League seaport linking Scandinavia to the north, central Europe to the south, Russia to the east, and the Americas westwards. Appropriately, the meeting attracted speakers from North America, Argentina, Mexico and Taiwan, as well as Europe. The conference was also manageable enough for the agile and keen to dodge between just two adjacent lecture theatres as there was only one set of parallel sessions of twenty papers each timetabled for the morning and afternoon sessions. Each of the three days was prefaced by excellent plenary lectures by Christoph Meinel (Regensburg) with a systematic analysis of communication and discipline formation in the nineteenth century; Michael Gordin (Princeton) on the extraordinary rise and fall of Russian as a chemical language; and by Robert Bud (London Science Museum) on the role of what he called "folkstories" about applied chemistry during the industrial revolution. Delegates were also entertained by Dr Axel Schultz (Rostock) in a dazzling lecture demonstration of dozens of famous historical experiments, including Liebig's barking dog, and a preview of a television film made by Stephen Lyons on the life of Madame Curie. The winner of the 2011 Bettina-Haupt Award, Dr Florian K. Öxler (Marburg), also gave a fascinating illustrated talk on the history of chemistry sets, the subject of his recent book *Von tragbaren Labor zum Chemiebaukasten* (Deutscher Apotheken Verlag: Stuttgart, 2010).

The workshop themes that I attended were wide in scope. In a session on alchemy Matteo Martelli (Berlin) teased out the transfer of Greco-Egyptian alchemy to Byzantium from fragmentary documents, while Adriaan Minderhoud (Amsterdam) described how seventeenth-century Amsterdam had been a meeting place for (al)chemical knowledge. Joel A. Klein (Indiana) supplied further evidence of the roles of weight balance and sensory impressions in the analytical practice of alchemists. In a session on chemistry and war Andrew Ede (Alberta) suggested that WW1 had been a catalyst in causing American Federal government to fund chemical education as opposed to the smaller-scale promotion by individual states before the war. In a poignant talk by the doyen of Polish historians, Roman Mierzecki (Warsaw) told the moving story of the clandestine activities of a group of Polish chemists during the Nazi occupation, while Malte Stöcken (Bielefeld) delineated the various ways German chemists had acquired and distributed foreign literature during WW2. Because it was the 200th anniversary of the birth of Robert Bunsen a special workshop was organized by Christine Nawa (CHF, Philadelphia) who spoke about Bunsen's American students, while Masanori Kaji (Tokyo) and W. H. Brock (Leicester) examined his Russian and British students. It emerged that at least seven of his German students (including Debus, Schorlemmer, Sprengel and Mond) found fame and fortune in Britain rather than Germany. Two interesting sessions were held on the impact of German chemistry on other countries. Steve Weininger (Brookline, MA) observed how Liebig's type of laboratory instruction had been adopted by American Land Grant Colleges; Eva Vámos (Budapest) looked at how many of Hungary's leading academic and industrial chemists had received their education in Berlin from men like Emil Fischer and Karl Rammelsberger. Bernardo Herold (Lisbon) played detective and elucidated the career of the Portuguese chemist Agostinho Lourenço in providing a conduit for the passage of German organic chemistry to Portugal via Goa. Finally, in two complementary papers in a session on instruments and apparatus, Anders Lungren (Uppsala) and Carsten Reinhardt (Bielefeld) probed the roles of smell and taste in early analysis and in twentieth-century attempts to materialize these senses with instruments.

While half of the papers concerned the circulation of ideas and practices between the "big" nations of Britain, Germany, France and America, the "periphery" was not ignored. For example, there were papers on the introduction of Stahl's animism into Portugal and Lavoisier's chemistry to Norway, the construction of chemical formulae in Turkey, the role of exiled Spanish chemists in Mexico during the Spanish Civil War, and the development of catalysis in the Venezuelan chemical industry. Nor was the social side neglected. Delegates had an excellent conference dinner in a restaurant overlooking the Baltic and visited the sandy seaside at Warnemünde, while a small group also toured the University of Greifswald (where C. E. Weigel had taught chemistry and pharmacy), and had a magnificent luncheon in Carl Scheele's birthplace (now a hotel) in the charming town of Stralsund. Amusingly, the restaurant basement, labelled "Scheele's laboratory", turned out to be a bar.

Altogether the meeting more than fulfilled Meinel's analysis of pathways in terms of diachronic inheritances from one generation to another, and synchronic transmissions to contemporaries through personal, textual and institutional connections. It was also good to see so much new work being done by young historians of chemistry as well as by retired teachers of chemistry. Our grateful thanks were given to the local organizer, Professor Gisela Boeck, and to the genial conference master-of-ceremonies, Carsten Reinhardt.

W.H. Brock

Dyes in History and Archaeology 30: a joint meeting with the Historical Group

A joint conference of the Historical Group and Dyes in History and Archaeology took place in Derby on 12-15 October 2011. The last meeting in the UK, also a joint meeting, was at Liverpool in 2005 as reported here (Newsletter, February 2006). In the meantime, DHA visited Suceava (Romania), Vienna (Austria), Istanbul (Turkey), Poznan (Poland) and Lisbon (Portugal). Although Derby may not be perceived as quite such an exotic destination, it attracted over 80 delegates from 20 countries. The conference venue was the University of Derby Enterprise Centre, 37 Bridge Street, Derby, a new purpose-built centre.

Oral presentations over two days covered a wide range of topics, from the purely historical to the rather technical. The historic papers included the use of organic dyes and lakes in Sweden, cudbear and galium (Cuthbert and George Gordon of Leith and Glasgow), natural dyes in Polish batik, dyeing recipes from eighteenth-century Languedoc and the Gösta Sandberg collection in Sweden. Nineteenth century di- and tri-aryl methane synthetic dyes were reviewed and the connection between the alum industry of the mid seventeenth-century and the Royal Society described.

Indigo featured in several presentations, and the lack of it in one, which highlighted the almost complete absence in the Pacific Islands. Natural indigo can contain significant mineral impurities which are difficult to remove, but the identity of these minerals could provide a clue to the origin of a sample. Woad, *Isatis tinctoria*, can give many other colours than blue due to the presence of flavanoids. Indigo has been recovered from two shipwrecks, the *Nuestra Señora de la Concepción* in the Caribbean (sank 1641) and the *Vrouw Maria* in the Gulf of Finland (sank 1771). The use of indigo by the Yorubas of South Western Nigeria was vividly illustrated by a video presentation. The antiquity of the brominated analogue of indigo, shellfish purple, was confirmed by its identification in Italian textiles from the necropolis of Strozacaponi near Perugia and dated to the 2nd-1st centuries BCE, and in pigment samples from various Greek locations near Akrotiri and from Trianda at Rhodes, an island located in the eastern Aegean Sea about 200km east of Thera, which could date from the seventeenth century BCE.

The more technical presentations included advice on how to use hand held XRF for the identification of dyes, using transforms of diffuse reflectance spectra and a comparison of a charged aerosol detector compared to a diode array detector for HPLC. A study of natural dyes used on Egyptian paper found that turmeric, weld and saffron were most often used. An investigation into the protoberberine alkaloids (berberine, palmatine, coptisine and jatrorrhizine) contained in different species of *Phellodendron* (Amur cork tree) showed that the origin (China or Japan) could be determined. Recent analyses of some of the extensive collections in the British Museum, the Victoria and Albert Museum and the National Gallery using modern techniques have uncovered much new information. A unique application of dyes was described in Northern Nigeria where charms are written on paper in Arabic script: the writing is washed off and drunk to achieve a medicinal effect.

The social aspects of the meeting were not neglected. A pre-meeting reception took place on the Wednesday and the traditional banquet was held in a former police station (Cathedral Quarter Hotel) on the Thursday. The Saturday outing was to Matlock Bath for the Heights of Abraham, where a cable car was taken to the top followed by a tour of a lead mine. There followed a coach transfer to Masson Historic Textile Mill Museum, housed in Sir Richard Arkwright's 1783 mill, for a guided tour of the collection of historic working textile machinery producing yarn and cloth.

The organisers of DHA30 are very grateful to Bruker AXS, manufacturers of XRF equipment, and Citrefine International Ltd, producers and suppliers of natural repellents, for financial support for the conference. A 59 page book of abstracts of the oral and poster presentations at the meeting, a 2.74 Mb Word file, can be found at http://www.chriscooksey.demon.co.uk/dha/Abstracts_2.doc . The next DHA meeting will take place in Antwerp, Belgium, 17-20 October 2012.

Chris Cooksey

Environmental Chemistry: An Historical Perspective

This meeting was jointly organized by the RSC Environmental Chemistry Group and the RSC Historical Group and held in the Chemistry Centre on 26 October 2011. The talks were chaired by Professor Michael Pilling, Emeritus Professor, University of Leeds. Some 80 delegates attended the meeting and their many questions added to a very enjoyable and informative day.

Anthropogenic CO₂ and climate change – a historical perspective

Professor Simon Tett, University of Edinburgh

Climate is what we expect; weather is what we get. Thus, climate change is change in the type of weather we expect. The development of our current understanding of the effect of CO₂ on climate has occurred over almost two centuries. The tale begins with Fourier's work in the early 19th century where he concluded that something must be causing the surface of the earth to be warmer than expected. In the mid-nineteenth century Tyndall found that CO₂ and water vapour were opaque to infra-red radiation and Arrhenius suggested that changes in these gases might affect climate. However, if CO₂ was opaque to infra-red radiation then changes in its concentration could not affect climate as all the infra-red radiation would be absorbed. In the mid-twentieth century a disparate group of Californian scientists found that upper-air CO₂ while still absorbing infra-red radiation was not opaque and that the oceans would not take up CO₂. This led to a view in the mid-1960's that changes in CO₂ could affect climate. With the development of computer modelling of the atmosphere, ocean calculations could be made that showed that changes in CO₂ could have a dramatic impact on 21st century climate and had already affected twentieth and early twenty-first century climate.

“Held fast in the iron grip of frost”: Field and Laboratory in John Tyndall's discovery of the Greenhouse Effect

Professor Frank James, Royal Institution, London

At a Friday Evening Discourse at the Royal Institution on the cleavage of slate in 1856, its Professor of Natural Philosophy, John Tyndall (1820-1893) argued that the phenomenon was caused by pressure alone. His friend, Thomas Huxley, suggested that the same explanation could account for the laminated structure of glaciers. Together they visited the Alps to study glaciers, which began Tyndall's lifelong association with the Alps. He was the first person to climb the Weisshorn in 1861 and seven years later was the first to traverse the Matterhorn. He made many measurements on glaciers and concluded that their motion was due to the regelation of ice under pressure – a phenomenon that Faraday had discovered in the early 1850s.

Tyndall observed the low temperatures in the Alpine mountains which he found strange because of the strength of the sun and the continuing existence of glaciers. This led him to study the part played by water vapour and other gases in absorbing and transmitting heat, studies not previously made for gases, and concluded that the effect was probably small. During 1860 and 1861 he developed equipment in the basement laboratory of the Royal

Institution to measure heat transfer and absorption through gases in long tubes, involving galvanometers and thermopiles. He found that nitrogen and oxygen were almost entirely transparent to heat but, surprisingly found that the smaller components of the atmosphere, e.g. CO₂, water vapour or ozone absorbed more than 80% of the radiation that passed through them. He explained this finding in terms of molecules: here compounds could vibrate in more ways than individual atoms. He quickly realised that, although the quantity of gases such as CO₂ in the atmosphere was small, because of their very powerful absorptive properties they exercised a disproportionate effect on the absorptive power of the atmosphere as a whole. Thus a significant alteration in the quantity of water vapour or CO₂ would produce changes in the climate, something that had probably happened in the past. As a result he described what we now know as the Greenhouse effect, now recognised as one of the major drivers of global climate change.

Arie Jan Haagen-Smit's contribution to air quality

Professor Peter Brimblecombe, University of East Anglia

Photochemical smog characterised twentieth century urban air. It was observed in Los Angeles in the early 1940s and after the war the LA administration felt it would take a few months to solve the smog problem. Despite investigations by Raymond Tucker, a pollution expert, he failed to recognise that Los Angeles smog was formed by reactions in the atmosphere, so it remained a problem. In the late 1940's Arie J Haagen-Smit, a biochemist concerned with crop damage, began to study the smog and recognised the presence of ozone as a reaction product. This early research realised that the smog had impacts, not only on health, but it also damaged materials such as rubber. Perhaps more importantly Haagen-Smit recognised the policy implications and wrote: "a proper evaluation of the contribution of air pollutants to the smog nuisance must include not only the time and place of their emissions, but also their fate in air." His picture of the smog was relatively simple, seeing it as arising from petroleum vapours from automobiles, but this view was opposed by automobile manufacturers and oil companies. Ultimately our modern understanding of smog chemistry came through the work of Philip Albert Leighton, a well-known photochemist, and his team. His book *Photochemistry of Air Pollution* of 1961 implied the regulatory significance of smog chemistry; as Morris Katz said: "in order to control such harmful by products... [we need to] know the facts concerning their formation and reactions." The pivotal role of the hydroxyl radical was really not completely clear until Hiram Levy II (1971), where the radical begins to be seen as a basic ingredient for the production of photochemical smog. Despite this improved understanding and the early realisation that chemistry needed to inform policy, the smog problem proved long and difficult to solve. However, chemistry contributed to the way air quality was managed in a world where air pollution issues had become more complex. Arie J Haagen-Smit recognised the uniqueness of the smog, but also addressed the implications its chemistry had for policy.

Robert Angus Smith and the search for wider and tighter pollution regulation

Peter Reed, Leominster, Herefordshire.

In 1863 Parliament approved the Alkali Works Act for a 5-year period to regulate the release of HCl (muriatic acid gas) by alkali works operating the Leblanc process. Under the Act, the Alkali Inspectorate was established and four sub-inspectors, under Robert Angus Smith as Inspector, ensured at least 95% of the corrosive gas was condensed. The remainder of the nineteenth century brought dramatic increases in tonnages of chemicals produced and the range of nuisances from chemical processes. Smith used every opportunity to draw attention to these unregulated nuisances.

Various nuisances caused concern for the Inspectorate. Sulfur waste was produced during the third stage of the Leblanc process and by the 1870s some 500,000 tons of waste were produced annually in Britain with 2 tons of waste resulting from every ton of soda produced. Most of this was dumped on land surrounding the alkali works and was a constant source of SO₂ and H₂S pollution. Copper works in Swansea and St Helens were regular polluters. The smoke comprised a concentrated mix of gaseous SO₂ and HF with particles of copper, sulfur, arsenic, lead, antimony and silver. Ammonia was an infrequent polluter but any release caused a major hazard.

Portland cement works were regularly reported to the Inspectorate. Offending nuisances included dust, KCl, Na₂SO₄ and K₂SO₄ and a smell originating from the organic matter in the clay. Although furnaces were redesigned regularly the dust remained a problem well into the twentieth century. Potteries were also brought to the attention of the Inspectorate, because of black smoke from burning coal for kiln heating. Salt-glaze potteries were singled out because during the final twenty-minutes of firing NaCl was thrown over the red-hot pottery with the release of gaseous HCl.

Changes to the regulatory framework were adopted from the 1870s to strengthen the powers of an Alkali Inspectorate facing an ever-increasing list of nuisances. These changes included “best practicable means,” continuation of central regulation, enforcement by legal prosecution and swifter regulation of nuisances. The impact of these nuisances on public health and occupational health was studied seriously from the 1870s; previously the prophylactic benefits of the nuisance vapours were often promoted. The 1895 Factory and Workshop Act required notification of industrial diseases for the first time, but it was with the appointment of Dr Arthur Whitelegge as Chief Inspector of Factories in 1896 and Thomas Legge as the first Medical Inspector of Factories in 1898 that a concerted effort began against industrial disease.

An article covering the main topics in this talk will be published in *Ambix* next July in a volume commemorating the 1962 publication of Rachel Carson’s *Silent Spring*.

The life and work of Frederick Challenger

Professor Richard Bushby, University of Leeds

Fred Challenger is chiefly remembered for his work of biomethylation. After a rather unpromising start (He obtained a third class London external degree in Chemistry from Derby Technical College) he obtained a position working with F.S. Kipping at University College Nottingham (1907-1910). Here he succeeded in making and resolving the first optically active compound based on an asymmetric silicon atom. This work won him a prestigious ‘1851 Exhibition’ Scholarship which gave him the financial resources he needed to continue his chemical studies in Germany where he worked at Göttingen with Otto Wallach. Subsequent appointments as a lecturer in Birmingham (1912-1920) under P.F. Frankland and as a senior lecturer in Manchester (1920-1930) under Robinson and Lapworth were followed by his appointment to the chair of Organic Chemistry in Leeds. Here, one of the first problems he became involved with was ‘Gozio gas’; the volatile poison given off from wallpapers and fabrics coloured with arsenical pigments. He showed that this is trimethylarsine and not, as had previously been thought, an ethylarsine derivative. Interestingly, these moulds were also shown to have the ability to methylate inorganic antimony, selenium and tellurium compounds. Eventually, he proved that the ‘methyl’ came from *S*-adenosylmethionine. He was a gracious and kindly man who had a genuine interest in his staff and a real desire to see them succeed.

The emergence of health concerns of the heavy metals and metalloids

Chris Cooksey, Watford, Hertfordshire

Arsenic compounds were known from antiquity to be toxic and are popularly associated with fatal poisoning. Inorganic arsenic poisoning kills by allosteric inhibition of essential metabolic enzymes, leading to multi-system organ failure. Methylation reduces the toxicity, e.g., dimethylarsinic acid, $(\text{CH}_3)_2\text{AsO}(\text{OH})$ (LD50 of 1200 mg/kg). Volatile arsines are extremely toxic, but not Me_3As (LD50 7870 mg/kg). The toxic mechanism is different: they generate methylarsinyl peroxy radicals which destroy DNA.

Mercury was known in ancient times. Its toxicity is vastly enhanced by methylation. Thus, Me_2Hg , discovered in 1852, caused several deaths in 1865. Methyl mercury, CH_3Hg^+ , was implicated in the notorious incidents at Minimata Bay in Japan, where waste water containing CH_3Hg^+ or Hg^{2+} , from the Hg catalysed hydration of acetylene to acetaldehyde, was discharged into the sea where the Hg^{2+} was biomethylated by microorganisms. This produced CH_3Hg^+ which was bio-concentrated in fish which were used for human consumption, leading to poisonings and deaths over several years.

Lead poisoning among miners (Derbyshire colic) was common, as was contamination in food and drink (Devonshire colic from cider). Lead is not alkylated in the environment, but alkyl lead compounds were first made in 1853, and PbEt_4 added to petrol from 1923, promoted by Thomas Midgley (1889–1944). Clair Cameron Patterson (1922–1995) campaigned, among others, for its withdrawal when he found that modern lead was widespread in the environment and interfered with his measurements of U/Pb isotope ratios from which he estimated the age of the Earth (4550 million years).

Cadmium is a recent discovery (1817) but by 1868 it was found that exposure to CdCO_3 dust used in silver polishing caused respiratory and gastrointestinal symptoms. By the 1950s the hazards of working with Cd were well established, causing emphysema and proteinuria from inhalation. Chronic poisoning leads to renal osteomalacia caused by a build-up of Cd in the kidneys leading to a bone disease with fractures and severe pain. The most notorious case occurred in Japan where the disease is known as *itai-itai* (Ouch! Ouch!). Dr Noboru Hagino discovered the source in 1961: waste water from a zinc mine, containing 1 ppm Cd, was discharged into the Jinzu River, the water was used for rice fields.

See also the PowerPoint presentation at:

http://www.rsc.org/images/health-concerns-heavy-metals-and-metalloids_tcm18-210187.pdf

Peter Reed

Academics, Consultants, Industrialists and Government Chemists: The History of Chemists' Careers in England from 1880 to the 1970s

The Society for the History of Alchemy and Chemistry held its autumn meeting on Thursday 24 November 2011 at St Hugh's College, Oxford. The first paper entitled "The Changing Nature of Chemical Careers (1880s-1970s)" brought together research that Robin Mackie, Gerrylynn Roberts (Open University) and Anna Simmons (University College, London) had previously carried out on chemists' careers in order to provide a framework for the meeting. The work was based on the Open University's project "Studies of the British Chemical Community, 1881-1971." Data on the distribution of employment sectors from the 1880s to the 1970s showed that industry was consistently the largest sector of employment. The data also highlighted the growth of academic employment and the decrease in the importance of consultancy, whilst government employment remained relatively stable. Multi-sector working was also highly characteristic of chemists' careers.

To earn a living as a chemist in the nineteenth century, multi-sector working was almost essential, with around 70% working in more than one sector. For careers beginning from the inter-war years onwards the figure was just under 50%. It was interesting to consider the individuals discussed in depth at this meeting: Henry Armstrong, William Crookes, William Nicol and Alfred Spinks in these terms.

A spell working abroad formed part of the careers of roughly 20% of Institute of Chemistry members born in Britain over the whole period investigated. Not surprisingly, the Dominions and Empire were the principal regions for overseas employment. Mobility also occurred within the United Kingdom as chemists moved about presumably for career advantage. Analysis of the individuals for whom there is data on at least twenty years of their career was carried out, with both mobility and stability within a single firm analysed. The most striking pattern appeared in industry. For those whose careers began in the interwar years, success was found via stable careers as bureaucratic careers were rewarded. However, those whose careers began after the Second World War found success with mobile careers.

In the second paper, "Contingent Careers: Armstrong, Crookes and Nicol," Professor William Brock of the University of Leicester examined the different career paths taken by three nineteenth-century British chemists. The organic chemist Henry Edward Armstrong (1848-1937) had what might be taken as a conventional academic career, namely initial training in England (under Hofmann at the Royal College of Chemistry) followed by postgraduate studies in Leipzig with Kolbe. Following part-time jobs at St Bartholomew's Hospital and the London Institution and abortive attempts to obtain posts in Leeds, Cambridge and the Royal Institution, from 1879 until 1912 he taught at Finsbury Technical College and the Central Technical College in South Kensington (part of today's Imperial College). His research was in the field of organic chemistry, but he also made considerable efforts in encouraging chemistry teaching in schools. Outside academia he held many consultancies with dyestuffs companies, breweries and agricultural field stations. He spent his long retirement (1912-37) engaged in popular journalism that was frequently highly critical (often amusingly so) of developments in twentieth-century chemistry. Curiously, it is for this work in retirement that he is best known today.

The chemical physicist Sir William Crookes (1832-1919) also studied chemistry at the Royal College of Chemistry, but did not go to Germany for further training. Despite his discovery of a new element (thallium) in 1861 and his FRS in 1863, he was always unsuccessful in gaining an academic appointment. He was forced instead to earn his livelihood by other means and he turned to photographic and chemical journalism and chemical consultancy. He was the founder, owner and editor of the weekly *Chemical News* from 1859 and this became the basis of his financial success. All of his research (mainly in spectroscopy, cathode rays, radioactivity, etc) was done in a home laboratory and financed largely by him. The fact that he worked in trade and commerce rather than academia initially counted against him; but such was the significance of his experimental research that he was able to conquer this stigma by the 1880s. He ended up (in 1912) as President of the Royal Society.

Like Armstrong, the Scottish chemist William Walker James Nicol (1855-1929) initially had a conventional academic career path. He trained at Edinburgh with Alexander Crum Brown and with Hofmann in Berlin before becoming a chemistry lecturer at the University College in Bristol. In 1881 he joined William Tilden at Mason's College, Birmingham, and switched his research from organic to physical chemistry. He worked on the controversial nature of solutions, but was also renowned for his lecturing, mechanical and photographic skills. When the Birmingham chair of chemistry fell vacant in 1894 Nicol

was the internal candidate. So great was his disappointment at not being appointed (the post went to Percy Frankland) that he abandoned chemistry completely at the age of 39. A lover of the countryside, he spent his long retirement unconventionally caravanning around the Highlands of Scotland. Nicol is one of several nineteenth-century chemists who became “lost to chemistry,” though his is an extreme example because his pockets were sufficiently deep from inheritances and photographic patents to allow him “the life of Riley.” In generalizing from these three case histories, Prof. Brock drew attention to the ways in which parents, marriages and wives, inheritances, knowing the right people and networks, choice of research field, and the psychological factor of humiliation (or the fear of it), must all be considered in discussing career patterns.

The third paper was given by Sally Horrocks of the University of Leicester and was entitled “Chemistry as a Career for Girls from World War II to the Sex Discrimination Act.” Dr Horrocks’ paper explored why it was difficult for women to have the same type of careers in chemistry as men and the attitudes towards appropriate gender roles in science. During the Second World War a widespread perception of a shortage of ‘scientific manpower’ existed. However, women scientists were not generally seen as a solution to this problem and Dr Horrocks related women’s stories of frustration about how they were not employed in the war effort.

The perceived shortage of scientific manpower following the Second World War did not necessarily mean that the employment of women would now be seen as a solution. Dr Horrocks quoted from the *Girl Annual* of 1959 which did discuss a career in nuclear fusion for girls but concluded that “the career of the confidential secretary can be just as exciting as tearing atoms apart.” This quote reflected a tendency in popular culture that suggested science was not a suitable career for women. The 1951 film, the *Young Wives’ Tale* echoed this sentiment, with the character of the young working mother employed in a chemical laboratory portrayed as efficient, controlled, constrained and unfeminine. There were, however, some positive portrayals of women working in industrial laboratories. Dr Horrocks showed a film from the Media Archive for Central England of the opening of a research laboratory for Birds’ custard with its female chemist employees.

However, by the mid to late 1960s attitudes began to change. With the arrival of the contraceptive pill, the assumption that women would leave employment when married changed. There was an increase in the number of women studying science at university. A shift in popular culture was also evident. In the *Girl’s World Annual* of 1970 welding and research in chemistry were considered as possible career options. The change in attitudes towards women was enshrined in the Sex Discrimination Act of 1975, but the change in the wider cultural climate had started before this date. Dr Horrocks concluded that rather than bemoaning the treatment of women chemists, it is important to look at the wider world of careers for women and to analyse the changes that occurred over a longer period.

In the final paper, Viviane Quirke of Oxford Brookes University spoke about “From Chemistry, to Pharmacology, to Biotechnology: Alfred Spinks’s career from wartime chemist to government advisor.” Alfred Spinks (1817-1982) occupies an important place in the history of British chemistry in the second half of the twentieth century. Not only did he help to shape the R&D strategy of Britain’s largest chemical group, Imperial Chemical Industries (ICI), but he also advised the British government on research policy in the 1970s to early 1980s. In her paper, Dr Quirke examined the successive phases in Spinks’s career, as he moved from ICI’s Dyestuffs Division, where he was research chemist from 1942, to ICI’s Pharmaceutical Division, where he became head of the Division’s new Pharmacology Section in 1953, and then to ICI’s Main Board, where he was responsible for the R&D of the entire group from 1970 until his retirement in 1979. During this last

phase of his career his advice went far beyond the group, as a member of the Advisory Board of Research Councils (ABRC) and founding member of the Advisory Council for Applied Research and Development (ACARD), culminating in his role as Chair of a Joint Working Party on Biotechnology (which produced the influential 1980 'Spinks Report'). These successive phases were linked not only to Spinks's changes in function, from bench chemist, to research manager, to Main Board member and government advisor, but also to changes in focus, from synthetic organic chemistry, to pharmacology, and later biotechnology and research policy. Spinks's career was therefore a multi-disciplinary as well as multi-phase career. In her concluding comments Dr Quirke argued that it illustrated a number of constants in successful twentieth-century chemical careers:

The role of 'boundary' research areas where chemical knowledge and expertise have a significant part to play (in this instance pharmacology in the 1940s-50s).

The enduring legacy of research networks (in this case Nottingham - ICI – Imperial College – Oxford).

The importance of a reward system allowing a certain fluidity between academic and industrial careers.

Nevertheless, some distinguishing factors that set Spinks's career apart were also identified: his was an extraordinary career, tied to an extraordinary company – ICI, and to a particular time and place – Britain in the 1950s-1960s, where the legacy of wartime projects endured, whilst recognising the value of 'Blue Sky' research.

The meeting concluded with a lively discussion based around the question "How did chemists' careers change over a century?"

Anna Simmons

The 250th anniversary of the birth of Smithson Tennant celebrated

Smithson Tennant (1761-1815) was born in Selby, near York, on 30 November 1761. He was later (in 1804) both to identify and isolate osmium and ruthenium, announced in a classic paper – a miracle of concision (S. Tennant, *Phil Trans. Roy Soc.*, 1804, **94**, 411). On 30 November 2011, 250 years later to the day, York University held a *Smithson Tennant Scientific Symposium* with lectures on the chemistry of osmium and iridium, and of what little is known of Tennant. A 250th anniversary birthday cake was made and an excellent, special 'Smithson's Ale' brewed by the Brown Cow Brewery, Selby, presented and joyfully consumed. I gave a short talk on Tennant. Although it is well known that no portrait of him was ever produced, two of the six speakers nonetheless had an image, from Google, of a person purporting to be him: it all goes to show that the internet is not infallible! I did show a portrait of John Locke, to the portraits of whom Tennant is said to have had a resemblance.

The meeting was sponsored by the RSC, BP, Johnson Matthey and the University. *Platinum Metals Review* produced a 'virtual third issue' containing a number of historical papers on Tennant and on iridium):

<http://www.platinummetalsreview.com/virtual-issues-2/#VI3>

Bill Griffith

FORTHCOMING MEETINGS

Royal Society of Chemistry Historical Group Meetings

Where there's muck there's brass!: Reclamation of Chemical Sites

This one-day meeting will be held at the Chemistry Centre, Royal Society of Chemistry, Burlington House, Piccadilly, London W1V 0BN on Friday 23 March 2012, beginning at 10.30am. The landscape of Britain has been transformed over many millennia, but in more recent times industrialization has had a major impact, with the chemical industry and industries using chemical processes at the forefront. The waste products are varied in their potential danger and in their quantity, but the remediation of these sites has become very important in the last 30 years or so. This meeting will review a number of different sites each with its own challenges to understand the progress being made. The Olympic stadium would not be there had the toxic waste not been removed: the opening talk by speakers attached to the Olympic Delivery Authority will address the issues. Full details of the programme and a booking form are enclosed with this Newsletter: please register and send your remittance as soon as possible if you wish to attend.

Bill Griffith

Society for the History of Alchemy and Chemistry Meetings

Sites of Chemistry in the Nineteenth Century, 6-7 July 2012

Institute for the History of Medicine and Science 'López Piñero', Valencia, Spain

This is the second conference in a series of four entitled, the *Sites of Chemistry, 1600–2000*, which deals with the multitude of sites, spaces and places where chemistry has been practised. Full details on the project, which is funded by SHAC and the Wellcome Trust, are available at www.sitesofchemistry.org. The main purpose is to analyse, first, who was practising chemistry in a particular site, where, how, to what ends, and the physical, social, cultural and economic organization of these sites; and second the wider social, economic, political and cultural contexts for the practice of chemistry through detailed examination of chemists' interactions, in and around these sites, with other actors.

Oxford Seminars in the History of Chemistry: February 2012 – May 2012

13 February: Chemistry and the Environment

Oxford Brookes University, Gipsy Lane, Headington (16.00-18.30)

Joint meeting with the Environmental History Seminar

Jean Baptiste Fressoz (Imperial College): "Chemistry and the Transformation of the Environment, 1750-1850."

John Perkins (Oxford Brookes University): "Chemical Expertise and Industrial Pollution in Rouen, 1770-1810."

6 March: Charles Webster - Paracelsus: Chemistry and Revolution

History Faculty Lecture Theatre, George Street, Oxford (17.00-19.00)

Charles Webster (Emeritus Fellow, All Souls, Oxford, and previously Reader in the History of Medicine and Director of the Wellcome Unit for the History of Medicine, University of Oxford) is author of *The Great Instauration. Science, Medicine, and Reform, 1626-1660* (1975) and *Paracelsus, Medicine, Magic and Mission at the End of Time* (2008).

2 May: Chemistry in Oxford at the end of the 17th Century

History Faculty, George Street, Oxford (15.00-17.00)

Anna Marie Roos (Oxford University): “The Learned Dr Plot (1640–1696), Philosophical Wine, and the Oxford Philosophical Society.”

Marcos Martinon-Torres (UCL): “Doctor Plot’s Pots: an Archaeological Insight into the Ashmolean *Officina Chymica*.”

12 May: Academic Chemistry and Artisanal Practices, 1600-1800

Maison Française d’Oxford, 2-10 Norham Road, Oxford (10.30-17.00)

This one-day colloquium explores the reciprocal relationships between artisanal practices and chemistry: both the importance of artisanal practices for the construction of chemistry as a discipline and, conversely, the interactions between academic chemists, artisans and entrepreneurs in bringing about innovation and technological change. The discussions centre on Ursula Klein’s work (Max Planck Institute). She will present a paper, with contributions from Cesare Pastorino (Sussex University), Liliane Hilaire-Perez (Conservatoire National des Arts et Métiers), Marie Thebaud-Sorger (École des Hautes Etudes en Sciences Sociales) and John Christie (Oxford).

30 May: Chemical Correspondences: Joseph Black and Michael Faraday

History Faculty, George Street, Oxford (15.00-17.00)

Robert Anderson (Cambridge University): “Dealing with some Correspondence: the case of Joseph Black.”

Frank James (Royal Institution), “ ‘To physicists, who have approached physics by the road of chemistry, Faraday’s memoirs sound like an admirably beautiful music’ (Liebig): Did Michael Faraday cease to be a chemist?”

Maison Française d’Oxford, Oxford University History Faculty, the Centre for the History of Medicine, Oxford Brookes University and SHAC support the seminars.

For further information contact jperkins@brookes.ac.uk

‘From Alchemy to Chemistry’

13 April 2012, School of Chemistry, National University of Ireland, Galway

This symposium features papers by Peter Forshaw (Amsterdam University) on alchemy, John Perkins (Oxford Brookes University) on eighteenth-century chemistry and Bill Brock (Leicester University) on nineteenth-century chemistry, and will end with a panel discussion on the future of chemistry. The event is supported by the NUI Galway Millennium Fund, the NUI Galway School of Chemistry, Boston Scientific and SHAC. Please email the organiser, Dr Peter Crowley: peter.crowley@nuigalway

American Chemical Society – Division of the History of Chemistry

San Diego, 25-29 March 2012

Sessions on HIST Tutorial, General Papers, the Springer Brief History of Chemistry Book Series and ‘The Double Bind’ - Minority Women in Science and Update Thirty Seven Years Later.

Philadelphia, 19-23 August 2012

Sessions on HIST Tutorial, General Papers, Characters in Chemistry, Chemistry Books edited by E.F. Smith, Celebrating the Sesquicentennial of the Land Grant College Act and

Dr Marie Maynard Daly, Her Life and Legacy. See <http://www.scs.uiuc.edu/~mainzv/HIST/index.php> on the HIST website.

CALLS FOR PAPERS

24th International Congress of History of Science, Technology and Medicine
University of Manchester, 22-28 July 2013

The theme of the Congress is “Knowledge at Work.” The organisers construe the theme broadly to include studies of the creation, dissemination and deployment of knowledge and practice in science, technology and medicine across all periods, and to encompass a variety of methodological and historiographical approaches. The deadline for symposia submissions is 30 April 2012. The call for individual papers will be issued in May 2012. The Congress website is at <http://www.ichstm2013.com>

FORTHCOMING CONFERENCES

Seventh Joint Meeting of the BSHS, CSHPS, and HSS

Philadelphia, Pennsylvania, USA, 10-13 July 2012

The programme will include parallel themed sessions, plenary lectures, education and outreach activities, and events at the American Philosophical Society, the Chemical Heritage Foundation, and the University of Pennsylvania. The deadline for submitting abstracts has now closed. For further details see www.hssonline.org