RSC Historical Group Newsletter February 2010

Contents

From the Editor

Thanks to all of you who sent me items for inclusion in this Newsletter, especially the essay on Prontosil by Alan Dronsfield, Peter Ellis, and John Cassella, which had been promised in an earlier Newsletter, and is reproduced from the journal *Chemical Education*; the 'Compilation of a register of Historic Chemical Collections' by Henry Rzepa of Imperial College; Bill Griffith's timely piece on Darwin and chemistry; David Leaback's thought-provoking 'Crunch Times for British Chemistry'; and last but not least Chris Cooksey's recollections of his time at Aeronautical Inspection Directorate (AID), Harefield. This Newsletter includes two book reviews, the first of Keith Baker's *Joseph Priestley*, by Alan Dronsfield, the second of the French biographical dictionary of chemists, *Itinéraires de chimistes*, by myself, which I hope will be of interest to RSCHG members. We have two evocative RSC Chemical Landmark Award reports, the first on Professor Edward D Hughes and Bangor University, by Dr E Malcolm Jones, Secretary of the North Wales Local Section; the second on Harwell Laboratories, by Alan Dronsfield. I am grateful for two most interesting meeting and conference reports sent to me by Peter Reed (on Chemistry and the Law, organised by the RSCHG) and by Georgette Taylor, Stephen Johnston and Stephen Clucas (on 'Chymistry and Mechanization in the Seventeenth and Eighteenth Centuries', organised by SHAC). Please note that SHAC will be celebrating its 75th anniversary in 2010, and that this will be marked with a meeting at the Royal Institution in London on Friday 19 November. Note also that this Newsletter includes a new item, *Publication News*, which we hope will become a regular feature of future Newsletters. I will welcome suggestions of items for inclusion under this heading. The deadline for your suggestions and other items for the next issue will be 25 June 2010. Please send your contributions to (vquirke@brookes.ac.uk) as an attachment in Word or rich text format, or on CDrom (post to 16 Drayton Road, Dorchester-on-Thames, OXON, OX10 7PJ).

Viviane Quirke
Oxford Brookes University

Royal Society of Chemistry Historical Group AGM

The thirty fourth Annual General Meeting of the Group will be held at Burlington House on Friday, March 19, 2010, at 4.15 as part of our meeting that day on The Rise and Fall of ICI.

Agenda

1. Apologies for Absence.

2. Minutes of AGM at Burlington House on Friday March 20, 2009.
3. Matters arising from the Minutes
4. Reports:
   - Chairman's Report
   - Secretary's Report
   - Treasurer's Report
5. Future Meetings.
6. Election of Officers and other Members of the Committee.
7. Any Other Business.
8. Date, time and place of next meeting

Bill Giffith

ROYAL SOCIETY OF CHEMISTRY HISTORICAL GROUP

Database of Presentations by RSCHG members

Following Chris Cooksey's plea in last year's January Newsletter for details of presentations which members can offer, details of nine presentations from six members have been received, and are now arranged in a database. If you would like a copy of this database, please contact Chris at the address below, and continue to send your contributions to him so that he can expand the database.

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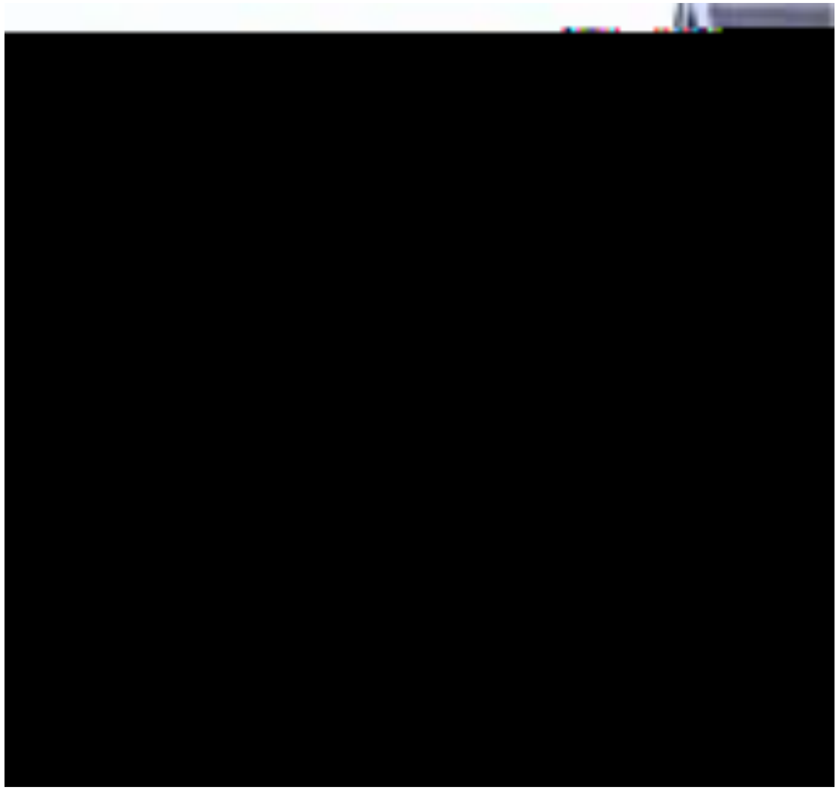
NEWS AND UPDATES

The Museum of Victorian Science: a little-known Yorkshire gem

I can guarantee that virtually no readers of this Newsletter will have heard of this museum, located somewhat out of the way in the village of Glaisdale, near Whitby, North Yorkshire. It's not a museum in the conventional sense you can't simply turn up, pay your admission fee and wander round. Instead, you have to book in advance (£20 if you turn up as an individual, or £10 a head for groups of 2-5). In return you get a two-hour lecture demonstration

of aspects of radioactivity, electrical discharges and the work of William Crookes, and (briefly) Thomson's work that led him to 'discover' the electron. I claim these as chemical discoveries, but physics colleagues might disagree. We also see demonstrations of various electrical machines including those like Priestley might have used in his experiments. These were improved during the 19th century culminating in the famous Wimshurst Machine (1880) capable of generating sparks several inches in length.



The museum's website is at http://www.museumofvictorianscience.co.uk/ and bookings should be made by telephone: 01947 897440. I went as one of a party of four like-minded scientists. The talk was tailor-made to our mainly chemical interests, and as they say, a good time was had by all!

Alan Dronsfield
University of Derby

Publication News

One of our members, Roy Macleod, has just published a biography of the chemist Archibald Liversidge, FRS: Imperial Science under the Southern Cross (Sydney University Press and Royal Society of New South Wales,

A view of the museum, as seen from the entrance doorway

2009). Liversidge was a Londoner, an analytical chemist, and the 'architect' of scientific organisation in colonial NSW. The book is framed within the context of the history of colonial chemistry, and discusses Liversidge's education in Victorian London and Cambridge, his life in Australia, and his later work in England during and after the Great War. The price is $59.95AUD. Further details from Prof Macleod at: roy.macleod@arts.usyd.edu.au

Also available is the 49-page monograph, A History of the International Dyestuffs Industry, written by our members Peter Morris and Tony Travis. This was first published in 1992 by the American Dyestuff Reporter, and has just been made available for (free) downloading from the Internet. The links are: http://colorantshistory.org/HistoryInternationalDyeIndustry.html and http://colorantshistory.org/HistoryInternationalDyeIndustryRev1/HistoryInternationalDyestuffIndustryCt6.pdf

It is an account of the rise of the synthetic dye industry and, as one would expect, gives prominence to William Perkin's epoch-making discovery of 1858 and subsequent developments.

It is anticipated the Publication News will become a regular feature of future Newsletters and the Editor will welcome suggestions of items for inclusion under this heading.

Alan Dronsfield
University of Derby

Trevor H. Levere has received the 2009 Edelstein Award

The Division of the History of Chemistry of the American Chemical Society (HIST) announced that Trevor H. Levere, University Professor Emeritus at the Institute for the History and Philosophy of Science and Technology (IHPST) at the University of Toronto, was selected to receive the 2009 Sidney M. Edelstein Award for Outstanding Achievement in the History of Chemistry. Levere was chosen from a group of international nominees because of the breadth and depth of his historical interests, his research productivity, his understanding of the intellectual and contextual aspects of the history of chemistry, and his promotion of the history of science in Canada.

Starting as an undergraduate chemistry major at Oxford in 1962, Levere changed his focus to the history of chemistry and published his B.A. thesis in Martinus van Marum in 1969. Continuing on at Oxford under A.C. Crombie, Levere received his D.Phil. in 1969 with a thesis that appeared in 1971 as Affinity and Matter: Elements of Chemical Philosophy 1800-1865, a work that still remains an essential reference for historians of chemistry. His historical productivity since then has been far-ranging, including not only the traditional eighteenth- and nineteenth-century history of European chemistry but also including the history of Canada, the history of exploration, and the history of scientific apparatus. His Transforming Matter: A History of Chemistry from Alchemy to the Buckyball, appearing in 2001, is often considered one of the best histories of chemistry in several decades, presenting the subject in a readable to a large audience beyond the specialist. Levere's entire career was spent at the University of Toronto, where he has played a major role in building the IHPST into an organization of international importance.

The Edelstein Award consists of an engraved plaque and a check for $3500. It is supported by HIST and the Chemical Heritage Foundation of Philadelphia and was presented to Levere at the fall national meeting of the American Chemical Society in Washington, DC in August 2009. Additional information about the award can be found on the HIST website at http://www.scs.uiuc.edu/~mainzv/HIST/awards/edelstein.php

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News from the Chemical Heritage Foundation (CHF)

On 14 May 2009, the CHF celebrated Heritage Day 2009, a celebration of excellence and achievement in the chemical and molecular sciences. On this occasion, the following awards were made: Othmer Gold Medal http://chf.pmailus.com/pmailweb/ct?d=HQOzGAB7AAEAAAEtAAKGEg

To Ahmed Zewail, Linus Pauling Professor of Chemistry and Professor of Physics, Director of the Physical Biology Center for Ultrafast Science and Technology, California Institute of Technology, and Recipient of the 1999 Nobel Prize in Chemistry.

American Institute of Chemists Gold Medal

To Oliver Smithies, Excellence Professor of Pathology and Laboratory Medicine, University of North Carolina at Chapel Hill School of Medicine, and Co-Recipient of the 2007 Nobel Prize in Physiology or Medicine.

Richard J. Bolte, Sr., Award for Supporting Industries

To David and Alice Schwartz, Founders, Bio-Rad Laboratories.

Chemists' Club-S Winthrop-Sears Medal

To Zsolt Rumy, Chairman, President, and CEO, Zoltek Companies, Incorporated.

SHORT ESSAYS

Compilation of a Register of Historic Chemical Collections

Something of a milestone was recently reached, the 50 millionth recorded molecule in the Chemical Abstracts database (for the record, it was (5Z)-5-[(5-Fluoro-2-hydroxyphenyl)methylene]-2-(4-methyl-1-piperazinyl)-4(5H)-thiazolone) (1). This of course means that there is at least one report in the literature of a molecule that is thought to have that structure. It is a sign of the times that such a report nowadays is almost as likely to be a calculation on a molecule of that composition as an actual synthesis and characterization of its properties; it may even be part of a combinatorial library where the molecule may or may not be present in a mixture of similar compounds. It is also probably true that only a very tiny fraction of these 50 million molecules are actually in existence at any moment in time as samples held in a specimen tube. Who knows what that fraction may be; I can only hazard a guess that it is less than 1%; would anyone like to offer a different estimate?

Which brings me to the theme of this article; the putative existence of the first authentic samples of molecules, very probably made by the chemists who first reported their synthesis. Such samples are likely to be very much rarer than even 1% of 50 million. Indeed, it is the very uncertainty of how many such collections exist that is the purpose of this request.

But let me start rather earlier, in 1967 in fact. I was then finishing school, and had become an aspiring university applicant. At one of the universities I had selected for admission, I was waiting in a large lecture theatre for my 30-minute interview (this by the way ended up being almost entirely about cricket and not chemistry), with about an hour to kill. I then noticed a large chemical display cabinet at the back of the theatre (an observation which is unlikely to be made nowadays because of health and safety legislation), containing a sealed glass topped box bearing the caption Michael Faraday's specimens. Inside this were six chemical samples: chloride of arsenic, chloride of sulphur, hydrochloride of carbon, elemental bromine and silicon, and yttrium phosphate. Faraday himself had made the first four in the list, but such was Faraday's prestige that it was common practice for chemists around the world to also send him samples of compounds (and in this case two elements). I was riveted by this display; in front of me was the very first sample ever isolated of elemental bromine, by Balard as it happens. I completed my interview and did not encounter that box again until very many years later. But its historical significance continued to fascinate; were these samples really what they purported to be? (an opportunity arose a few years back to test this for the original Faraday sample of benzene, which turned out in the event to be remarkably pure) (2).

My own chance to investigate this theme came in 2004, when the Manchester Museum of Science and Technology felt it could no longer house the historic 120 year old Armstrong-Wynne (AW) collection of naphthalenes, and contacted the archivist Anne Barrett at Imperial College asking whether she could take over this collection (the samples had been originally synthesised at Imperial College). Had the answer been no, the probability was that the samples would have been destroyed. I managed to rescue the collection with the aid of a one-off grant from the Arts and Humanities Research Council. The AW collection had been comprehensively catalogued whilst still located at Manchester; at Imperial a number of these samples were then subjected to further analysis and crystallography to verify their identity. Armstrong and Wynne were spot on for the three structures (using 120 year old crystals) we so verified (3)! Such forensic analysis has more recently been recently performed on another historic collection with resonance for Imperial College; the antique samples associated with William Perkin (4), which resulted in extending the family of compounds present in the mixtures known as mauveine to around ten from the three previously mooted.

One further memory takes this theme a further step. I ended up doing both my first and second degrees at Imperial College, and frequently attended lectures in 'Theatre D', where at the time Derek Barton presided. At the back of this theatre were also display cabinets, and these held samples of

natural products isolated during the heyday of such chemistry in the department in the 1920s; there were at least 1000 samples, perhaps more (I have no idea if a catalogue of the collection existed). Someone told me at the time that not a few of the organisms whose metabolism had produced these compounds had now mutated, and that these natural product metabolites were now in effect extinct. Since the chemists of the 1920s had few spectroscopic techniques with which to ascertain the structures, which were normally identified by the same methods that Armstrong and Wynne had adopted, namely degradation to known species, I again pondered how many of these 1000+ structures were correct and how many might be in error. I never got the chance to find out, since after Barton left the department, the collection dissipated. So to did the Hofmann Collection, created by August von Hofmann when he was the first professor of organic chemistry at Imperial College in the 1850s. No catalogue is known (to me at least) to exist, either of the original, or the extant samples. Likewise the famous collection of phthalocyanines made by Linstead in the 1930s.

This has lead me to ponder how many shining examples of such successful curation of our chemical sample heritage might exist elsewhere, in the UK, or indeed further afield. So might I call for anyone who knows of any coherent or themed collections of catalogued chemical samples that deserve wider dissemination? If you do, please email me at rzepa@imperial.ac.uk. Any responses will be documented in the next newsletter.

Henry S Rzepa
Department of Chemistry
Imperial College London

References:

(1) See the article at http://www.cas.org/newsevents/releases/50millionth090809.html

(2) Video films of John Cadogan's Royal Institution lecture on the theme can be viewed by subscribing to the following podcast: http://www.ch.imperial.ac.uk/video/index.rss

(3) Our project is described at this site: http://www.armstrongwynne.org/

(4) M.M. Sousa, M.J. Melo, A.J. Parola, P.J.T. Morris, H.S. Rzepa and J.S. Seixas de Melo, 'A study in Mauve. Unveiling Perkin's Dye in Historic Samples', Chem.-Eur. J., 2008, 14, 8507-8513. DOI: 10.1002/chem.200800718

Recollections of AID Harefield

Bill Brock's short essay about William George Shilling in the August Newsletter prompted a distant memory. In 1960, five years after Shilling's death, I left school and started work at the Aeronautical Inspection

Directorate (AID), Harefield, in a laboratory dedicated to the analysis of light alloys. It was my second choice. AWRE Harwell had declined to offer me employment. At that time, AID was more commonly used as an abbreviation for Artificial Insemination by Donor.

An analysis was started by weighing exactly 1 gram of metal turnings into a flask. I was told that this was necessary to make the subsequent calculation easier. The metal was dissolved in acid. Copper was estimated as the metal by electrolytic deposition on to a cylinder of platinum gauze which was weighed. The copper metal was dissolved in nitric acid and the gauze weighed again. Nickel was also estimated gravimetrically but this time as the bright pink dimethylglyoxime complex. For the estimation of silicon, the sample was burned and the residue weighed. Then HF was added and after further heating the residue weighed again. Silica was lost as SiF_4 and from the loss in weight, the silicon content of the original sample could be calculated. I was warned not to get HF under my finger nails because it hurt. Several colorimetric methods were in use, but the details have faded.

Washing up was not permitted. This was performed by a dedicated team in the evening so that all the apparatus and glassware used during a day was clean and dry by the following morning.

One popular entertainment was the use of a vapour degreasing bath, a five litre beaker containing trichloroethylene on a hotplate, to clean parts of car engines.

After a year there, having learned all about inorganic chemistry, I departed to do a BSc degree at University College.

Chris Cooksey
Watford

Darwin, Chemistry and the Age of the Earth

This is an expanded version of my short article in *Chemistry World* (1). Last year, 2009, marked the bicentenary of the birth of Charles Darwin (1808-1882) and the sesquicentenary of *On the Origin of Species by Means of Natural Selection* (2), one of the most important and still controversial books ever written. It seems appropriate to mark these events: although Darwin was not a chemist, nevertheless chemistry was to become important to him in a number of ways.

Darwin wrote: Towards the close of my school life, my brother worked hard at chemistry, and made a fair laboratory with proper apparatus in the tool house in the garden, and I was allowed to aid him. He made all the gases and many compounds, and I read with great care several books on chemistry.. The subject interested me greatly, and we often used to go

on working till rather late at night (3). At Shrewsbury school Charles was known as 'Gas' Darwin because of his chemical interests; his father sent him and his brother Erasmus to Edinburgh to study medicine. Darwin was much impressed there by the chemistry lectures of Thomas Hope (1766-1844, successor to Joseph Black in the Edinburgh chair and regarded by some as the discoverer of strontium) (4), which he found theatrical and entertaining. He did not complete his medical degree.

His crucially important journey from 1831 to 1836 as companion to Captain James Fitzroy (1805-1865) on the *Beagle* would not have occurred without the intervention of a chemist's son. The renowned potter Josiah Wedgwood FRS (1730-1795), was of course also a distinguished chemist; his daughter Susannah married Charles' father, Dr. Robert Darwin and in 1839 Charles married Emma Wedgwood (1808-1896, daughter of Wedgwood's eldest son, also called Josiah, or 'Joss' (1769-1843), who followed his father's professions). When Robert opposed his son's plans to join the *Beagle* it was Joss who persuaded him that the enterprise would do Charles a world of good. The 23-year old Darwin embarked on 27 December 1831 on his epic voyage. It was planned to last for two years only 'to Tierra del Fuego and home by the East Indies', but the *Beagle* circumnavigated the globe, taking five years and covering 44,000 miles.

On the journey, not only to the Galápagos but to many other places, he studied botany, geology, the local peoples and fossils. On the *Beagle* and subsequently, Darwin developed his theory of evolution and of natural selection, corresponding on these matters with many scientists, but publishing very little on the subject apart from a privately circulated essay in 1844. The chemist, Edward Blyth (1810-1873), later to become a botanist, was one of Darwin's most frequent correspondents and is mentioned in the *Origin* (he published early papers on evolutionary matters) (5).

In 1855 the naturalist Alfred Russel Wallace (1823-1913) wrote *On the law which has regulated the introduction of new species* (6). Darwin's friends the geologist Charles Lyell (1797-1875) and the botanist Joseph Hooker (1817-1911) warned Darwin that it contained material on evolution. Wallace wrote to Darwin in 1858 enclosing an essay, *On the Tendency of Varieties to depart indefinitely from the Original Type*, expanding on his ideas; Darwin realised that Wallace, more so than in his 1855 paper, had an understanding of evolution akin to his own. He sent the essay to Hooker and Lyell, who arranged that it, some of Darwin's 1844 material and a letter by Darwin to the botanist Asa Gray be read at the Linnean Society on Thursday 1 July 1858 (7). Neither author was present: Darwin's tenth and last child, Charles, had died two days earlier and Wallace was still in the Far East. There have been suggestions that Wallace was poorly treated by Darwin but with little supporting evidence; Darwin's evolutionary views were more securely grounded, deeper in concept and better supported by the vast amount of data he had collected (8).

Chemistry impinged again after publication of the Origin. On page 287 of the first edition, using erosional data, Darwin calculated that '**the** denudation of the Weald must have required 306,662,400 years, or say three hundred million years' (2). This was one of the very first attempts to give any figure related to the antiquity of the Earth and was much criticised. The phrase and indeed all the Weald material was omitted from the third and subsequent editions of the Origin. Darwin knew well the work of his close friend Sir Charles Lyell FRS (1797-1875) – he had read Lyell's Principles of Geology of 1830 (9) on the Beagle. Lyell, who realised the vast antiquity of the Earth but gave no figure for its age, was one of those who persuaded Darwin to write the Origin.

The formidable Lord Kelvin (William Thomson, 1824-1907) opposed Darwin's evolutionary views because he thought that they neglected the basic laws of physics, rather than for theological reasons, writing in 1862 …what then are we to think of such general estimates of 300,000,000 years for the 'denudation of the Weald'? (10) On the assumption that the Earth was cooling from its molten rock core, Kelvin calculated that it was between 20 and 400 million years old (11); in 1895, using newer data on rock thermal conductivities, he estimated it to be nearer 20 million than 40 million years (12). Darwin, in a letter of 1864 wrote 'I am greatly troubled at the short duration of the world according to Sir W Thomson, for I require for my theoretical views a very long period from before the Cambrian formation' (13). It was another chemist, Ernest Rutherford (1871-1937) (14), who was to show that Darwin had a surer grasp of the Earth's great antiquity. Rutherford believed that the Earth's internal heat was driven by radioactivity, and that analysis of radioactive minerals and the half-lives of their constituents could date these ancient materials. He announced this in 1904 (15) and later (16) estimated the age of terrestrial radioactive ores as between 500 and 1,000 million years, from the amount of helium formed by radium disintegration trapped in the minerals. Subsequently, using data on the content of actinium in uranium ores, he calculated a date of 3.4×10^9 (3.4 billion) years (17). The currently accepted figure (18, 19) is $4.57 \pm 0.07 \times 10^9$ years, based on the ^{207}Pb:^{206}Pb ratio (arising from ^{235}U:^{238}U decay ratios) from meteorites.

Finally, Darwin corresponded with over a hundred chemists (19) including Brodie, Frankland, Hofmann, Kolbe, Meldola and Playfair. He collaborated extensively with Sir Edward Frankland (1825-1899), professor at the Royal College of Chemistry from 1865, who sent him chemicals for his experiments at Down House, and analysed for him the pepsin and acid

secretions from the carnivorous sundew plant Drosera. Between 1873-1882 Darwin wrote 31 letters to Frankland, and Frankland 11 letters to Darwin from 1873-1882.

Conclusions Darwin, while no chemist, was fascinated by the subject and collaborated fruitfully with chemists (Blyth, Frankland, Hofmann and others). His early comments on the age of the Weald in part catalysed more direct determination, by Kelvin and Rutherford, of the age of the Earth.

References:

(1) C. Darwin, On the Origin of Species by Means of Natural Selection (John Murray, London, 1859).

(2) Bill Griffith, Chemistry World, September 2009, p. 84.

(3) The Autobiography of Charles Darwin, ed. N. Barlow (Collins. London 1958), p. 46.

(4) Bill Griffith, Newsletter, July 2005, p. 29

(5) E. Blyth, Mag. Nat. Hist. 1835, 8, 40; 1836, 9, 399; 1837, 1 (new series), 1, 77, 131

(6) A.R. Wallace, Ann. Mag. Nat. Hist. 1855, 16, 184.

(7) C. Darwin and A. R. Wallace, J. Proc. Lnnean Soc., Zoology 1858, 3, 45-62; http://www.linnean.org/index.php?id=378 (accessed 7/12//2009)

(8) J. van Wyhe, Notes Recs. R. Soc. 2007, 61, 177; M. Bulmer, ibid. 2005, 59, 125;

(9) C. Lyell, Principles of Geology (John Murray, London, 1830-4).

(10) W. Thomson, MacMillan's Magazine 1862, 5 (29), 388.

(11) W. Thomson, Trans. Roy. Soc. Edinburgh 1863, 23, 157.

(12) Kelvin W.T., Trans. Victoria Inst. 1899, 31, 11; Nature 1895, 51, 438.

(13) Darwin to J. Croll, January 31 1864; More Letters of Charles Darwin; 1903, 2, 162.

(14) D. Wilson. Rutherford: Simple Genius (Hodder & Stoughton, London, 1983); Bill Griffith, Educ. Chem. 2009, 46 (1), 10; 2008, 45 (6), 175.

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(16) E. Rutherford, J. Royal Astronomical Soc. Canada 1907, 145.

(17) E. Rutherford, Nature 1929, 123, 313.

(18) C. Patterson, Geochim. Cosmochim. Acta 1976, 10, 230.

(19) I. S. Williams, Nature 207, 448, 880.

(20) F. Burkhardt et al., eds., Correspondence of Charles Darwin (CUP Cambridge) http://www.darwinproject.ac.uk/ (accessed 7/12/2009)

Bill Griffith
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Synthetic Dyes and Drug Discovery

In the spring of 2008 the Historical Group held a very successful conference on the development of synthetic dyes after William Perkin's epoch-making discovery of Mauveine in 1856. Limitations of time meant that one important aspect of synthetic dyes chemistry could not be addressed - its connection with drug discovery. We published a short article on the use of methylene blue as a chemotherapeutic agent in an earlier Newsletter and follow it up, here, with a longer historical account of the discovery of the sulfonamide class of drug. This article first appeared in Education in Chemistry in May 2002 and is reproduced here by kind permission of the Editor and the three authors.

Prontosil, and its place in the history of drug discovery

The role of chemistry in the control and cure of disease has a long history. Almost 5000 years ago ephedrine - in tea prepared from the Chinese herb ma huang (Ephedra sinica) - was used to relieve asthma. Then, 2500 years later, the Chinese noted that some skin infections could be cured by applying mouldy soy bean curd. Sulfur ointment was later used to treat scabies, and from ca 1500, in Italy, mercury and its salts were used as dubious remedies against syphilis. Most histories of chemical intervention in disease and illness, though, start in the 17th century with the alkaloids, which were crudely extracted from plant sources. Quinine, an extract of cinchona bark, was used to treat malaria in 1619, and emetine, from ipecuanha root, was introduced to Europe as a remedy for dysentery in 1672. As for controlling disease, digitalis from the foxglove plant has been used since 1775 to reduce fluid retention caused by congestive heart failure. Despite these advances, until the middle part of the last century doctors were far better at identifying illnesses than curing them.

A ray of hope…

That chemistry might have a role to play in the prevention of disease came with the work of Joseph Lister, a surgeon at the Glasgow Royal Infirmary. In 1867, following (but perhaps unconsciously) Louis Pasteur's work on the connection between disease and putrefaction by living organisms, Lister used solutions of carbolic acid (phenol) to disinfect wounds. From 1869 he used a spray of carbolic acid in the operating theatre and his innovations reduced the high mortality associated with any but the most minor of surgical interventions. Infection from external agents, such as the bacteria in the often filthy surroundings of hospitals of the day, could at last be controlled. However, there was still the risk from bacteria which entered the body and so the search was on to find some means of effective 'internal disinfectant' to treat disease generally.

In 1891 came a breakthrough with a discovery by Paul Ehrlich. Ehrlich had trained as a medical doctor and had developed a passion for histology, the study of dye-stained body tissues under a microscope. Any abnormalities in the tissues, including the presence of infectious agents, could be observed using this technique. The organism responsible for malaria, a plasmodium, had been discovered in 1880. Ehrlich found that this plasmodium could be stained selectively with methylene blue and reasoned that this dye, which was well tolerated by patients, might be administered in a sufficient dose to stain and then kill the plasmodia. In 1891 he used the dye to treat two patients suffering with malaria (1). Both recovered and 'this small success of this somewhat primitive and empirical trial was a decisive event in Ehrlich's career and a landmark in the history of chemotherapy' (2). His goal became to shoot the microbes with 'magic bullets' without harming the host.

Spurred on by the success of methylene blue, Ehrlich was convinced that the recently discovered coal-tar dyes would provide further 'magic bullets' for other diseases. (After William Perkin's discovery of mauveine in 1856, synthetic dyes - almost all made from coal-tar derived chemicals - became available by the hundreds each year). Ehrlich hoped that among the growing number of 'rainbow-coloured bottles on the chemists' shelves there would be other magic bullets for use against other microbes. He reasoned, however, that since bacteria had been difficult to stain with the new dyes, this approach was unlikely to treat bacterial infections. Nevertheless, he injected mice, infected with a variety of organisms, with a range of synthetic dyes; the mice turned all colours of the rainbow... and then died. Ehrlich then turned his attention to trypanosomes (single-cell parasites). In 1900, Charles Laveran and Felix Mesnil had showed that the trypanosomes responsible for some tropical infections both in humans and in animals could also infect mice. Ehrlich found that the parasite Trypanosome equium was susceptible to a dye he named Trypan red. Sadly, though it cured the infected mice, Trypan red was ineffective in larger animals. Even similarly infected rats failed to survive, despite being treated with massive doses of the dye. Next Ehrlich considered the common venereal disease, syphilis. The biologist Fritz Schaudinn had (incorrectly) shown that syphilis was a protozoan (single cell organism) of the same group as the trypanosome responsible for sleeping sickness, so Ehrlich and his team began to explore the effect of known trypanocides on syphilis. (Had he known that syphilis was caused by a spirillum (a type of bacterium), he might not have made it the focus for his research and the history of chemotherapy might well have taken a different path).

Ehrlich began by using the drug Atoxyl, the sodium salt of 4-aminophenyl arsonic acid, which had been reported by Ayres Kopke as being effective against sleeping sickness (but at a cost: some patients suffered from irreversible blindness). Ehrlich also tried a variety of arsenic-derived drugs against syphilis-infected rabbits but with no success. Success eventually came in 1909 with his 606th compound. Salvarsan — also called Arsphenamine or simply '606' — was born.

Used properly, the new drug destroyed the spirochetes. Ehrlich's dream of an ideal antimicrobial agent, a 'magic bullet' was not truly realized with Salvarsan, since the drug was toxic in large doses, had side effects and in lower doses would cause the spirochetes to develop resistance. Nevertheless the drug had immense practical consequences as the best treatment of venereal disease.., a horrible contagious disease, comparable in its time to the impact of AIDS today (2).

The 'doldrum' years?

But other 'magic bullets' were few. Despite the frenzied synthesis and testing of thousands of dyes and non-dye molecules, chemists only came up with a handful of other molecules, and these generally showed only dubious effectiveness against a small range of diseases uncommon in the Western world. The period 1910-35, from a chemotherapeutic viewpoint, has been termed 'the doldrum years'. Twenty-five years of research along the lines developed by Ehrlich failed to yield results. Iago Galdston, secretary for medical information at the New York Academy of Medicine, recounts that effective chemotherapy was restricted to four distinct antimalarials, six trypanocidal compounds and an almost miraculous spirocheticide... we realise that all the advances were limited to the field of protozoal diseases. All these parasites, those causing malaria, and those of trypanosomal and of the spirochetal or spirillar diseases belong to the animal kingdom. The more common, the more numerous, the more devastating diseases, however are caused by parasites of the vegetable kingdom. Count among these tuberculosis, pneumonia, typhoid, the pus-producing infections, gonorrhoea and the magnitude of their destructiveness is at once apparent. Against these diseases which cripple and kill hundreds of thousands, chemotherapy had, as yet, produced naught (3).

The German syndicate I. G. Farbenindustrie (IGF), which had its origin in several 19th century manufacturers of dyestuffs, did not, however, subscribe to this defeatist view and embarked on a testing programme along the lines first propounded by Ehrlich. Essentially, chemists would test the potential drug against a range of different microbial germs in vitro. If the results were promising, biologists would undertake toxicity tests with the compounds on animals. Finally, if the promise was maintained, in vivo trials on animals and humans would be done. This somewhat 'hit and miss' approach to drug discovery was used for many years by the pharmaceutical industry. Most of IGF's results were as disappointing as Ehrlich's, but one compound showed

potential. This was an azo dye prepared by Fritz Mietzsch and his assistant Joseph Klarer at IGF in 1932. The chemists diazotised 4-aminobenzenesulfonamide (sulfanilamide) and reacted the product with m-phenylenediamine (1,3-diaminobenzene) (Scheme 1).

Scheme 1 The synthesis of Prontosil from sulfanilamide

The resulting dye was sulfamidochrysoidine, more familiarly known by its trade name Prontosil. (The sulfonamide starting material was first prepared by Paul Gelmo in Vienna in 1908 and was seen at the time solely as a precursor to dyestuffs. It was later found to play a crucial role in the curative action of the sulfonamide drugs, but this was several years away).

Accounts that Mietzsch and Klarer's interest lay in the new dyes possible use as a colouring agent (for leather) are probably incorrect, Mietzsch was a medicinal chemist noted for his work on barbiturates, and in the early 1930s he was investigating the use of azo compounds as potential bactericides. It was Gerhard Domagk (see Box), however, another IGF chemist, who realised the compound's potential as a chemotherapeutic agent against bacterial infection, According to Domagk '...in the course of our investigations we encountered a group of very non-toxic azo compounds which had no in vitro disinfection effect against streptococci, but revealed a clearly recognisable effect in experiments with mice. This group (Domagk and his team) heard that Prontosil had been synthesised by Mietzsch and Klarer in 1932. With Prontosil we observed the best ever chemotherapeutic effects against streptococcal infections in animals' (4).

But why did Domagk persevere with expensive animal tests, when the test tube experiments were unpromising? And why did it take him three years to announce his discovery to the world? We think the answer to the first question lies in his awareness of results published by Ivan Ostromislensky.

In 1930 Ostromislensky reported that 4-ethoxyphenylazo-2,4-diaminobenzene (1), which has many structural features of Prontosil, was effective as a 'urinary antiseptic' and was partially effective in treating the venereal disease, gonorrhoea.

The fact that it showed an *in vivo* activity may have spurred Domagk to side step part of the Ehrlich testing protocol and 'chance his arm' with animal testing using some of his molecules. As far as the delay in publication is concerned, Leonard Colebrook, one of Domagk's admirers, makes some suggestions, though one senses he has some difficulties: Three years elapsed before his striking result was reported... (in) 1935. It is not clear whether publication was delayed until conclusive evidence was available as to the effects of Prontosil on human infections, or whether Domagk (and possibly other workers) had difficulty in repeating the 1932 experiment in its perfection. In retrospect it seems probable that any such difficulties may have been chiefly due to the fact that strains of streptococci used by different workers varied in their susceptibility to Prontosil, and that more than one dose of the drug was often required to protect the mice indefinitely (5).

In delaying the publication of his work Domagk allowed other researchers (Förster in 1933, and Grütz in 1934) to report on the effectiveness of Prontosil against various forms of bacterial infections, but it is generally agreed that their results 'were too obscure to deserve much notice' (6).

Moving on...

Later developments lay in two areas. First, attempts were made to establish the mode of action of this class of drugs. The breakthrough came in 1940 with the discovery by Donald Woods, working at Oxford University, that their effectiveness was antagonised by a constituent of yeast extract, namely p-aminobenzoic acid. This acid is essential for the biosynthesis of folic acid, which in turn is essential for the growth/replication of microorganisms (Scheme 2). Prontosil, and all the other sulfonamide drugs, break down in the body to yield Gelmo's sulfonamide. This is so structurally similar to the aminobenzoic acid that it is incorporated by the microorganism, but is then metabolically inactive. If there is enough sulfanilamide, there will be too little p-aminobenzoic acid to support the growth and replication of the microbe.

The sulfonamides are bacteriostatic rather than bacteriocidal – ie they do not kill the bacteria themselves, but prevent their replication, while the body's own defences do the actual killing. As they are no longer battling an ever-increasing infective agent, the body's own immune system eventually succeeds.

Secondly, armed with the knowledge that the sulfanilamide portion of the Prontosil was the curative moiety, this structure was incorporated into a variety of analogue molecules with the intention of enhancing its behaviour. Some early successes are included in Box 2, together with indications of their advantages over the parent Prontosil.

The end of the multi-coloured rainbow leads, some believe, to a pot of gold, but this was not the case for I. G. Farbenindustrie, Domagk's employer. The active metabolite, sulfanilamide, was in the public domain and could not be patented. But the search for the pot of gold remained the main stimulus for pharmaceutical firms to pursue their researches.

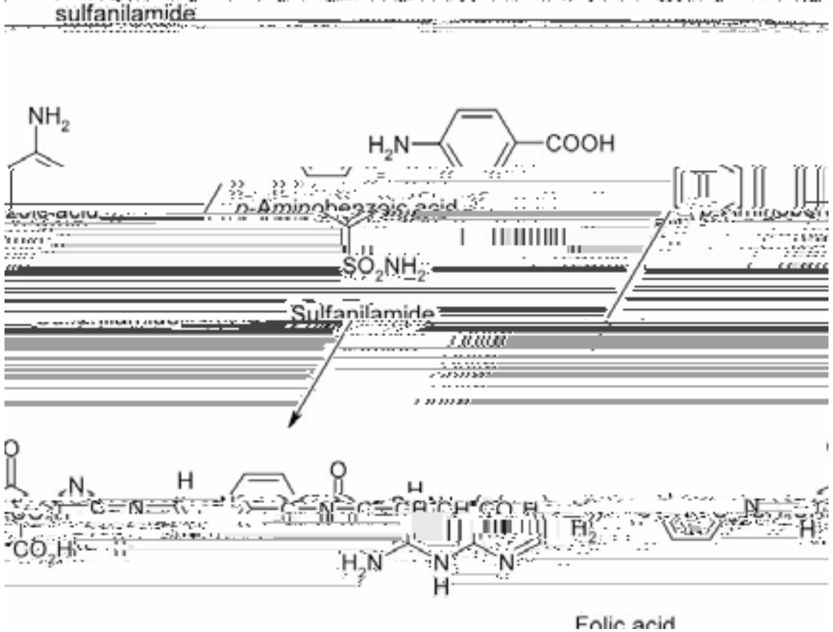
Thanks to sulfonamide therapy, diseases which had been associated with dispiriting mortalities saw a dramatic reduction in their death rates. Typically, there were 1750 deaths from scarlet fever in England and Wales in 1935. By 1940 this figure had dropped to 250. In 1934 these compounds were practically unknown. In 1941, 10-15 million people in the US were treated by sulfanilamide and its analogues. By 1943 this had risen to 130 million (6). It is probable that no therapeutic remedies have since been developed so widely in so short a time. However, by the late 1940s penicillin therapy became the preferred option because it was active against a wider spectrum of disease and caused fewer side effects (7).

Diseases in which only the sulfa drugs are recommended are now few and have been restricted by the emergence of acquired resistance in many of the previously susceptible organisms. Their principal value is in treating urinary tract infections in combination therapy. Their use in treating respiratory infections is restricted mainly to *Pneumocytis carinii* pneumonia. This pneumonia, once rare, is ever-increasing as an opportunistic infection owing to AIDS. The value of sulfonamides in treating meningococcal infection (meningitis) is reduced owing to bacterial resistance. Sulfonamides are occasionally used for trachoma, sexually transmitted chlamydial infections, and for drug-resistant malaria and toxoplasmosis.

On reflection

It is interesting to reflect that the process for identifying effective antibiotics described by Ehrlich became the standard in the pharmaceutical industry for many years. Only more recently, with improved understanding of how drugs interact with the body through receptors, and the precise shape of molecules necessary to interact with receptor sites, has it been possible to begin to design, rather than discover new pharmaceuticals. And just as a rainbow has to have a prescribed shape, so do these modern drugs.

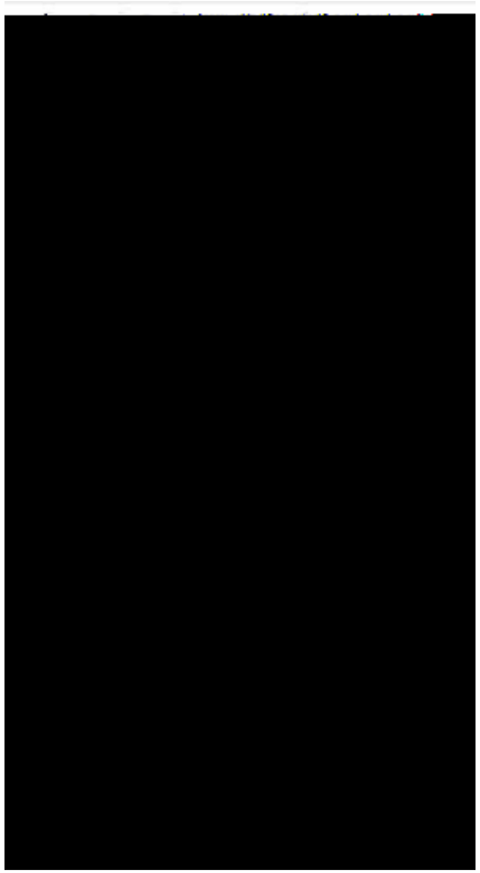
Scheme 2 The relationship between folic acid, p-aminobenzoic acid and sulfanilamide



Gerhard Domagk

Gerhard Johannes Paul Domagk was born in 1895 in Lagow, Germany, the son of a school teacher. He studied medicine at the University of Kiel, graduating (after war service) in 1921. After six years of university teaching posts he, joined the German chemical syndicate I. G. Farbenindustrie as director of research, examining many thousands of chemicals for drug potential. It was here that he discovered the action of Prontosil, publishing in 1935. In his later work he moved from his sulfonamide-related studies to focus on tuberculosis (mainly using thiosemicarbazide therapy) and cancer. Domagk died in 1964. For his work in opening up the sulfonamide era of therapeutics and saving hundreds of thousands of lives as a result, he was awarded the Nobel Prize for Medicine in 1939. Shortly after being notified of the honour he was obliged by the Nazis to decline the award. (When Carl von Ossietsky, a German pacifist opposed to the regime was awarded the Peace Prize in 1936, a furious Adolf Hitler decreed that no German should

henceforth accept a Nobel Prize. It was only after World War II that Domagk was able to travel to Stockholm to receive the honour)



Acknowledgement: We thank Michael Greenwood (University of Derby) for helpful comments. Galdston (3) provides a readable historical account of disease and its treatment. Colebrook presents a short account of Domagk's scientific work (5). More general biographical work relating to Domagk is available on the Internet (8).

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Alan Dronsfield (University of Derby)
Peter Ellis (University of Otago, New Zealand)
and John Cassella (University of Staffordshire)

Crunch Times for British Chemistry

Recently (1, 2), I presented accounts of the dramatised version of my 'Victory Place Magenta Story', which was acted by local 10 year olds (3), as part of National Science Week 2009. This was the 17th science play I had researched, written and produced on, or near, the actual sites where significant scientific events had occurred. In this case, it was the site of the long forgotten Southwark dyeworks of Messrs. Simpson, Maule & Nicholson, where the family of beautiful Magenta dyes was born which, incidentally, established a new chemical principle that not only started an under-standing of colour and chemistry, but also was later to play an important part in Biological Chemistry.

The actual event ended with the singing of the song I wrote in praise of the spirit and teachings of the man who had inspired much of the work at Victory Place, Professor A.W. Hofmann. That song was sung so lustily and joyously that it indicated to me the event had been a happy one, and the main thing left to do was to assess the transfer of the essentials of the play to the children. In previous schools this has been done by each of the actors writing a short post-performance account of the play, followed by key-word analysis, by me, of those accounts.

Typically, other schools have provided about 92% of the cast's potential post-performance accounts of the play. Only 4 (15%), of the promised accounts were eventually received from Victory Place, of which, only one (4%) of these actually referred at all to the play's contents, and that from a girl who volunteered she wanted to be a chemist. Only one other child

D.H. Leaback (1973)

The above image shows the Atlas figure that once stood proudly above the Hackney Wick office building of Simpson, Maule & Nicholson over-looking the well-appointed Atlas Dyeworks serviced by the large smoke-stack (right), which later (ca.1911?) bore the Bronco logo of a subsequent maker of toilet paper.

originally from the class would have seemed likely to have coped with chemistry as in our earlier project with 6 year olds (4). The father of that other responsive child told me his son was way ahead of nearly all his class mates in all subjects, so he was removing his son to another school. He added that he saw no future for his son in a school beset with absenteeism, police trouble, and pupils from broken homes. Such matters clearly need much attention to remedy the above wide educational performances. Will those extra resources be available for such children in their crucial learning period, in these present stringent financial time?

When the girl with aspirations to be a chemist asked, I told her how the dyeworks soon outgrew the Victory Place site, and a bigger workplace was built at Hackney, with a research block, a tall central chimney and a giant Atlas figure proudly proclaiming aloft their successful pioneering venture. In fact, that transformation of the marshy Hackney site into an ideal one for industrial chemistry had been a costly heroic task, so when a good offer for the enterprise came from a new partnership headed by a rich Manchester merchant, Edward Brooke, the opportunity to fulfil Hofmann's prediction that the U.K. would dominate this new industry, fell to Messrs Brooke, Simpson & Spiller.

But early signs were ominous when W.H. Perkin saw the new owners neglecting the efficient, profitable processes he had painstakingly established. Brooke left all that to lowly chemists, while he engaged in both his social aggrandisement and lavish furnishing of his mansions. Eventually German competition and a looming credit crisis brought the decline of the Hackney enterprise to his attention. Brooke belatedly took on some good chemists, but the chances of fulfilling Hofmann's prediction faded and died there when Brooke, Simpson & Spiller ceased trading in 1906. Not long after, a firm of paper-makers moved in, and Nicholson's tall chimney soon sported the name of their Bronco toilet-paper, while lofty Atlas still looked steadfastly away.

Many years later, I contacted the last chemist at Hackney Wick's Atlas Dyeworks, Mr. H. Wilkinson. He told me that the firm failed largely because its directors, greedily and irresponsibly took too much from its resources, rather than wisely investing their way via youngster's vigour and research, to new socially-useful products beyond the 'credit crunch' impact of their time.

David Leaback
Biolink

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RSC National Historical Chemical Landmarks

Chemical Landmark Award for Joseph Black to Edinburgh and Glasgow Universities

This took place on Tuesday 4th August 2009 at the Scottish Exhibition and Conference Centre, Glasgow as part of the IUPAC Congress. The proceedings started with a lecture by Robert Anderson on 'The Noblest Prospect? Diasporic Scottish Chemists'. This considered the significance of the schools of chemistry set up by Joseph Black in the eighteenth century. His lectures first at Glasgow and then at Edinburgh were very influential. Dr Anderson considered the many Scottish trained medical students who found posts teaching chemistry in English and foreign universities. He mentioned in particular the strong links between UCL's chemistry department and Edinburgh (Edward Turner, Thomas Graham, Alexander Williamson, William Ramsey).

After the lecture a Chemical Landmark Award for Joseph Black was presented by Dr Anderson to the Universities of Edinburgh and Glasgow. He started by talking about the life of Joseph Black, a topic he was well placed to give as he has been working for a number of years on the correspondence of Joseph Black. This research will be published in 2010.

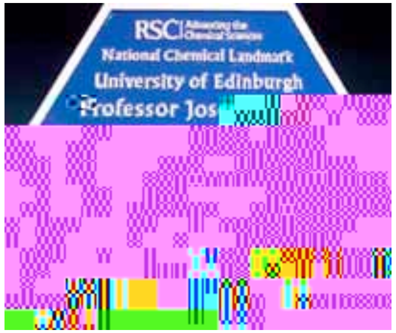
Joseph Black was born in 1728 in France. In 1740 he went to the Latin School in Belfast and in 1744 to Glasgow University. After a general arts degree in languages and philosophy he studied medicine. He was much influenced by William Cullen who had been appointed in 1747 to a newly established chemistry post. He encouraged his students to conduct experiments, an approach which Black adopted with enthusiasm. In 1752 he transferred to Edinburgh to complete his medical degree. His dissertation (in Latin) was on magnesia alba (basic magnesium carbonate). In 1754 he was awarded his MD.

At first he practiced medicine in Edinburgh but when Cullen was appointed to a post at Edinburgh Black, aged 28, took Cullen's post at Glasgow. In 1766 Black returned to Edinburgh. His lectures each year at Glasgow and then Edinburgh ran from 1757 to 1796 and were approximately 128 lectures given each weekday from 10-11am and sometimes on Saturday between November and May. Each lecture had plenty of practical demonstrations.

Black's experimental work included the discovery of latent heat, although this was a result he did not publish. He spent much time as a consultant to local industry. James Watt, who was appointed an instrument maker at Glasgow University (1756), became involved in Black's works and conducted experiments on steam with Black.

Attendees were presented with a useful booklet with a much fuller life of Joseph Black.

Gerry Moss



RSC Chemical Landmark Award: Professor Edward D Hughes and Bangor University 23 October, 2009

An application for the Chemical Landmark was made by the North Wales Local Section, citing firstly, the major contribution to the development of kinetics and mechanisms in organic chemistry by Professor Ted Hughes and, secondly, for Bangor University and Chemistry celebrating its 125th anniversary. The support and information from staff in Chemistry at Bangor was much appreciated. The Chemical Landmark Ceremony was part of the Chem 125 celebrations, Oct 22/23, at Bangor University comprising an open day, a Commemorative Book launch (www.bangor.ac.uk/chem125), displays, shows and a superb lecture by Prof Sir John Meurig Thomas. The RSC was represented by Professor David Philips, Council member and President-Elect, by Pauline Meakins, Landmark co-ordinator and by many Local Section members. Professor Philips presented the Plaque to the Vice Chancellor, Professor Merfyn Jones and to Dr Mike Beckett, Acting Head of Chemistry.

Professor Ted Hughes was a trailblazer in kinetics and mechanisms in organic chemistry. As a researcher in the period, 1928-63, Hughes's work changed the aspect of organic chemistry by progressively replacing empiricism by rationality and understanding. Hughes was a long time colleague and friend of Sir Christopher Ingold, equally recognised for this area.

Hughes and Ingold introduced the mechanism terminology of S_N1, S_N2, E1 and E2 to organic chemistry in the mid-1930s and behind this was a multitude of carefully planned reactions, a talent that Hughes possessed. The understanding that Hughes and others, but not always, Ingold developed on substitution and elimination will be core to every first/second year university chemistry course across the world.

Hughes, son of a farmer, was born near Criccieth, in Gwynedd, close to where David Lloyd George was brought up. His first language was Welsh and he was educated at Llanstumdwy Elementary and Porthmadog County Schools. He graduated with a 1st Class Honours in Chemistry at UCNW, Bangor and obtained his Ph.D. also from Bangor in 1930 with Ingold as the external examiner. During this period, under the Leadership of Professor K. Orton, Bangor was one of the finest centres of physical chemistry in the world.

He joined Ingold's new group at University College, London (UCL) where he stayed until 1943 when he was appointed to the Chair of Chemistry at Bangor. Hughes developed an active research programme at Bangor and his best-known work during this period was the development of a method for isolating isotopically enriched water from natural water by continuous fractional distillation. This technique yielded O-18 enriched water that could be used to trace the fate of particular O atoms in a substrate molecule undergoing reaction and thereby elucidating the mechanism of the reaction. We understand that this was the first time 18-O had been separated by distillation in the UK and would have opened the door to enormous advances in Chemistry, Biology and Nuclear Physics. During his tenure at Bangor, Hughes maintained his collaboration with Ingold by his appointment as Honorary Research Associate at UCL. It is also worth noting that Ingold spent the time during the 2nd World War at the University of Aberystwyth.

In 1948, Hughes moved back to UCL to a Chair in Chemistry where he remained until his death in 1963, aged 57. He was elected a Fellow of the Royal Society in 1949. While Hughes was dedicated to Chemistry, he had a love of breeding and racing greyhounds. When he died, he left a wife, a daughter and 57 greyhounds. Ted Hughes must surely be one of Wales's most eminent and productive chemists. The names of Hughes and Ingold are giants in organic chemistry and Bangor University was a key location along this journey. A true Welshman, born and educated in Gwynedd, Hughes's contribution to organic chemistry would be well recognised by an RSC Chemical Landmark being designated at the Chemistry Department at Bangor University.

The Landmark recognition acknowledges both Professor Ted Hughes's contributions and the 125-year history of Chemistry at Bangor. This is the first such recognition in Wales. Being bilingual, it is also the only Landmark to contain the Welsh language. Bangor University has a strong tradition and current strength in bilingualism with Chemistry and many other Schools at Bangor providing such facilities. Bangor School of Chemistry was recently awarded a Welsh Medium Fellowship for sustainable Welsh Medium delivery of Chemistry courses.

The whole day, October 23, was truly outstanding with about 200 people present and the Chemical Landmark presentation was one of the highlights.

Dr E Malcolm Jones
Secretary North Wales Local Section

Chemical Landmark Award to the Harwell Laboratory

This took place on Wednesday 25th November 2009. Some 100 former employees and representatives of the RSC were welcomed by Alan Neal, Managing Director of Research Sites Restoration Ltd (RSRL), the company responsible for decommissioning the laboratories. There were four presentations associated with this event:

Dr John Wilkins outlined the history of the laboratory, starting from the opening of the site in 1946

Alan Neal reviewed the activities of RSRL in the removal of contaminated equipment and rendering the site suitable for other uses

Dr Sally Ann Forsyth, Director of Science Parks, Goodman Ltd, spoke of the intentions to develop the site, capitalising on its worldwide reputation for excellence in science. At present the site was a base for 4,500 employees across 140 organisations. As the 'Harwell Science and Innovation Campus' this would expand to 7,000-10,000 jobs

Lady Barbara Judge, Chair of the UK Atomic Energy Authority, addressed the need for nuclear power in today's world and the public's perception of it.

The Landmark Plaque was presented to Alan Neal by RSC President Professor Dave Garner. The text on the plaque reads:

Harwell Laboratory
In recognition of the
pioneering research and development work
performed by scientists at Harwell since 1946.
Their work has provided fundamental support
in the development of nuclear power in
the UK and a greater understanding
of the chemistry of the
actinide elements.

The Historical Group was represented by its Chairman.

The following account of the work of the Harwell laboratory has been adapted from *B220 - Sixty Years of Scientific Discovery*' published by Research Sites Restoration Ltd to commemorate the Landmark award:

'For sixty years, Harwell's radiochemical laboratories have been at the heart of the UK nuclear chemical industry, initiating and developing much of the original science and technology upon which that industry was based, and attracting and fostering the skills of some of the country's most talented and forward-thinking scientists.

In 1946, with the nuclear industry in its infancy, it was recognised that a specialised building was needed to carry out chemical studies of radioactive materials. The then Atomic Energy Research Establishment – later the United Kingdom Atomic Energy Authority – had just been set up at Harwell and was initially undertaken in modified RAF buildings already on the site. It was soon recognised that a specialist laboratory was needed and the building that emerged, known as B220, was completed in 1949. It was the only radiochemical building of its kind in Europe and the most advanced to be built anywhere in the world.

It is essentially the same building that has remained in use until the present day, housing scientists who collectively have greatly increased the sum of our radiochemical knowledge and making important discoveries in areas such as reactor fuels, medical radioisotopes and the management of nuclear waste.

As part of the national atomic energy research and development programme, scientists at the Harwell laboratories studied the chemistry of irradiated fuels and actinides – radioactive heavy metals such as plutonium, protactinium and neptunium. At this time they led the world in the development of reprocessing techniques to isolate and purify plutonium from radioactive fuel.

Today's mature nuclear industry no longer required a large-scale facility like the radiochemical laboratories and since the mid-1990s a progressive programme of decommissioning has been underway. In the last 15 years a total of 350 glove-boxes used for the handling of radioactive materials have been decontaminated, dismantled and removed. Several laboratories have been decommissioned and much of building B220 is now empty and safe for conversion to alternative use. It will remain as a testament to the many fine scientists and engineers who have worked there down the decades in the furtherance of the UK's nuclear power industry.'

Alan Dronsfield
University of Derby

BOOK REVIEWS

Keith Baker, *Joseph Priestley; friends and foes – remarkable lives in an age of revolution* (Leeds: The Priestley Society, 2009) £12.50 + £2.00 postage from the author (keith.baker3@virgin.net) 75 Hillcote Close, Sheffield S10 3PT.* Pp 176; ISBN 0-9558077-1-9 (pb)

For Newsletter readers wishing to delve into the life and work of Joseph Priestley, one of the 18th century founders of our subject, we have four main resources:

- Priestley's books, papers and pamphlets, many of which are now available for downloading from the Internet
- His entries in the Dictionary of Scientific Biography (and presumably the new 2008 version, but I haven't checked this) and the Oxford Dictionary of National Biography
- Single volume dedicated biographies such as the one recently written by Isabel Rivers and David L. Wykes: *Joseph Priestley, Scientist, Philosopher, and Theologian*
- The information concerning him in Volume 3 of Partington's *History of Chemistry*

This last work is usually my first port of call and Partington provides us with a 64 page 'block' entry, second only to that for Lavoisier, together with some 100 references scattered across the remainder of the volume. From Partington's writing we get some information about Priestley and his

character, but not much. Mainly, as one would expect from this particular historian of chemistry, it is a scholarly account of his contributions to our subject.

Keith Baker, the author of this attractively illustrated volume, provides us with complementary information to enable us to get an impression of Priestley, the man, his character and the relationships he had with some of his contemporaries.

Thus we have nine chapters devoted to his principal friends and foes – one chapter apiece – and two 'omnibus' ones (one to King George III, William Pitt and Edmund Burk, and another to the three USA presidents with whom he had some interactions: Washington, Adams and Jefferson). Baker counts among Priestley's 'friends' Benjamin Franklin, Richard Price (a radical dissenter and scholar), John Wilkinson (iron master, entrepreneur and inventor), Anna Barbould (writer, poet and religious essayist), Theophilus Lindsey (clergyman, described here as Priestley's closest friend) and Thomas Cooper (writer, lawyer and political activist). As to Priestley's 'foes', we have substantial accounts of Samuel Horsley (bishop and high church conservative), William Cobbett (essayist, satirist and political writer)... and Antoine Lavoisier, with whom Priestley fell out, feeling that his work on the discovery of oxygen was being undervalued, and even appropriated, by the French chemist. This chapter, some 13 pages long, contains the actual bulk of the chemistry in the book.

Baker writes perceptively on his subjects (see example below as an illustration) and this volume is an important addition to our knowledge of Joseph Priestley. The author is to be complimented on perceiving the need for this book, and then writing it, and the Priestley Society for undertaking its publication.

> 'The approach of Priestley and Lavoisier to scientific investigation was quite different. Priestley was primarily a theologian, who believed that a study of science would provide further understanding of God's grand design on earth. Lavoisier dedicated his life to science and used to explain the world without any intervention of divine providence. Priestley was an outstanding experimenter who never claimed to be a theorist although he was meticulous in his preparation and recording. He liked to gather together all the information and then begin the task of making sense of it... Lavoisier took the opposite or the modern approach to scientific investigation. He rarely experimented by chance. He proposed a hypothesis first, and then searched for evidence to complete the chain of thought, thereby reconciling apparently disordered facts into the framework of an orderly theory. Applying this

approach enabled Lavoisier to change chemistry from a qualitative to a quantitative science and he is justly regarded by many as the Father of the Modern Chemistry.'

*Also available from Amazon

Alan Dronsfield
University of Derby

Laurence Lestel (coord.), *Itinéraires de chimistes: 1857-2007, 150 ans de chimie en France avec les Présidents de la SFC* (Les Ulis/Paris: EDP Sciences/SFC, 2007). Pp 582, ISBN 978-2-86883-915-2 (hb)

This is yet another volume to add to our growing collection of dictionaries of chemists' biographies. In my view, the interest of this particular volume is double: 1) its selection of biographical entries is drawn from the Société Française de Chimie (SFC); 2) it is beautifully produced and well conceived. Indeed, *Itinéraires de chimistes* provides those interested in the history of chemistry in general, and of French chemistry in particular, with a wealth of information on French contributions to chemistry in the last 150 years, that is to say since the SFC's creation in 1857. The SFC was the first chemical society to be formed after Britain's Chemical Society, in 1841 (the Deutsche chemische Gesellschaft was not created until 1867). It was founded in the heyday of French chemistry, at a time when names such as Michel Eugène Chevreul, Jean-Batiste Dumas, and Marcellin Berthelot attracted foreign students to study under them. It is therefore no surprise that the two first Presidents of the Society were not French, but Italian and Norwegian, or that the President elected in 1887 was of Portuguese origin, and had practiced pharmacy in Hong-Kong, before moving to Paris where he taught chemistry. In this way, the SFC contributed to the internationalisation of science at the end of the nineteenth century, and continued to do so throughout the twentieth century, participating in the activities of the International Union of Pure and Applied Chemistry (IUPAC), and in the establishment of European journals of chemistry, starting with the *Journal of Chemical Research* (1977).

However, the biographical entries in *Itinéraires de chimistes* also touch upon some features characteristic of the French school of chemistry, and as such offer historians scope for investigation of topics that have so far largely been overlooked in the historiography. These features include: the gradual extension of the Society's work from Paris to the Provinces, with the opening of local sections, beginning with Nancy in 1895; the important part played by pharmacists and physicians in the development of the Society's activities, and of chemistry in France more generally; the somewhat hesitant relationship between academic and industrial research, with the

establishment of an industrial section in a first, failed attempt in 1894, which was repeated, and this time successful, as late as 2006. Last but not least, the difficulties and dilemmas involved in being scientists under the Vichy government and German Occupation during World War Two are addressed in several biographical entries, especially those of Ernest Fourneau, Pierre Joliot-Curie, Henri Moureu, and Jacques Tefouël.

Itinéraires de chimistes is beautifully produced and well conceived, with numerous portraits and photographs. It begins with a helpful summary of the Society's history in an introduction written by the volume's coordinator and President of the SFC's historical group, Laurence Lestel, followed by 88 biographical entries, each of them summarised in English. The entries include not only past Presidents, but also Honorary Presidents, and French winners of the Nobel Prize who were members of the SFC, such as the only two women included in the book: Marie and Irène Curie.

In sum, this is an interesting and well produced dictionary of biography, whose value lies as much in the questions it opens up for further research, as those it answers, and I am happy to recommend it to members of the °ÄÃÅÁùºÏ²Ê¿ª½±¼ÇÂ¼HG.

Viviane Quirke
Oxford Brookes University

MEETING AND CONFERENCE REPORTS

Chemists and the Law. Friday 23 October 2009.

This meeting was organised by the Royal Society of Chemistry Historical Group and was held in the Council Room at Burlington House. The meeting attracted about 50 people, in the main members of the Historical Group.

When the Committee first discussed the idea of a meeting on the theme of chemists and the law and began to identify the possible topics that might be addressed it became evident quite soon that some selection would be necessary. Nevertheless, the final programme reflected a connection between the law and various areas of chemistry including, food and drink, pharmaceuticals and drugs and the detection of poisons, as well as some case studies where chemists began to appear in court cases as expert witnesses during the early part of the 19th century. While the meeting concentrated on historical aspects it was also felt important to reflect on the modern role of chemist in forensic science and how evidence is presented as part of criminal casework. In total there were seven talks.

Each talk gave rise to a number of questions from the audience and these helped to broaden out the topic and allow the speaker to elaborate further points excluded from the talk by limitations of time. Overall the meeting seems to have been well received by all those attending.

Abstracts

Frank James (Royal Institution London), 'An old practitioner at the bar – Michael Faraday in the court-room'

Using two case studies relating to Michael Faraday's role as a scientific expert in court, James drew attention to the problems surrounding the use of scientific knowledge and expertise in a legal setting. Following a disastrous fire in 1819 in a sugar factory, the insurers refused to pay the £70,000 to repair the damage caused because, they argued, they had not been informed of a change in manufacturing process which in their view increased the risk of fire. In the ensuing case prominent chemists, including Faraday, Friedrich Accum, William Allen, John Bostock, William Thomas Brande, John George Children, Samuel Parkes and Richard Phillips appeared on both sides of the argument as to whether the change in process had invalidated the insurance policy. Such opposing expert testimony annoyed the judge who found the whole process a 'humiliation for science'. The insurance company, for whom Faraday gave evidence, lost the case. James's second case study was the 1844 inquest into to explosion at Haswell Colliery, County Durham, in which ninety-five men and boys had been killed. At the personal request of the Prime Minister, Robert Peel, Faraday and the geologist Charles Lyell took part in the proceedings of the inquest. Peel's involvement indicated the politically sensitive nature of the inquest which followed a bitterly contested strike in the North-East coalfield. Although the inquest returned a verdict of accidental death (thus exonerating the mine owners from any responsibility), with which Faraday and Lyell agreed, their subsequent report so embarrassed the government that Peel has to resort to political tactics in the Commons to suppress it. The explosion and its inquest subsequently entered into Marxist literature and was, for instance, discussed in Frederick Engels's *Condition of the Working Class in England*. James concluded from both case studies that the historian could not isolate the court room from the rest of society, but that science, politics, business and the law were inextricably linked through the legal process.

Further reading:

June Z. Fullmer, 'Technology, Chemistry and the Law in Early 19th-Century England', *Technology and Culture*, 1980, 21: 1-28.

Frank A.J.L. James and Margaret Ray, 'Science in the Pits: Michael Faraday, Charles Lyell and the Home Office Enquiry into the Explosion at Haswell Colliery, County Durham, in 1844', *History and Technology*, 1999, 15: 213-31.

Peter Reed (Leominster, Herefordshire), 'Robert Angus Smith – A Traumatised Expert Witness'

On 24 August 1857 Robert Angus Smith, then a consulting chemist in Manchester, appeared in the court case, Regina v Spence, at the Civil Court in Liverpool. The court case was brought by the Corporation of Salford against Peter Spence's alum works in Pendleton, Manchester. Smith appeared as an expert witness for the defence, having previously inspected the works for nuisances such as ammonia, sulphur dioxide and hydrogen sulphide that had been alleged by inhabitants close to the site of the works, and found quantities of these gases in smaller concentrations than usually contained in the air of Manchester. Edward Frankland, then Professor of Chemistry at Owens College and who like Smith had inspected the works and found them well operated, appeared for the prosecution. At the conclusion of the case the jury found Spence guilty causing a nuisance (though not injurious to health).

Smith was great troubled by the outcome of the case. He had taken considerable care preparing his testimony, basing it on his scientific investigations of the works, but felt his testimony was undermined and scientific contradictions were contrived through counsels' cross-examination. He also became concerned that the services of 'professional witnesses' might be bought.

The experience of the 1857 case prompted Smith to start campaigning through the National Association for the Promotion of Social Science, the Law Amendment Society and the Royal Society of Arts, for changes to the way expert witness testimony was presented in court. This led others to take up the cause; William Crookes used editorials in *Chemical News*; the British Association for the Advancement of Science had a standing committee from 1862 led by Rev. Vernon Harcourt; *Nature* and leading newspapers, including *The Times*, ran articles.

The talk also showed the possible link between the experience of the court case and Smith's avoidance of court action against manufacturers when appointed Inspector under the Alkali Works Act in 1864 and relying more on the peripatetic role of the Inspectors (much to the consternation and chagrin of his civil service colleagues) that proved so successful in enforcing the terms of the legislation.

Katherine D. Watson (Oxford Brookes University), 'Forensic Chemists in English Trials for criminal poisoning, 1750-1950'

Forensic chemists (even if they did not always use that term to describe themselves) have been a regular presence in poisoning trials since the late eighteenth century. To explain how their professional profile changed over time, the two centuries from 1750 to 1950 have been divided into five distinct periods of development, each of which corresponded to the appearance of a particular type of witness in trials for criminal poisoning. The nature of poisoning crimes meant that both medical and chemical evidence was required to prove it, but throughout much of the period it was those who provided the chemical evidence, rather than the pathological evidence, who had distinctive career patterns and who could lay claim to a specialist body of knowledge.

Local surgeon-apothecaries (1750-c. 1836) were superseded by professional (mainly academic) chemists and toxicologists (1836-c. 1880) as the Medical Witnesses Act of 1836 authorized coroners to pay for an autopsy and analysis. The academics were slowly displaced when the new role of the public analyst was created in the 1870s. In 1871 the role of Home Office Analyst was created, and those who held the post (all of whom had medical training) gained national reputations as medical detectives. Finally, during the 1930s the Home Office Forensic Science Service was founded, employing scientists who could take on a variety of forensic tasks. Chemists remained part of the team needed to investigate a suspected case of criminal poisoning, but do not seem to have achieved the same degree of public visibility as their pre-war predecessors, the medical detectives. But by that time, poisoners too had become far less the figures of media interest that they had once been.

Anna Simmons (University College London), 'From adulteration to pharmacopoeias: The Society of Apothecaries and the regulation of drugs prior to the 1852 Pharmacy Act'

Through a succession of Acts of Parliament, a legal framework for drug regulation emerged during the nineteenth century, the efficacy of which was much debated. The ongoing discussions involved numerous groups participating in the medical marketplace, whilst individuals such as Friedrich Accum and Arthur Hill Hassall helped to provoke a public debate about drug adulteration. This paper explores the ways in which a City of London Livery Company, the Society of Apothecaries, sought to regulate the supply of drugs in the capital from its foundation in 1617. The Society aimed to achieve a form of regulation in two ways. Firstly, it acted as a guarantor of drug quality by supplying reputable products. It manufactured medicines at its laboratory at Apothecaries' Hall from 1672 and rigorously employed all available methods to ensure high quality. Secondly, the Society set and upheld standards in drug production through its involvement with the College of Physicians in the *Pharmacopoeia Londinensis* and in the inspection of apothecary shops. Initially poor quality drugs were burnt outside the offender's shop, but this was superseded by private destruction

and fines. The powers given to the Society under the Apothecaries Act of 1815 prompted it to inspect apothecaries' shops without the College on a wider geographical basis. However most vendors of medicines were outside of the Society's regulatory powers and, unlike in the eighteenth century, the Society had no desire to police the marketplace for drugs. Whilst the 1850s saw growing calls for legislation to combat drug adulteration, the Society had little interest in influencing the legal framework that would emerge.

Mike Saltmarsh (Inglehurst Foods) 'Buyer beware: food law before 1900'

Food and drink has been the subject of fraud and adulteration since it was first traded. By the 19th century the situation in the UK was so bad that it was said that 'It would be difficult to mention a single article of food which is not to be met with in an adulterated state, and there are some substances which are scarcely ever to be procured genuine'. (Accum). Generally frauds could not be detected once the ingredients (ash and elder leaves for tea, roast and ground peas and beans for coffee and cocoa) were mixed, so the law concentrated on prosecuting those on whose premises the adulterants were found. In 1850 the Chancellor of the Exchequer said in Parliament that he had been assured that it was impossible to tell if coffee had been mixed with chicory. Arthur Hill Hassall proved that the two substances, and many others, could be identified under a microscope. As a result, from 1851-54 he was employed by The Lancet to examine retail purchases and report on them under the title of the Analytical Sanitary Commission. At the same time, chemical and physical methods were being developed to identify other contaminants including the presence of lead from lead acetate used as a sweetener in wine. The increased public awareness of adulteration and the ability to detect it brought sufficient pressure on Parliament to force it to act and the first Adulteration of Food Act was passed in 1860. While this allowed local Boards of Works to appoint analysts, it was largely ineffective and it was not until 1899, after a series of Acts in 1872 and 1875, that a sound basis for the protection of food and drugs from adulteration and contamination was enacted.

Reference:

F. Accum, A treatise on adulterations of food and culinary poisons (Longman, Hurst, Rees, Orme and Brown, London 1820)

Roger King (Key Forensic Services Ltd), 'From Sherlock Holmes to CSI: developments in chemistry in the 20th century'

This talk traced developments in forensic science in the 20th century. The methods available at the time Sir Arthur Conan Doyle was writing the Sherlock Holmes stories were compared to those used in CSI: the hugely popular (and grisly) American TV series. While the speaker admitted to no qualification as an historian, he did offer an eye-witness account of many of the advances he described.

The speaker traced how forensic science was organized in the UK, from the first police laboratory established by the Metropolitan Police in 1935 to the commercial market that now exists for forensic science services in England and Wales. The 1985 Bradford City FC fire was used to demonstrate the teamwork, patience and persistence required to collect good quality evidence from a scene.

Advances in marks and traces evidence, the identification of body fluids, drugs, explosives and digital evidence were described. Finally, the application of Bayesian statistics to the interpretation of evidence was discussed.

David Jarratt-Knock (Key Forensic Services Ltd), 'Modern day forensic science: crime scene to court case'

Historians in the twenty-second century reviewing forensic science in the early twenty-first will be likely to observe that the field probably enjoys a higher profile in our own time than ever before. This is due in large part to the popularity of a number of television dramas where it forms an important plot device. Real forensic practitioners recognise that art does not always accurately mirror life, and this talk reviews the work of present-day forensic scientists, particularly those involved in criminal casework. A brief outline of the criminal justice process shows where scientists can be involved, from the searching of the crime scene, to the laboratory examination, and ultimately to presentation of findings in court. Chemists can be involved in a wide range of evidence types; some of these are discussed in detail, illustrating in particular the challenges involved in handling very small samples, and outlining some of the analytical techniques used. This leads in to a discussion of court presentation, and the issues facing the chemist giving expert evidence in a criminal trial. The main function of an expert witness is to assist the court in understanding the significance of the scientific results, and the talk presents current thinking on how scientists attempt to interpret their findings in a systematic and unbiased manner. Specifically, this involves the application of Bayes's Theorem, and some of the issues around estimating probabilities, and communicating probability-based statements to the court, are explored. Finally, there is a brief discussion of the 'CSI Effect'; how dramatic depictions of forensic science may affect jurors' expectations of its efficacy, and the proliferation of degree-level courses in forensic science.

Peter Reed
Organiser of the Meeting

Society for the History of Alchemy and Chemistry

SHAC's 75th Anniversary

2010 marks the 75th anniversary of the founding of SHAC, an event which will be celebrated on Friday 19 November with a meeting at the Royal Institution in London starting at midday. In the afternoon a series of papers by leading historians will discuss the development of the history of chemistry since 1935, and this will be followed by a public lecture delivered by Professor Simon Shaffer of the University of Cambridge, sponsored by SHAC and the RI. A dinner will conclude the day's events. Further details will be available in due course on www.ambix.org and in the SHAC Newsletter, Chemical Intelligence.

The Society for the History of Alchemy and Chemistry Meetings

On Saturday 14 November 2009, The Society for the History of Alchemy and Chemistry held a meeting at Birkbeck College, Malet Street, London. The meeting was entitled 'Chymistry and Mechanization in the Seventeenth and Eighteenth Centuries'. This meeting is the first leg in a two part collaborative colloquium with Université de Lille 1, and all the papers given were presented by speakers from Lille. The second part will be taking place in 2010 in Lille.

The first speaker, Solange Gonzalez, spoke on 'The role of chemistry in the debates on occasionalism in the second half of the 17th century'.

Descartes identified matter as nothing more than extension, and mundane change as matter in motion. The doctrine of occasionalism subsequently limited the agency of matter even further by claiming that all events are caused directly by God: matter does not even act as a secondary cause. How did chymistry, with its principles and active matter, fare within this post-Cartesian philosophical context?

Géraud de Cordemoy (1626-1684) accepted Descartes' premise that the fundamental structure of matter should be deduced from the properties of extended substance. He distinguished a prime matter of ultimate corpuscles which combine to create the higher order of visible bodies, which in turn make up mixed substances. All change is in principle explained by the movement and rearrangement of minute parts, but Cordemoy made no attempt to connect his theoretical discourse with the actual properties of bodies. He presented classic chymical processes such as fermentation and digestion as merely mechanical transformations. In this programme driven by metaphysical concerns, one might say that chemical phenomena are to be explained away rather than explained.

But this was not the only response to Descartes' legacy. Pierre-Sylvain Régis (1632-1707) was equally committed to Cartesianism but had a far more substantial exposure to chemical teaching, particularly through Lémery's *Cours de chymie*. He recognised the practical and explanatory utility of chemical principles but interpreted them as made up of elementary subtle matter, variously configured by its passage through the differently shaped internal pores of the earth. Although retaining this link to Cartesian physical foundations, Régis did not pretend that the hypothetical constructions of theoretical chemistry attained the metaphysical certainty that Descartes demanded of natural knowledge.

These two case studies displayed the difficult epistemological position of chemistry in later 17th-century France. For Cordemoy, adherence to a Cartesian theory of matter left no room for a distinctively chemical explanation of phenomena; for Régis, the remote abstractions of Cartesian matter gave a freer, but less demonstrative, hand to autonomous chemical enquiry.

The second speaker, Anne-Lise Rey, gave a paper on 'The place of chemistry in the natural philosophy of G. W. Leibniz: The Leibnizian understanding of chemical changes of matter in the correspondence between Hartsoeker and Leibniz'.

In this paper Anne-Lise Rey examines the correspondence between Leibniz and the chemist Nicolas Hartsoeker from December 1706 to December 1710 on the subject of the reality of chemical principles, and shows that, for Leibniz,

chemistry was neither a science nor a principle of intelligibility, but had a purely heuristic value (allowing the natural philosopher to perceive the results of imperceptible processes).

Hartsoeker was an atomist who maintained that chemical principles were the elementary material components of all substances. Leibniz, however, insisted that the principles of the chemists were both indemonstrable and theoretically impossible. Rey shows how Leibniz's philosophical commitments to the infinite divisibility of matter and to a vitalist conception of matter as endowed with soul and perception leads him to oppose the idea of chemical principles. For Leibniz, chemical principles could not be elementary, but could always be decomposed into simpler bodies. He also denied that as a purely material substrate chemical principles could account for the production or destruction of substances in nature, which must be the result of an internal active principle. Rey shows that chemical principles fell between the two levels of the intelligibility of bodies recognized in the Leibnizian system: the dynamic and the organic. Chemical principles, understood as primary elements did not accord with Leibniz's conception of sufficient reason, which gave intelligible form to material reality.

For Leibniz the status of chemical principles and physical atomism was illusory and fictional. The explanations of the chemists were conjectural – they appealed to the imagination, but gave no real account of the reality of material transformations. Rey rejects the idea that there is a Leibnizian atomism. While Leibniz referred to the monad as a 'metaphysical' or 'spiritual' atom, there is an irreducible difference between Leibniz's philosophy and the atomism of the chemists of the second half of the 17th century – while for the latter the atom is a material substrate which can meaningfully account for the perceptible transformations of bodies, for Leibniz lifeless material atoms could never account for the orderliness and harmony we see in the material universe.

The meeting broke for lunch, during which the AGM of the Society was held.

The first speaker after lunch was Bernard Joly, speaking on 'Between Newton and Stahl, Etienne-Francois Geoffroy and the chemical mistrust of mechanism'. This paper delved into what is a long standing debate in the history of chemistry – the question of whether E.F. Geoffroy, the originator of the first affinity table in the early 18th century, can be labelled as a Newtonian, a Cartesian or a Stahlian. Joly argues that it is impossible to assign a decisive position to Geoffroy, whose work was influenced predominantly by his laboratory experiences, as well as by Stahlian, as well as Newtonian ideas. He claims that Geoffroy's reluctance to join the mechanist ideas inspired by Cartesianism was more due to his attachment to an alchemical tradition as renewed in the work of Stahl as much as any interest in the works of Newton.

In 1698, as Joly explains, Geoffroy visited England (as yet a very young man), during which visit he met Hans Sloane and was elected FRS. Geoffroy established a regular correspondence between himself and Sloane, and became an intermediary between the Royal Society and the Academie Royale des Sciences. Much of this correspondence survives and Joly draws heavily on it for his argument, including one letter concerning the appointment of British philosophers as associé étrangers in which Newton was described as having been 'contemptuous of this mark of distinction' [my translation]. Newton had not seen fit, despite having had the title of associé étranger conferred on him, to communicate with the Academie. In his discussion of chemical and philosophical matters, however, Geoffroy seems to have been cautious in his approach to Newtonianism, and as Joly shows, although some remarks might be interpreted as demonstrating his adherence to Newtonian thinking, the same remarks might just as easily be interpreted as showing the opposite.

Joly also distinguishes between the chemical content of Geoffroy's affinity table, which clearly drew on a Stahlian modernisation of traditional alchemical chemistry, and the idea itself of bringing together these experiments into a table and arranging them in order of 'rapports'. The latter idea appears thoroughly Newtonian, and indeed did so to Geoffroy's successors. However, Joly argues, where Newton utilised chemistry only to buttress his general thesis, Geoffroy held strictly to the chemical domain.

Much of Geoffroy's own chemical work, as communicated to the Royal Society and published in the Philosophical Transactions, was notably influenced by the works of Stahl and Becher, and by an older chemical tradition, to the extent that his Cartesian rivals, the Lémerys, criticised his work and his reluctance to adopt a reductionist mechanism. The Lémerys took issue with Geoffroy both on the grounds of his references to Stahl and Becher while at the same time suspecting him of an adherence to Newtonianism. In their eyes, what all these doctrines had in common was their lack of accommodation of the mechanist reduction of the objects of chemistry to form, extension and movement that, for them, constituted modern chemistry. Geoffroy, Joly argues, did not respond dogmatically to these attacks, nor did he adopt the posture of either a Newtonian or a Cartesian. He was simply a chemist. This, he argues, was what made his table des rapports, so successful.

The final speaker, Remi Franckowiak of Universités de Lille 1 and de Lille 3, spoke on 'Du Clos and the Mechanization of Chemical Philosophy'. This paper explored ten papers read by Samuel Cottereau Du Clos 1669 to the Academie Royale des Sciences in Paris on the subject of Robert Boyle's Tentamina Chimica. Rather than discussing directly Du Clos's view of Boyle's work, Franckowiak sought to use his discussion of the latter to elucidate Du Clos's own philosophy of chemistry. He sought to show that Du Clos aimed to introduced some mechanical considerations about a divisible and passive matter that can be driven by the action of a cause, while at the same time reducing the tangible properties of bodies to substantial qualities attached to the chemical principles of which they were made.

Du Clos sought to apply Boyle's own practice to the Tentamina Chimica in confronting his doctrine with his practice as set out in that work. He also confronted it with his own experiments, performed before his Academician peers. He showed that in many of the cases cited by Boyle, there was no cause of the motion that resulted in new arrangements of particles. Rather

than calling into question Boyle's experiments, he simply rejected their interpretation.

However, as Franckowiak shows, Du Clos did not reject mechanical considerations entirely. Indeed he did refer to particles in motion which can unite and bind, but he confined these kinds of explanations to tangible bodies only. Du Clos's chemical philosophy combined a Paracelsian idea of two realities (one a tangible part, concerned with mechanical explanations only and the other a spiritual matter full of forces and qualities) with a more complex scheme that saw each body as composed of three principles – a 'nature' principle, active and incorporeal, an informative cause that takes place in the 'body principle. The latter is concrete and passive and is made up of the element of water, to which air and the other elements are attached. The 'spirit' principle is intermediate between the nature principle and the body principle, establishing a link between the two instances of reality for the constitution of natural mixts. Franckowiak demonstrates how Du Clos utilised this system to provide both mechanical and chemical explanations of chemical occurrences, although the mechanical approach is only justified as a first and superficial approach to laboratory phenomena.

Du Clos's chemistry thus mixes chemical and mechanical reasoning in a complementary way. Franckowiak describes Du Clos's chemistry as a 'chemical physics', aiming for knowledge of causes of natural phenomena and natural principles of bodies by experimental practice. But particles, for Du Clos, do not represent the ultimate foundation of matter – the true causes must be sought on a more fundamental, chemical, level where the qualities of a substance are the expression of an interior chemical activity. As Franckowiak concludes 'Du Clos, in the History of Chemistry, may be the first after Boyle to equip chemistry with mechanical explanations, which in addition is in a perfectly coherent form with a chemistry of the principles'. The meeting closed with a short reception.

Georgette Taylor (University College London), Stephen Johnston (Museum of the History of Science, Oxford), Stephen Clucas (Birkbeck College London)

American Chemical Society – Division of the History of Chemistry

It is hard to believe that we are already six months into my responsibilities as chair of HIST. It has been a busy time with a low and a number of highs. First the low, the passing of Jack Stocker, HIST's jolly good fellow, chief jokester, grand cheerleader, and true chemical historian. The HIST scene at national ACS meetings will be very different without Jack's presence. To honor Jack, HIST will have a special symposium at the Spring 2010 meeting in San Francisco. Although we will invite some speakers, I would encourage any of you who desire to present a paper, a remembrance, a story to contact me so we can get title, abstract, time — all of those official issues. In addition, I plan to have an ‘open mike’ session at the end of the symposium for those who want to just add a few comments.

Now for the highs. Your Executive Committee has been working steadily to shape the future of HIST within the current professional and economic environment. First, we have finalized and formalized our association with CHF. We are still working, with Roger Egolf as our representative, to best frame this relationship. But it is important for both HIST and CHF that we complement, not duplicate, our mutual efforts to support the progress of chemical history. It should be noted that Jack Stocker has been since the beginning an official ACS representative to the CHF group. ACS has not indicated yet who will take his place, but he was also a great HIST influence on CHF in that position. Second, we are taking a detailed look at the funding of on-going programs and awards of HIST. This is far from completed but we are moving forward. Stay tuned for more in the future. Third, Seth Rasmussen is to be congratulated in the first two programs that he has arranged for Salt Lake City and for Washington DC. And from the look of future meetings, he has taken a strong yet creative approach to our National Meetings programming. One area the Division of History needs to improve is our programming at Regional Meetings. We need YOUR help. Every year there are seven to ten regional meetings. Think of your interests, think of your area, look at the schedule of regional meetings and help us bring more HIST programming to the regions. Fourth, we are working for further coordination of our activities with other Divisions and organizations. Joe Jeffers is our contact person for working with the Divisional Activities Committee in looking at long range and thematic programming. As our former program chair, he does understand our interests and our abilities. But again, we need you to step forward to help expand the range and diversity of our programming. Fifth, one area we have been active in, but not yet heard the result, is in the activities concerning the plans of the State of Pennsylvania to close the Joseph Priestley home as a museum and educational site. Many of you responded with LAN responses, with letters, with comments. Thank you to all of those who responded so rapidly. I still do not know the outcome, but this will certainly be an on-going concern.

Finally, we on the Executive Committee need to hear from YOU. Please send me your ideas at jmhayes@earthlink.net. Sending an idea does not mean I will ask you to carry out the plan, but you would be welcome to participate. Again, thank you for honoring me with being selected as your

2009-2010 HIST Chair. Please let me know, as many of you have already, how I can make HIST a more prominent and productive part of the ACS.

Jan Hayes
2009/2010 HIST Chair

Boston, August 22-26, 2010

General Papers. Seth C. Rasmussen, Department of Chemistry and Molecular Biology, North Dakota State University, Fargo, ND 58105, Phone: (701) 231-8747, Email: seth.rasmussen@ndsu.edu

Busted - Myths of a Chemical Nature. Vera V. Mainz, University of Illinois Urbana-Champaign, School of Chemical Sciences, 142B RAL, Box 34 Noyes Lab, 600 S. Mathews Ave, Urbana, IL 61801; Phone: (217) 244-0564; Fax: (217) 244-8068; Email: mainz@uiuc.edu

Women Chemists and Scientists You Know, or If You Don't Know You Ought to Know Them. [co-sponsor: WCC] Janan M. Hayes, Merced College (retired), 6829 Barbara Lee Circle, Sacramento, CA 95842; Phone: (916) 331-6886; Email: jmhayes@earthlink.net.

Royal Society of Chemistry Historical Group Meetings

RSCHG meetings: 2009 and 2010

As in earlier January Newsletters here is a short summary of the activities held this year (2009) and those which we plan to hold in 2010.

2009: There were three meetings, all well-attended and well-received by their audiences.

Organometallic Chemistry: Past and Present. Friday March 20, 2009, organised by Bill Griffith and Colin Russell. A one-day meeting in the Council Chamber, jointly with the RSC Chiltern and Middlesex Section, March 20, 2009 (For a report cf. August 2009 Newsletter p. 36).

Pharmacy in History, a joint afternoon meeting with SHAC and the Society of Apothecaries on Tuesday May 12, 2009. For a report cf. August 2009 Newsletter p. 41.

Chemists and the Law. Friday October 23, 2009, organised by Peter Reed. There will be a report in this Newsletter.

°ÄÃÅÁùºÏ²Ê¿ª½±¼ÇÂ¼ National Chemical Landmarks. The group was represented at three of these: for Joseph Swan at Newcastle-upon-Tyne, 23 February; for Joseph Black at Glasgow University, 4 July 2009; and at Harwell on 25 November 2009.

2010: Two meetings are planned:

The Rise and Fall of ICI. A one-day meeting on Friday March 19, 2010 in the new Chemistry Centre, Burlington House, organised by Jack Betteridge. For details see the flyer accompanying this Newsletter.

The history of chemical information. Planned for October/November 2010. Joint meeting with the Chemical Information Group (CICAG). Chris Cooksey is the RSCHG organiser.

Bill Griffith

Other Meetings

Oxford History of Chemistry Seminar: 'Mastering Nature? Chemistry in History' (a joint Oxford University, Oxford Brookes University, Maison Française d'Oxford, and Society for the History of Alchemy & Chemistry seminar)

Provisional Programme:

Feb. 25th 2010 'New Researchers' History Faculty, Old Boy's High School, George Street

Georgette Taylor, UCL, 'Pedagogical progeniture or tactical translation? George Fordyce's additions and modifications to William Cullen's philosophical chemistry'

François Pepin, Université Paris-Ouest, 'Diderot and chemistry: a model of experimental philosophy'

March 11th 'New Researchers' History Faculty

Catherine Jackson, UCL, [on the development of synthetic organic chemistry in academic contexts during the 19th century, title tbc]

Erik Langlinay, EHSS, Paris, 'Scales and spaces of the chemical industry in France, 1890-1930'

April 29th 'Chemistry in the Low Countries in the 19th and 20th centuries' Maison Française, Norham Road

Ernst Homberg, University of Maastricht, 'Chemists and chemistry in the Netherlands, 1830-1960.'

Brigitte van Tiggelen, Catholic University of Louvain (title tbc)

This seminar will be followed by a reception and presentation of the Morris Award of the Society for the History of Alchemy and Chemistry to Professor Ray Stokes, University of Glasgow, for his work on the history of the German chemical industry. Professor Stokes will then give a lecture.

Wednesday May 12th 'Chemistry and pharmacy in the colonial world' Centre for the History of Medicine, Oxford Brookes University, Gipsy Lane

Floriane Blanc, Université de Lyon 1, 'The Dakar Faculty of Medicine and Pharmacy, part of a global plan?'

Stuart Anderson, London School of Hygiene and Tropical Medicine, 'Setting the Standard: The British Pharmacopoeia as an Instrument of Imperialism 1864 to 1932'

Wednesday May 26th (date tbc) 'Chemical adventures: the search for natural products' Maison Française

Laurent Sorcelle, journalist, Paris, will discuss his novel, Le Trésor de Los Mangos, on the search in Mexico by a young chemist for a rare periwinkle with therapeutic properties

Second speaker to be announced

Please note that all seminars will take place on Thursdays from 3 to 5 pm, until that on May 12th, and May 28th (date to be confirmed)

Further details, including maps & directions, can be found at http://www.history.ox.ac.uk/hsmt/histchem, or contact Prof. Corsi's secretary, Stephanie Jenkins, History Faculty, Oxford, 01865 615027, stephanie.jenkins@history.ox.ac.uk

Convenors: Pietro Corsi, John Christie, Robert Fox, Muriel Le Roux, John Perkins, Viviane Quirke

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Royal Society Publishing has just published a special issue from Notes and Records on The Royal Society and science in the 20th century: Papers from a conference for the Royal Society's 350th anniversary, guest edited by Dr Peter Collins, Director of the Royal Society Centre for History of Science. It is FREELY available online from http://rsnr.royalsocietypublishing.org/seefurther