Historical Group

NEWSLETTER
and
SUMMARY OF PAPERS

No. 65 Winter 2014

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COMMITTEE

http://www.chem.qmul.ac.uk/rschg/
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RSC Historical Group Newsletter No. 65 Winter 2014

Contents

From the Editor

Welcome to the winter 2014 RSCHG Newsletter. If you have received the newsletter by post and wish to look at the longer electronic version which contains more images. It can be found at:

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

The first RSCHG meeting in 2014, "A Revolution in Chemical Analysis and Instrumentation", will be held at Burlington House on Wednesday 19 March. It is an afternoon meeting starting at 1.30 pm and full details can be found in the flyer enclosed with the hard copy version and also in the online version.

This issue contains a wide variety of news items, articles, book reviews and reports. Partly by coincidence, many of them focus on chemistry at University College London. There are four short essays: the first by Chris Cooksey is entitled "Logwood Chips are History" and the second by Alwyn Davies is entitled "Edward Turner's

Examination Paper 1829-1830". The third, written by Duncan Thorburn Burns discusses Thomas Andrews, who was recently remembered with a RSC Chemical Landmark Plaque at Queen's University of Belfast. The final short essay is a compilation of reports on the year-long series of events at University College London, commemorating the 150th Anniversary of Anglo-Japanese Scholarly Relations.

The book reviews in this issue include Alwyn Davies and Peter Garratt, *UCL Chemistry Department, 1828-1974*; Prakash Kumar, *Indigo Plantations and Science in Colonial India*; and Eric Scerri, *A Tale of 7 Elements*. There is also a short review of the BBC2 television programme *Science Britannica* which featured the discovery of mauveine. There are reports on the RSC Chemical Landmark Plaques for Surface Enhanced Raman Spectroscopy at the University of Southampton and for ibuprofen in Nottingham. An article appears on the RSCHG meeting entitled "Chemistry and Medicine" held last October. There are also reports covering the 24th International Congress of History of Science, Technology and Medicine in Manchester and the Sites of 20th Century Chemistry Meeting and the 9th International Conference on the History of Chemistry, both held in Uppsala.

On a personal note I would like to thank the RSCHG's out-going Chairman, Alan Dronsfield, for all the help and support he has given me as Editor and to say how I am looking forward to working again with the group's new Chairman, John Hudson. Finally I would like to thank everyone who has sent material for this newsletter, with particular thanks to the newsletter production team of Bill Griffith and Gerry Moss. If you would like to contribute items such as news, articles, book reviews and reports to the newsletter please do contact me. The guidelines for contributors can be found in the summer 2012 edition or online at:
http://www.chem.qmul.ac.uk/rschg/Guidelines.html

The deadline for the summer 2014 issue will be Friday 13 June 2014. Please send your contributions to a.simmons@ucl.ac.uk as an attachment in Word. All contributions must be in electronic form.

Anna Simmons
University College, London

ROYAL SOCIETY OF CHEMISTRY HISTORICAL GROUP NEWS

From the incoming Chairman

At the AGM, I was elected to serve as Chair of the Historical Group in succession to Alan Dronsfield. My immediate thought is that Alan is going to be a hard act to follow. He has led the Group at a difficult time, when we faced uncertainties resulting from the RSC's new policy for membership of Groups. During this period, not only did our membership more than double to over 600, but even more significantly, our numbers have subsequently held steady at this higher level. Another achievement is that Alan has undoubtedly raised the profile of the Group within the RSC. Furthermore, he has campaigned on important issues connected with the history of science by writing to national newspapers. As I said, he will be a hard act to follow.

I will of course ensure that our principal activities, namely organising meetings on aspects of the history of chemistry and publishing an interesting and informative Newsletter, continue as before. But I wish to encourage some new developments. I would like to see us organising more meetings outside London. These have been infrequent in the past, although we held a very successful meeting at Catalyst in Widnes last spring. The ideal I think would be one meeting per year away from London. But such meetings would need local organisers, so if you have an idea for a meeting, and/or know of possible speakers who could contribute, please get in touch via johnhudson25@hotmail.com and we will discuss the idea at Committee. I would also like to see more of our members doing historical research on their own account. There could be numerous possibilities. To cite two examples, it could be that the history of your own company has not been fully researched, or maybe a well-known chemist had a connection with your area which could be followed up. It would be great if such work resulted in an article in the Newsletter or a presentation at a meeting, but the principal reason for doing work like this is the interest and enjoyment it brings. Finally, I would like members to feel that the Committee is responsive to their ideas and suggestions, so if there is anything else you think we could be doing, please get in touch.

John Hudson

Changes to the Committee

Professor Jack Betteridge is standing down as a Committee member. We are extremely grateful to Jack for his service over many years, which included six years as Chairman. We have co-opted on to the Committee as an observer RSC staff member Dr Chiara Ceci. Her role within the RSC is that of Communications Executive. We shall enjoy working with her.

John Hudson

RSCHG Meetings: 2013-2014

As in former *Winter RSCHG Newsletters* here is a brief summary of what we did in 2013 and what is planned for 2014.

2013 Meetings

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

The History of the Chemical Industry in the Runcorn-Widnes Area. Held on Saturday 2 March 2013 at the Catalyst Science Discovery Centre, Widnes. Reported in the *Summer 2013 Newsletter*, pp. 45-52.

The History and Chemistry of Fluorine. Held on Thursday 21 March 2013 at the Council Chamber, Burlington House, organised by Alan Dronsfield and Bill Griffith. Reported in the *Summer 2013 Newsletter*, pp. 52-57.

Robert Woodward – Chemist Extraordinary. An afternoon meeting on Friday 17 May 2013 held in the Council Chamber, Burlington House. Peter Morris delivered the RSCHG Wheeler lecture entitled "Robert Woodward: Chemist Extraordinaire". A report appeared in the *Summer 2013 Newsletter*, pp. 57-65.

Chemistry and Medicine. A Full-day meeting at the Chemistry Centre, Burlington House, on Wednesday 23 October 2013. A report appears in our *Winter 2014 Newsletter*.

2014 Meetings

Our planned meetings for 2014 are as follows and will be held at Burlington House:

A Revolution in Chemical Analysis and Instrumentation (19 March 2014)

Chemistry as a Hobby (19 June 2014)

Wartime research (date to be finalised, but expected to be in October 2014)

The first is an afternoon meeting and the second and third are currently expected to be full day meetings. As is our usual practice, we do not intend to charge for these meetings. Light refreshments will be provided in the morning and the afternoon, but lunch will not be offered. Instead, we encourage those attending to take advantage of the various places to eat nearby.

John Nicholson

Royal Society of Chemistry Award for Service

Derry Jones, a member of the RSCHG, has recently received the Royal Society of Chemistry Award for Service, which recognises outstanding non-academic service to the RSC's work. Derry joined the Chemical Society as a student member in 1947 and has been involved in a variety of committees and groups for over 50 years.

COMMENTS TO THE EDITOR

From Historical Group Member, John Green

Quite naturally chemists in industry are largely associated with the chemical industry, but there were, and still are, chemists making contributions in organisations engaged in activities other than chemical manufacture. For example, large groups at Crosse & Blackwell laboratories in the 1930s devoted to processed foods, Metal Box from the 1930s to 1980s in packaging, Unilever on various sites, but often also just singletons such as Mamie Oliver at Chivers from the 1920s working on fruit and vegetable preservation. Does anyone know of any literature on the sort of work they did and the conditions in which they did it, are there memoirs of 'industrial chemists'? These thoughts came to mind when I heard of the loss of an old friend and colleague who was in industry for many years and then became director of an industry oriented research establishment. Isaac Newton said 'We stand on the shoulders of giants' but we stand on the shoulders of all, who have gone before us, not just the 'giants' and some might have had interesting stories to tell – are all of them lost?

John Green
Hemel Hempstead

If anyone wishes to contact John Green, please send your comments to me and I will pass them on. I have already suggested a few sources and told him about Gerrylynn Roberts and Robin Mackie's *Biographical Database of the British Chemical Community, 1880-1970.*

PUBLICATIONS OF INTEREST

If you would like to contribute anything to this section please send details of your publications to the editor. Anything from the title details to a fuller summary is most welcome. This month we focus on a paper on the history of the discovery of free radicals:

T.T. Tidwell, "Sunlight and the Discovery of Free Radicals", *Nature Chem.*, 2013, **5**, 637-639, http://dx.doi.org/10.1038/nchem.1703

The conventional wisdom regarding the discovery of free radicals is represented by the following very recent statement: "Moses Gomberg's 1900 paper…reports the discovery of free radicals" (*J. Org. Chem*., 2013, 5817, on 5819). However as reported in *Nature Chemistry* in 2013 this overlooks a very clear report from 1879 in accord with current interpretations for the photochemical conversion of chlorine and of hydrogen peroxide to the corresponding chlorine and hydroxyl free radicals. This was presented by the English scientists Arthur Downes and Thomas Blunt, who found that sunlight destroyed hydrogen peroxide, which was stable in the absence of light. To interpret this behaviour they made a profound proposal:

> we may regard the hydrogen peroxide as made up of two atomic groupings of the chlorous radicale HO and, if the theory we predict is correct, the decomposition in this case is brought about by the dissociation of these radicles. We believe that the tendency of sunlight is to dissociate (or 'weaken the bonds' between) what we have termed 'chlorous radicles', whether these be simple, as oxygen or chlorine, or compound as HO, and thus promote their combining energy.

The modernity of the description is breath-taking. It precedes the concept of the electron pair bond from G.N. Lewis by almost 40 years, but the recognition of the symmetrical breaking of the bond between the two equal halves of the hydrogen peroxide or chlorine molecules is clearly contained in the description. Furthermore the high chemical reactivity resulting from the absorption of light is specifically assigned to the resulting radicals.

This work was carried out in Shrewsbury, at least partly in the Blunt family pharmacy, a building that still stands. This discovery was neglected by chemists and chemical historians, and its significance first reported only in 2012. The Blunt family pharmacy would appear in my opinion to be an excellent candidate for a National Chemical Landmark.

Blunt Pharmacy, 1894, photograph from the Samuel Butler Collection, reproduced with the permission of the Master and Fellows of St John's College, Cambridge.

The Blunt Pharmacy Today, Shrewsbury

Thomas T. Tidwell
University of Toronto

Members' Publications

Chris Cooksey, "Quirks of Dye Nomenclature. 1: Evans Blue", *Biotechnic & Histochemistry*, DOI:10.3109/10520295.2013.822560. Publication date 20 August 2013.

The history, origin, identity, chemistry and use of Evans blue dye are described along with the first application to staining by Herbert McLean Evans in 1914. In the 1930s, the dye was marketed under the name, Evans blue dye, which was profoundly more acceptable than the ponderous chemical name.

Rupert Purchase, "The Treatment of Wilson's Disease, A Rare Genetic Disorder of Copper Metabolism", *Sci. Prog.*, 2013, **96**, 19-32.

Rupert Purchase, "The Link Between Copper and Wilson's Disease", *Sci. Prog.*, 2013, **96**, 213-233.

Underlying the story told in these two historical notes is the influence of Australian-educated scientists and Australian government investment in science and agriculture. Four individuals are considered. Sir John Cornforth, born in Sydney in 1917, and who *inter alia* deduced the structure of D-penicillamine (a drug used to treat Wilson's disease) as part of Oxford University's contribution to understanding the chemistry of penicillin during the Second World War. Two Australian scientists, Harold William Bennetts (1898-1970) and Alexander Thomas Dick (1911-1982), who carried out studies on copper metabolism in ruminants. Sir Alan Walsh (1916-1998) who worked on the development of atomic absorption spectroscopy as a method for measuring copper (and other elements). This work took place after he had emigrated from the UK to Australia in 1947 to work in the Spectroscopy Section of the Council for Scientific and Industrial Research (renamed in 1949 the Commonwealth Scientific and Industrial Research Organisation) in Melbourne.

OBITUARY

Dr Mark Finlay (1960-2013) of Armstrong Atlantic State University was killed in a car accident on his way back from a meeting in Philadelphia in October 2013. He was a fine historian of agricultural chemistry and of the rubber industry in America, known for his book *Growing American Rubber: Strategic Plants and the Politics of National Security*. He will be much missed.

NEWS AND UPDATES

Society for the History of Alchemy and Chemistry

At its AGM in November 2013 new officers were elected to SHAC Council. Simon Werrett, a lecturer in the Department of Science and Technology Studies at University College London, is the new Hon. Secretary. Michael Jewess, a patent attorney and member of the historical groups both of the Royal Society of Chemistry and of the Institute of Physics, is the new Hon. Treasurer. A new role of membership secretary has been created and this will be filled by Anna Simmons, editor of this newsletter.

SHAC Award Scheme 2014

The Society offers two types of award: support for research into the history of chemistry or history of alchemy by new scholars and support for subject development of either history of alchemy or history of chemistry. Applications will open on 1 March 2014 and close on 31 May 2014 and are only open to members of the Society. Further details can be found on the SHAC website: www.ambix.org

News from the Chemical Heritage Foundation

The Beckman Center for the History of Chemistry, 2014–2015: Fellowships in the History of Science, Technology, Medicine, & Industry

The Beckman Center for the History of Chemistry at the Chemical Heritage Foundation (CHF), Philadelphia, invites applications for fellowships. Short-term fellows are particularly meant to use the collections, while long-term fellows' work must help to support the mission of the institution and fit with collections more generally. Applications come from people in a wide range of disciplines across the humanities and social sciences. Application Deadline: 15 February 2014. For further information visit: www.chemheritage.org/research/beckman-center/

SHORT ESSAYS

Logwood Chips are History

Logwood chips, that benign component of twentieth century chemistry sets, have a long history. While useless for making explosives, pretty coloured fireworks, or frightful stinks, logwood chips have provided much entertainment for chemists.

When Europeans first visited Central America at the end of the fifteenth century seeking gold and silver, they came upon the use of logwood, called *ek* by the Maya inhabitants of the Yucatan Peninsula, for dyeing cotton and for medicinal purposes. Logwood comes from the heartwood of the leguminous tree *Haematoxylon campechianum* L. and is celebrated in the coat of arms of what is now Belize, formerly known as British Honduras. Although not initially perceived to have great value, the dense wood, known at that time as *Bois de Campeche*, was used as ballast for ships returning to Europe. When the utility of the wood as a source of a dye became apparent, increasing quantities were shipped to Europe. As the popularity of logwood for use as a dye increased, the amounts harvested increased dramatically from 1,000 tons per year in 1690 to many tens of thousands of tons per year in the nineteenth century, peaking at 100,000 tons per year in 1896. During the twentieth century the popularity decreased, although wars gave a temporary impetus, and by 1995 an estimated 12,000 tonnes per year were produced.

In England, an Act of Parliament in 1581 prohibited the use of logwood as a dye, claiming that it was “false and deceitful” and “only sold and uttered to the great deceit of the Queens loving Subjects, within this her Realm of England, but also beyond the Seas, to the great discredit and slander, as well of the Merchants, as the Dyers of this Realm”. The full text is quoted by J.B. Hurry [1]. The real reason was to protect the indigenous woad industry and for the same reason a similar prohibition was issued against Indian indigo. But dyers often found it convenient to ignore legislation.

The Act was repealed in 1661, with the words: “that the ingenious industry of these times hath taught dyers of England the art of fixing colours made of logwood; so that by experience they are found as lasting and serviceable as the colour made with any other sort of dyewood” [2].

Captain William Dampier (1651–1715) led an interesting life. He was the first person to sail round the world three times. His career began with two merchant voyages to Newfoundland and Java before joining the Royal Navy in 1673. In 1702 he was found guilty at a court martial of “hard and cruel usage of the lieutenant (George Fisher)” and was discharged from the Royal Navy, but later reinstated. At times he was an adventurer and pirate, but is best known today for the published description of his voyages and acute observations of the places he visited. One such place was Campeachy where, in 1676, he spent almost a year harvesting logwood for export to England. He describes logwood thus:

> Here grow divers sorts of Trees of no great bulk or height. Among these the Logwood Trees thrive best, and are very plentiful; this being the most proper Soil for them: for they do not thrive in dry Ground; neither shall you see any growing in rich black mould. [...] We always chuse to cut the old black-rinded Trees; for these have less sap, and require but little pains to chip or cut it. The sap is white and the heart is red: the heart is used much for dying; therefore we chip off all the white sap, till we come to the heart; and then it is fit to be transported to Europe. [...] Some trees are 5 or 6 Foot in Circumference: and these we can scarce cut into Logs small enough for a Man’s Burthen, without great labour; and therefore are forced to blow them up [3].

Later he found it more expedient to ambush French or Spanish ships laden with the same cargo.

At the end of the eighteenth century, many investigations were made into plant materials, particularly in France. A notable achievement was the development of techniques for crystallizing substances. In particular, alkaloids or their salts are crystalline and during the period 1800-1820 many, such as morphine, brucine, strychnine, and quinine, were isolated. The wood dye precursors, brazilin from brazilwood and haematoxylin from logwood, were discovered during this period (1810-1812). The actual dyes were obtained by oxidation, *viz.*, brazilein and haematein respectively. Although the molecular formulae of these compounds were soon determined, the molecular structures were not elucidated for another century. The structures of haematoxylin and haematein are shown in Figure 1.

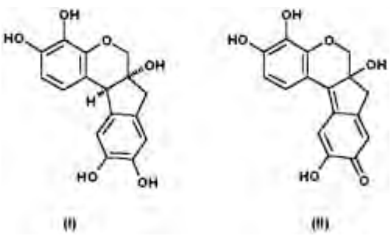

Figure 1. The structures of (–)-haematoxylin (I) and (–)-haematein (II)

Edward Bancroft (1744–1821), scientist, writer, spy and double agent was elected a Fellow of the Royal Society in 1773 as “a gentleman versed in natural history and Chymistry, and author of the natural history of Guiana”. He sang the praises of logwood:

> Sulphate of copper added to the decoction of logwood, gives it a purplish blue colour; sulphate of zinc added to a similar decoction, produces a dark purple; nitro-muriate of gold, an orange; muriate of quicksilver, an orange red; muriate of antimony, a beautiful crimson; acetate of lead, a garter blue; arseniate of potash, a deep yellow; muriate of barytes, a reddish purple; nitrate of barytes, a brownish purple; stronta earth, a violet; sulphate of magnesia, a purple; muriate of magnesia, a yellow; sulphate of lime, a purple;

> and muriate of lime, a violet purple. These effects show that the tingent matter of logwood, is capable of producing, with different mordants or bases, almost all the possible varieties of colour [4].

But by far the greatest use was to dye black, the preferred colour for professional gentlemen and grieving ladies.

James Napier (1810–1884), author and a Fellow of the Royal Society of Edinburgh devotes a section of his 1853 book to logwood. “[...] there is no dye-wood we know so universally used, and so universally useful”. The isolation of the active ingredient in logwood, haematoxylin, first achieved by Chevreul in 1810 and improved by Erdmann in 1842, is described in detail:

> The extract of logwood being evaporated to dryness, is pulverized, and mixed with a considerable quantity of pure silicious sand, to prevent the agglutination of the extract, and the whole allowed to stand several days with five or six times its volume of ether; the mixture being often shaken, the clear solution is poured off and distilled, until there is only a small syrupy residue. By this means most of the ether is saved; and this residue being mixed with a certain quantity of water, is allowed to stand for some days, when the haematoxylin crystallizes out, and may be dried between folds of blotting paper. We are afraid both of these processes will be too tedious for adoption in a dye-house [5].

The addition of a certain quantity of water is obligatory because haematoxylin crystallises with three molecules of water.

The conversion of logwood into a product that can be used in dyeing is not trivial. The wood contains a glucoside of haematoxylin that needs to be hydrolysed and the resulting haematoxylin, which is colourless, oxidised to give haematein that is brown and is the agent that gives the colours for dyeing.

> In order to bring about the decomposition of the glucoside, and the conversion of the haematoxylin into the colouring matter proper - haematein - the wood is either rasped or chipped, and after the addition of a certain amount of water (about 25 per cent.), placed in heaps of about 20 feet long, 10 to 12 feet broad, and 3 or 4 feet high. The heaps are frequently turned over in order to allow the air to act upon the haematoxylin, and also to prevent a too great elevation of temperature, which would cause excessive fermentation, resulting in the complete destruction of the colouring matter. This operation, the so-called ageing or maturing of logwood, simple as it may appear, requires the greatest care and skill in its management. The state of the atmosphere has a great effect upon this process of fermentation. On a warm, dull and foggy day the whole of the colouring matter in hundreds of tons of wood may be destroyed in the course of a few hours. At such periods the heaps of chipped or rasped wood in process require constant attention, otherwise excessive oxidation ensues, with the results already mentioned. When this has occurred the wood is said to be *overheated*, *burnt*, or *killed*. Its colouring matter is not worth extracting, and if the *heating* once it sets in cannot be checked, the whole lot is practically rendered worthless. The nature of this change is not known [6].

The aging process is described in great detail by others [7, 8]. After the aging process, the product can be extracted with water to give a solution used in dyeing.

The chemical structure of haematoxylin was first convincingly determined by Perkin and Robinson in 1908 [9]. Robert Robinson (1886–1975) was awarded the Nobel Prize in Chemistry in 1947 for his investigations on plant products of biological importance. Robinson made many contributions to the chemistry of brazilin and haematoxylin. The first was in his second published paper in 1906 [10] and the last, his 717th, was in 1974 [11]. “Few other natural compounds have done so much towards the development of organic chemistry as brazilin, which should take its place along with camphor, strychnine, cholesterol and penicillin as one of the foundation stones of this subject” [12]. Confirmation of the structure of haematoxylin by its synthesis, as was traditional at the time, confounded chemists for many years. The synthesis of (±)-haematoxylin was finally achieved in six steps starting with pyrogallol in 1965, but this could not compete with the natural product [13].

The use of logwood as a dye declined towards the end of the nineteenth century. It was replaced by synthetic dyes, especially the sulfur blacks. But another use emerged – as a stain in histology and histopathology. Over the years, many recipes have been evolved. Some use a haematoxylin-rich extract with an oxidising mordant and others oxidise the haematoxylin to give haematein using air or chemical oxidants (‘ripening’) followed by a non-oxidising mordant such as alum. Invariably, this is combined with another dye, the most popular being eosin, to provide contrast [14].

Thousands of tons of wood are no longer shipped round the world. These days, the production of logwood extract takes place near the plantations by Mexicana De Extractos S.A. located in Campeche, Mexico and is exported as such to Abbey Color Inc., in Philadelphia, Pennsylvania, USA. The export of logwood chips from Mexico is banned [15]. William Perkin was concerned that, having played a major role in the destruction of the madder industry, *Rubia tinctorum* might become extinct, so he planted some in his garden. Logwood chips are history, but the future of the *Haematoxylon campechianum* species seems assured.

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Chris Cooksey

Edward Turner’s Examination Paper, 1829-1830

In 1828 University College London (then called University of London) opened its doors for teaching, with Edward Turner as its first Professor of Chemistry. Turner is often said to be Scottish but in fact he was born in Jamaica. His father was a prosperous planter, and brought his son to Britain to be educated. He graduated in medicine in Edinburgh, but abandoned medicine for chemistry, and in 1824 was appointed as a Lecturer in Chemistry at the University of Edinburgh. He is best known for his textbook *Elements of Chemistry*, which ran to eight editions, and for his work on the accurate determination of atomic weights, which disproved Prout’s Hypothesis that all atomic weights should be integral numbers.

After he had been teaching at UCL for two years there came the inevitable examination and Figure 1 shows an etching of students sitting the examination in those early years. The most obvious thing is that they are all men: women were not admitted until the 1870s.

Figure 1: Students sitting the examination.

The examination paper contained 35 questions which could earn a maximum of 1100 marks, and students had to score two thirds of that total to be awarded a Certificate of Honours. It was not until 1836 that the name of the college was changed from University of London to University College London, and the title of University of London was given to a body which embraced both UCL and Kings College, and had the power to award degrees. The time allowed for the examination was six hours.

University of London

SESSION, 1829-30

EXAMINATION FOR PRIZES AND CERTIFICATES OF HONOUR

Each Question is to be answered in writing. The Questions will be delivered at Twelve o'Clock, and no papers containing the Answers will be received after Six o'Clock. Those who have finished sooner need not wait, but may give in their Answers when ready. The Answers must be signed with the Motto which the student has adopted.

The Numbers subjoined to each Question denote the relative value which will be assigned to the Answers when correctly given ; but the Examiners will use their discretion in increasing or diminishing this printed value, according to their estimate of the merit of the Answer.

The examiners do not desire a return to all the Questions ; the Student may select what subjects he pleases ; he may answer many of the Questions shortly, or fewer of them at length : but the Examiners would prefer short and distinct Answers to a competent numbers of questions, as affording them a greater facility of estimating the acquirements of the Student.

QUESTIONS FOR THE STUDENTS OF CHEMISTRY

The aggregate value of the Answers to all the Questions in this Class is 1100; and no Certificate of Honours will be given to those who have less than two-thirds of this amount.

No. Value of Question

1. Of solids, liquids, and gaseous substances, which in general are the best conductors of heat ? 10
2. By what means is heat conveyed through liquids and gases ? 20
3. State the qualities of surfaces which influence the radiation, absorption, and reflection of heat. 30
4. State the law according to which the heating influence of a radiating substance diminishes. 15
5. State the conditions favourable to the formation of dew, the source of the moisture, and the theory of the subject. 50
6. How are the fixed points of a thermometer determined? And state the chief circumstances to be attended to in ascertaining the upper fixed points. 30
7. What is meant by specific heat, and the caloric of fluidity? Illustrating each by an example. 40
8. Explain the principle of the cryophorus, and of Leslie's method of freezing water in *vacuo.* 40
9. In decomposing water, potash, and sulphate of potash, by means of galvanism, at which poles do the constituents of these compounds appear? 50
10. Specify an instance illustrative of the law of combination in multiple proportions, both by weight and volume. 30
11. State the equivalents of the following substances:- oxygen, hydrogen, nitrogen, carbon, sulphur, muriatic acid, carbonic acid gas, sulphuric acid, carbonate of soda, bisulphate of potash, and nitrate of ammonia. 40

3

No. Value of question

12. By what methods is oxygen gas procured? 30
13. In what state do sodium and bromine occur in mineral waters? And by what means may their presence be detected? 30
14. What are the constituents of prussic acid? By what test may it be detected? And how does the change alluded to take place? 25
15. What is the action of chlorine and muriatic acid on nitrate of silver? 35
16. State the mode of preparing cyanuret of mercury, and the change produced in it by heat and by sulphuretted hydrogen gas. 50
17. What is the action of dilute sulphuric acid on zinc, and on protosulphuret of iron ? 25
18. What is the action of sulphuric acid on mercury in the cold, and when heat is applied ? 25
19. What metals are always found in meteoric iron ? 20
20. What is the taste of white arsenic ? from what circumstance may it be confounded with phosphoric acid ? and by what means may these acids with certainty be distinguished from each other? 35
21. Describe briefly the process by which the presence of arsenic in mixed fluids may be detected, without leaving any uncertainty. 50
22. What is the action of water on metallic lead ? 25
23. By what process may muriate of baryta be formed from sulphate of baryta ? 30
24. What is the action of strong muriatic acid on native carbonate of baryta ? 15
25. State the change which ensues when oxalate of cobalt or nickel is decomposed by heat in close vessels. 30

4

No. Value of question

26. What is the chief ore of chromium, and how is chromate of potash prepared from it ? State also the colour of the acid and oxide of chromium, and the tests of the former. 35
27. What is the principle of the process for analysing organic substances ? 40
28. What are the ultimate elements of the principal vegetable alkalies ? and how, generally are these alkalies prepared ? 40
29. What gases are disengaged when oxalic acid is heated with excess of sulphuric acid ? and how is the change accounted for ? 30
30. Why are some kinds of ink very pale when first used, and darkened by exposure to air ? How may ink be made dark at first ? and why does the colour of writing frequently change by age from black to brown ? 35
31. What are the conditions required for the vinous fermentation? from what substance is the spirit formed ? and what is the nature of the change ? 50
32. What are the conditions necessary to the germination of seeds? and what substance is developed in the seed during the process ? 40
33. How is the presence of iron in the blood demonstrated ? 30
34. With respect to the process of respiration, what probably becomes of the oxygen which disappears from the inhaled air ? and whence is derived the carbonic acid exhaled ? Is the quantity of exhaled nitrogen always equal to that which is inhaled ? 50
35. What are the principal urinary concretions ? and how is the uric acid calculus distinguished from an earthy one ? 35

EDWARD TURNER

Figure 2: Turner's first UCL examination paper (full version online)

The questions range from physics, through chemistry, to biology, and some could still be asked today, though not at degree level. Others clearly are not suitable. Thus question 20 asks *What is the taste of white arsenic?* Poisoning by arsenic was an important question early in the nineteenth century but it is still a surprising question. Students could not answer it from first-hand experience since Turner did not start practical classes until 1831.

Thirty five students passed the examination. David William Nash won the Gold Medal and First Certificate, Collings Mauger Carré won the First Silver Medal and Second Certificate, Henry Cook won the Second Silver Medal and Third Certificate, and a further thirty-two students gained Certificates of Honours.

One of those thirty-two students was John William Draper, of Sheerness. When his father died in 1831, his mother moved the family to the USA. He became, among other things, a photochemist and a pioneering photographer, and is credited with being the first astro-photographer. In 1876 he became the founding President of the American Chemical Society and his image appears on their Draper Medallion. It was Draper's descendants who, a few years ago, presented the examination question paper on which this essay is based to the UCL Chemistry Department.

Figure 3: ACS Draper Medal

Alwyn Davies
University College London

Thomas Andrews, MD, MRIA, Hon. FRSE, FRS, (1813-1885)

Thomas Andrews, whose seminal work on the liquefaction of gases is celebrated by the RSC Blue Plaque at Queen's University of Belfast, is one of the easiest Victorian scientists to talk about. This is due to the *Scientific Papers of Thomas Andrews* being prefaced by a *Memoir* by P.G. Tait and A. Crum Brown based on family records and Andrews' own letters and letters received by him [1]. Prior to the *Memoir* is a steel engraving, made from a photograph in Paris in the summer of 1875, and said to represent his appearance faithfully in his sixty-first year.

The official portrait of Andrews hangs in the University Great Hall. This was part of the College memorial to commemorate Andrews' services to science and education. The memorial was to be a portrait of Andrews to be placed in the College, together with a replica for the family and a prize or scholarship. The Andrews' studentship for Chemical and Physical Science was first awarded in 1883.

Thomas Andrews was the eldest son of Thomas John Andrews, a linen merchant, and Elizabeth Stevenson. He was born on 19 December 1813 at 3 Donegal Square South, Belfast. He lived at this address until his transfer to his College residence in 1845. His first school was the Belfast Academy in Donegall Street, but he soon transferred to the Academical Institution.

After a short period of working in his father's office during 1828, aged 15, he went to Glasgow to study chemistry under Thomas Thomson. Two years later, in 1830 he went to Paris, to study with André Dumas. Illness compelled his return to Belfast. He then trained for four years as a medical student at Trinity College, Dublin. Next, he spent a year at Edinburgh, graduating M.D. and also qualifying at the Royal College of Surgeons in 1835. After returning to Belfast he set up in practice as a physician and was soon appointed Professor of Chemistry in the then new Medical College at the Academical Institution. He combined medical practice with research and teaching chemistry. In 1842 he married Jean Hardie, Daughter of Major Walker of the 42nd Highlanders. In 1845, he gave up medical practice and his post at the Academical Institution when appointed Vice-Principal of the projected Northern College of the Queen's University of Ireland. The Chair of Chemistry was not officially founded until 1849 but Andrews was named as first Professor in 1847 and remained in that post until his retirement in 1879.

1847 was the start of the Irish Famine. Andrews was active in raising funds for the establishment of soup kitchens. His exertions on behalf of the poor at that time and during the epidemic of fever that followed are recorded as, indefatigable. His concern for the poor continued. For example in 1867 he published “Suggestions for Checking the Hurtful Use of Alcoholic Beverages by the Working Class” [2].

Figure 1: Thomas Andrews (1813-1885)

His various dealings with the College are recorded in Moody and Beckett’s *Queen’s Belfast, 1845-1949* [3]. He did not always have an easy time, hence Tait and Crum Brown’s earlier comment, “We have endeavoured to picture the Man, and especially the Man of Science, not the sorely-tried Vice-President of an Institution”.

Following his early educational visit to Paris, Andrews travelled extensively in Europe, met and maintained contact with many of Europe’s leading chemists including Thenard, Chevreul, Berthier, Gay-Lussac, Schonbein, Bunsen, Liebig, and Hoffman [4]. He also met up with British chemists whilst abroad including his close friend Michael Faraday in Paris in 1856. Large sections of some of their letters are given in The *Memoir*.

Upon retirement in 1879 he moved to Fort William Park, Belfast. After a period of ill health he died on 26 November 1885 and was buried at the Borough Cemetery, where a granite obelisk marks the grave.

Andrews’ scientific papers are in the collection of Tait and Crum Brown and listed in the Royal Society Catalogue of Papers. The latter records many of the papers that were translated. These are useful when assessing the impact of his scientific publications. They may be divided into five sections, namely:

i) Analytical methods
ii) Electrochemical studies
iii) Thermochemistry
iv) Nature of ozone
v) Critical states and liquefaction of gases

The most significant sections being those on thermochemistry, the nature of ozone and critical states and the liquefaction of gases. Between 1841 and 1848 he paid particular attention to, and became extremely skilled at thermochemical measurements. Many of his results were remarkably accurate for the period.

His work on ozone was scientifically a near miss [5]. Having shown that the supposedly different sorts of ozone were identical, the attempts by Andrews and Tait to determine the density of ozone failed. This was because they did not understand that the reagents that removed the ozonic properties from a mixture of ozone and oxygen, combined with ozone, removed an atom of oxygen from a molecule of ozone leaving a molecule of oxygen. Hence no change in volume took place. Since a measurable quantity of ozone thus appeared to occupy zero volume, its density must be infinite. Had they known that oxygen was a diatomic molecule their measured volume relations would have given O_3 for ozone, as was deduced by William Odling, in 1861.

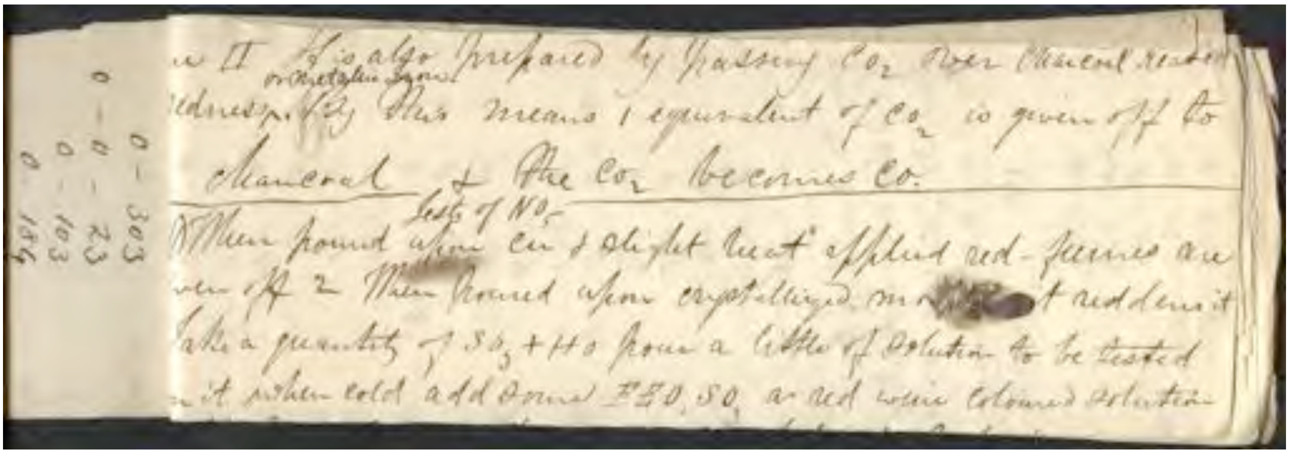

Figure 2: Used Side of Examination Answer Book

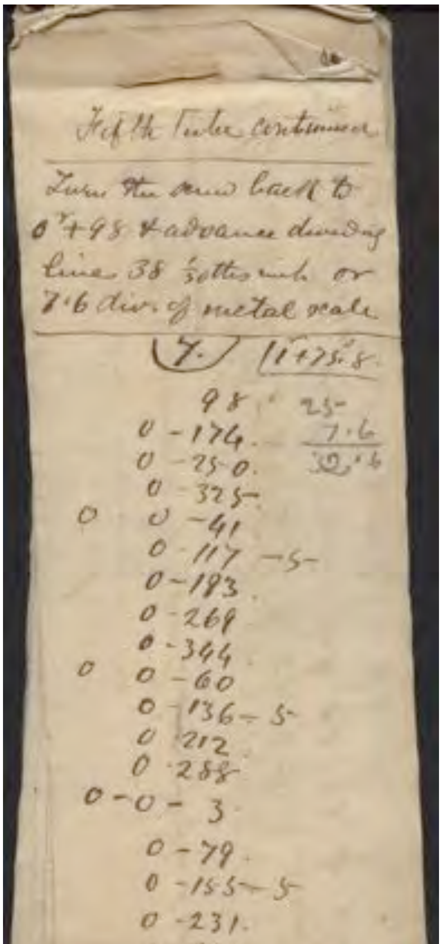

Figure 3: Side not used by student, used by Andrews to record data

Andrews is best known for his now classical work, that on the continuity of the gaseous and liquid states, particularly for his discovery of the critical temperature of carbon dioxide in 1861 [1, 6]. Andrews' value was 30.94 ^{O}C, the modern value being 31.04^{0}C. These studies formed the basis of his Bakerian Lectures of 1869 and 1876. The P-V-T diagrams were constructed by subjecting carbon dioxide and a 'permanent' gas to the same pressure, calculated from the latter's volume, and temperature. These diagrams have been known to generations of students, and today, as 'Andrews' isotherms'. Then, as now, money for research was scare. Andrews recorded his P-V-T data on the back of student's examination scripts that had been used on one side only.

Andrews worked mainly alone, producing single author papers, but had the assistance of P.G. Tait for part of the work on ozone. He was noted for his manipulative skills and his ingenuity in solving practical problems; he constructed most of his own apparatus, thermometers, the dividing engine for their calibration, the complex glassware for the experiments on ozone etc.

From student days onwards Andrews received many distinctions, honours and awards. Attention is drawn to a few of his awards. The Royal Society Medal in 1844 was for his work on "thermal changes accompanying substitutions". The Academy of Sciences in Paris Award of 1850 was for a related topic: "heat disengaged in chemical combination". The two Royal Society Bakerian lectures both were, on and for, the continuity of states work. As an FRS (1849), MRIA (1839) and Hon. FRSE (1870) he held the rare distinction of achieving the Triple Crown in British science, a feat several since at Queen's have tried but failed to emulate. He must be almost unique in declining a Knighthood, in his case according to Tait and Crum Brown, on the grounds of indifferent health. The position may not have been so simple, as in the obituary in *Nature* it is recorded that "In the somewhat delicate matter of a civil title he shared the opinion and followed the practice of his cherished friend Faraday" [7]. Faraday's religious views did not allow him to accept worldly honours. Space does not permit discussion of his significant and interesting contributions to religious and social affairs, dissemination of science to the general public, and the role of Universities [2, 8, 9].

The RSC Blue Plaque at Queen's University, Belfast, unveiled on 16 October 2013, was awarded to celebrate Andrew's work on the continuity of the liquid and gaseous states and the liquefaction of gases. This paved the way to many aids to daily life today such as refrigerators, as well as to the use of low temperatures, essential to much modern work in physics and chemistry.

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D. Thorburn Burns
Queen's University of Belfast

Alexander Williamson and the Modernisation of Japan

In the middle of the nineteen century, Japan, under the Edo regime, was a closed feudal society, divided by clan rivalries and feuds. It was a crime to read foreign literature and a capital offence to travel abroad. This is the remarkable story of the key role played by Alexander William Williamson (1824-1904), who was Professor of Chemistry at University College London, in the transformation of that backward and isolated country into a modern open parliamentary democracy.

Some of the clan leaders had a limited window on the west through the British and Dutch companies which had trading rights in some of the ports. They realised that if Japan was to be strong enough to defend its independence it had to change its political and social isolation and join the industrial revolution which was then taking place in the west.

On 12 May 1863, William Keswick of the Jardine, Matheson & Co. Trading Company smuggled five young samurai students of the Choshu clan, aged between 21 and 29, disguised as British sailors, onto one of the company's ships in Yokohama. They have since become known as the Choshu Five. If they had been discovered, they and their families would have been killed. They sailed to Shanghai and there they were split up, three as passengers on the SS *White Adder*, and the other two working as deckhands on the SS *Pegasus*. Travelling round the Cape, they arrived in Britain in November 1863.

Hugh Matheson asked Augustus Prevost, who was on the UCL Council, for advice about what the five students might do in England, and Prevost proposed that they should be put into the charge of Alexander Williamson. UCL had been founded on the principal of accepting students irrespective of their race, religion, or background and Williamson and his wife, Catherine, were a very hospitable, caring, and internationally-minded couple. They took Hirobumi Ito, Masaru Inoue and Kinsuke Endo into their own home in Haverstock Hill, and Yozo Yamao and Kaoru Inoue lodged nearby. A year later, the Williamsons moved to a larger house in Hampstead. Catherine Williamson taught the students English and helped them to adjust to a completely different way of life. Alexander Williamson registered them for courses in the Chemistry Department at UCL and arranged for them to visit iron works, farms, shipyards, mines, the Bank of England, and the Mint to acquaint them with western modern technology and governance.

Figure 1: The Chosu Five. From left to right - back row: Kinsuke Endo, Masaru Inoue, Hirobumi Ito; front row: Kaoru Inoue, Yozo Yamao.

It is astonishing what these five young men achieved when they returned to Japan after a few years. They had come to Britain with the initial intention of learning modern technology and naval strategy so that they could protect Japan from the threat of western powers by excluding foreigners. Their experience here made them change their minds and they returned with the wish to open up the country to foreigners and to introduce western civilization.

The Edo regime was overthrown in 1868 and was followed by the Meiji Restoration. Hirobumi Ito held appointments as vice-ambassador, Construction Minister, then Secretary of the Interior, before becoming the founding Prime Minister in 1885; he was re-elected three times, drafted the constitution, and established a constitutional government. Masaru Inoue became head of Mining and Railways, and laid and ran the first railways in Japan in 1872. He established a training school for engineers in Osaka, and became the first Minister of Railways. Kinsuke Endo became Master of the Mint in 1870; he modernized the coinage and produced the first copper coins in Japan.

Yozo Yamao was Secretary of State in the Ministry of Industries. Williamson had sent him to work in the Napier shipyards in Glasgow; he introduced deaf and dumb sign language into Japan which he had learned in the deafening noise of the shipyards, and established schools for the deaf and blind. He also took back the song *Auld Lang Syne*, which is now sung at Japanese graduation ceremonies. Kaoru Inoue became Under-Secretary of State for Financial Affairs and then Minister of State for Foreign Affairs in Ito's cabinet. A film, *The Chosu Five*, in Japanese, was released in 2007.

In 1865 fourteen students of the Satsuma clan came to work with Williamson, and there is a monument to them in Kagoshima. When they returned, they made equally significant contributions to the new burgeoning Japan. Williamson was asked to recommend British teachers to introduce their subjects to the Japanese universities. Two of the chemists who went were Robert Atkinson and Edward Divers, and they in turn sent their students to study in England. Of a total of 71 who studied chemistry in England, 42 were registered with Williamson.

One of these students was Joji Sakurai, who worked with Williamson from 1876 to 1881 and published papers with him on organomercury chemistry. He followed Atkinson as professor of chemistry at Tokyo University, and as Baron Sakurai he became known as their greatest scientist and the founder of some of their scientific institutions. In 1937, Sakurai was the first foreigner to be made a Fellow of UCL and a recording of the speech which he made at the Fellows Dinner is available on the web (https://soundcloud.com/uclsound/joji-sakurai). It paints a graphic picture of life in Victorian London:

> *It was however, not the scientific training alone that I received in England. The five years of my student life in England were in the latter half of Queen Victoria's reign, a period which is one of the most glorious in the whole history of England. It was a period in which some of the greatest and most illustrious of men and, also, of women were to be met with in almost every field of human activity. As statesmen and orators, Lord Beaconsfield and the grand old man - Mr. Gladstone - were shining like stars of first magnitude; Tennyson was being adored as poet Laureate, Ruskin as a writer and critic and George Eliot as a feminine novelist of unusual talent; Charles Darwin was enjoying to see his life-long labours bearing fruit, Herbert Spencer was laying a scientific foundation of Sociology, whilst Henry Irving and Ellen Terry were, night after night, drawing crowds of enthusiastic audiences in the Lyceum*

The Chosu and Sakurai students are commemorated on the monument which stands on the Terrace roof garden at UCL. On one face it has the names of the Choshu and Satsuma students in English, and on the other face in Japanese. A translation of the *haiku* on the end of the monument is:

When distant minds
come together
cherries blossom

Tuberculosis was rife in Victorian England, and one of the Satsuma students, Kosaburo Yamazaki, contracted the disease. Catherine Williamson took him into their home, and nursed him till he died in 1866. He was buried in a Buddhist plot in Brookwood Cemetery, near Woking, south of London, together with three other students who later succumbed. The Williamsons arranged that, when they died, they should also be buried in Brookwood, close to the Japanese students who they had befriended.

Figure 2: The monument at UCL to the Choshu and Satsuma students.

A monument to the Williamsons has been erected in Brookwood cemetery by the *London Shogyoji Tust* and the Williamsons' grave has been refurbished by the generosity of the *Japan-British Society of Yamaguchi*.

Figure 3: The Williamsons’ monument in Brookwood Cemetery

The inscription on the monument is follows.

In Memory of Alexander Williamson FRS 1824-1904 and his Wife Catherine Williamson 1831-1927. Devoted to learning, he rose above the prejudices of his day, above the differences of race and religion and culture. As a Professor at University College London and a dedicated teacher he responded to the bravery and the thirst for knowledge of the young men of the Choshu, Satsuma, Saga and Tosa clans and took the former into his own Department. It was they who went on to lay the foundation of modern Japan. His devoted wife shared her husband's passion for the education of the young men who would one day be leaders in their various fields. Above all, she was a supremely compassionate woman, who welcomed the students into her own home to make friends with them and to take care of them when they fell gravely ill.

Out of the silence
their voices still speak to us
if we but listen

The year 2013 marks the 150th anniversary of the arrival of the Choshu Five, and the event was commemorated in Brookwood Cemetery and at the Japanese Embassy on 2 July and at UCL on 3 July. More than 130 people from Japan, some of them descendants of the original students, came to the UK for the ceremonies, and they brought a band with their traditional costumes and instruments.

Buddhist ceremonies were held at the Williamsons’ grave and at a *stupa* in the grounds. The monument to the Williamsons was unveiled by the Japanese Ambassador who presented the Provost of UCL, Sir Malcolm Grant, with a framed manuscript of thanks to the Williamsons from Shinzō Abe, the Prime Minister of Japan. This (with a translation) and Sir Malcolm’s reply, now hang in the foyer of the UCL Chemistry Department.

Figure 4: The letter from the Prime Minister of Japan addressed to Alexander and Catherine Williamson.

The translation of Shinzō Abe's letter reads:

A Letter of Thanks
to Professor Alexander Williamson
and his Wife, Emma Catherine Williamson

Professor and Mrs Williamson: you made a tremendous effort to welcome groups of young men from Choshu, Satsuma and other clans in Japan, who came all the way to your country at the end of the Edo Period for the modernization of our country. You provided both practical and spiritual support to these young men, who studied at University College London, after which they went on to play leading roles in the establishment of modern Japan. You also made an invaluable contribution to the building of modern Japan by sending your students and colleagues, such as Professor Robert Atkinson, to our country so that they could lay the foundations of modern academic institutions in our country.

I believe that pure human love without any trace of discrimination and UCL's philosophy of 'harmony within diversity', together with your efforts, led the university to accept those Japanese students. This was symbolised by the fact that you accepted one of them who had become ill and took care of him at home until the very end of his life.

Looking back at the history of the ever-evolving ties between the United Kingdom and Japan, I am considerably impressed to find right there at the start your unconditional love and your strong wish for the further development of our friendship.

This year we are celebrating the 150th anniversary of the time when you welcomed the first five students in 1863. I am very moved to learn that the unveiling ceremony of the monument specially erected to commemorate both of you is taking place during this special year. I would like to express to you, on behalf of the whole Japanese nation, our deepest and most sincere gratitude.

Shinzō Abe, Prime Minister of Japan
2 July 2013

In September Sir Malcolm Grant travelled to Japan and delivered the following reply to Shinzō Abe.

A Letter of Response
To Shinzō Abe, Prime Minister of Japan

I am honoured to reply on behalf of UCL to your generous and heartfelt letter of thanks to Professor Alexander William Williamson, and his wife, Emma Catherine Williamson. Their story is indeed moving and remarkable. They assumed responsibility not only for the education but also for the welfare and acculturation of the five young Japanese students who came to UCL in 1863.

The generosity of their hospitality reflected the ethos of UCL as the first university in England to embrace, in the spirit of equality, students of any race, religion or class. But in their personal support they went well beyond the realm of institutional welcome. We are all of us touched by the exceptional humanity that they displayed.

Much has been built since on those firm foundations. A small group of students educated at UCL were to have a rapid and profound impact on the development of the modern nation of Japan, across many areas of activity. A strong trading and cultural relationship has developed between Japan and the United Kingdom, and in particular an extensive network of collaborations between Japanese and British universities.

It is in these successes that the true legacy of Professor and Mrs Williamson is to be found. We at UCL today share your admiration for them, and will continue to build on their vision, their internationalism and their commitment, for the benefit of our staff, students and society more generally.

Professor Malcolm Grant CBE, President and Provost, UCL
2 July 2013

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Alwyn Davies
University College London

A Chance Encounter….

I was recently enjoying a coffee in the lobby area adjoining our Library and overheard two Japanese gentlemen quizzing the duty librarian on the life and work of the famous nineteenth century chemist, Alexander Williamson. By this time I had been joined by John Hudson and the two of us attempted to help our visitors by directing them to Yoshiyuki Kikuchi’s recent *Ambix* paper that dealt with Williamson and his Japanese connection. The Rev. Kemmyo Taira Sato is a Shin Buddhist Priest and noted scholar and his companion that day was fellow Buddhist and Priest, the Rev. Kenshin Hiroshi Ishii. Their interest in Williamson had been catalysed by a ceremony, held earlier in the year, that they had held in Brookwood Cemetery to honour our famous chemist. That over 130 people had travelled specially from Japan to attend the event shows his present standing in their home country, some 110 years after his death. John and I asked Professor Sato to write up the event for our Newsletter and this is the result.

Alan Dronsfield

Dedication of a New Monument to Professor and Mrs Alexander W. Williamson

At Brookwood Cemetery in Surrey on 2 July 2013 a gathering of two hundred and fifty people, one hundred and thirty of whom had travelled all the way from Japan, celebrated the unveiling by the Japanese ambassador, Mr Keiichi Hayashi, of a new monument to Professor Alexander Williamson and his wife Emma Catherine, whose kindness made the first Japanese students to the United Kingdom so welcome in the latter half of the nineteenth century. The proceedings began with a few words of introduction from Professor John White, formerly Vice-Provost of University College London. Following the unveiling of the monument, Sir Malcolm Grant, Provost of UCL, responded to a posthumous letter of thanks to Professor and Mrs Alexander Williamson written by Mr Shinzō Abe, present Prime Minister of Japan, and read out before the monument by the Japanese ambassador. Finally Dr Robert Parker, Chief Executive Officer of the Royal Society of Chemistry, gave a short but very impressive talk on the status of Professor Williamson as one of the most eminent chemists of the nineteenth century.

When the initial group of students from Choshu Province arrived in London to study at University College in 1863, Professor Williamson and his wife, Catherine, invited the five young men to live with them in their own home. As their house at 16 Provost Road was not really large enough to house so many, two of the students later moved out to 103 Gower Street. Then, when in 1865 a further nineteen young men arrived from Satsuma Province, Williamson again stepped in, asking his fellow researchers to accept the students into their homes. He also managed to persuade the Administration Office of UCL to accept and register the young men as students in the Department of Chemistry. By taking care of them in this way, the Williamsons not only facilitated the students’ academic study but also helped them learn the language, etiquette and culture of Britain in daily life. As hosts, Alexander and his wife were exceedingly kind to these students who, coming from a far off country in the east, were unable to speak English properly and knew next to nothing about the British way of life.

On the students’ return to Japan, most of them assumed extremely important roles in Japanese public life and one must assume the “UCL experience” and the helpful, kindly attitude displayed by Professor Williamson must have had a great influence on their subsequent careers. Many rose to fame, but space permits only the mention of a few. Hirobumi Ito became the first Prime Minister of the new Japan, Kaoru Inoue became Minister of State for Foreign Affairs, Yozo Yamao, known as the father of Japanese engineering, became the Secretary of State in the Ministry of Industry, Masaru Inoue became the Founder and first President of the Japanese Board of Railways, Kinsuke Endo the Founder of the National Mint Bureau, Arinori Mori the Minister of Education, Yoshinari Hatakeyama the first Head of what is now the University of Tokyo and Hisanari Machida the first Director of Museums and Founder of the National Tokyo Museum. Many of the others likewise held high office, including Tomoatsu Godai, who contributed to the development of Osaka as a modern industrial and commercial centre.

With regard to the warmth and kindness experienced by the Japanese students at the hands of Professor and Mrs Williamson, particularly moving is the fact that, when Kosaburo Yamazaki, one of the Choshu students, fell ill with tuberculosis the winter after his arrival in 1865, the Williamsons invited him into their home and tended him till the day he died. I was so moved by the unconditional love the Williamsons showed Yamazaki that, when I first stumbled upon the couple's grave at Brookwood Cemetery, close to the graves of Yamazaki and the other three students who had died in London around that time, I instinctively prostrated myself before the couple's headstone and was unable to raise my head for quite some time.

According to an obituary written in *The London and China Express*, dated 10 March 1866, and a burial register kept at the office of Brookwood Cemetery, the funeral ceremony of Kosaburo Yamazaki, who died in London aged twenty-two, was attended by Professor Alexander W. Williamson, twelve fellow Japanese students from University College and about four other people. Yamazaki's is the oldest Japanese grave found in this country.

Nowadays the monument to the Williamsons stands quietly there in Brookwood Cemetery, close to the graves of Kosaburo Yamazaki and the other three students. It is surely a memorial of the affection shown by the Williamsons to those early students, but also of the professor's own enormous contribution to the modernisation of our country. As adviser to the new government, Professor Williamson took it upon himself to send out his own students and fellow researchers, thereby helping establish the foundation of scientific studies in Japan.

The monument is founded on our awareness of what was done by Professor and Mrs Williamson, both for the students in their time of need, and for Japan itself. The cooperation and affection that manifested itself through the couple still underlies and supports all manner of Anglo-Japanese relationships to this day, be they political, economic, academic or cultural - artistic and sporting relationships, too, I believe. The monument that we have established is a modest token of gratitude from us to the British people for all they have done for us.

Kemmyo Taira Sato

The RSC Thomas Graham Lecture for 2013 was also part of the year-long series of events commemorating the 150th Anniversary of Anglo-Japanese Scholarly Relations. It was given by Associate Professor Yoshiyuki Kikuchi from the Graduate University for Advanced Studies, Sokendai on 22 November 2013 and entitled "Joji Sakurai and the Development of Anglo-Japanese Relations in Chemistry, 1863-1939".

In 1863, five young samurai from the Chōshū domain in Western Japan came to London after the four months of difficult travel. With the support of Alexander Williamson, professor of chemistry and practical chemistry at University College London, they studied analytical chemistry and other scientific and engineering subjects, starting the long fruitful scholarly relations between Britain and Japan. After two years, 14 samurai from another domain in south-western Japan, the Satsuma domain, arrived in London and followed suit, again with the support of Williamson. The Thomas Graham Lecture examined how their studies in Britain influenced the subsequent development of chemistry in Japan. More specifically, it showed their tremendous impact on the development of Anglo-Japanese relations in chemistry in the nineteenth and early twentieth centuries through the eyes of Jōji Sakurai (1858-1939). As a chemistry student, professor, research organizer, and as a "scientific diplomat", Sarkurai experienced first-hand and contributed to this development from the 1870s until his death in 1939.

Yoshiyuki Kikuchi

BOOK REVIEWS

Alwyn Davies and Peter Garratt, *UCL Chemistry Department 1828-1974* (St Albans: Science Reviews (2000) Ltd., 2013). Pp. vii + 286. ISBN 978-1-900814-46-1. £12.

Available online: http://onlinestore.ucl.ac.uk/chemistrybook or from the UCL shop.

This engaging book covers the history of the oldest surviving chemistry department in London. University College was opened in 1826 as the University of London and ten years later was renamed University College. In 1828, the chemistry department opened, with Edward Turner (1796-1837) as Professor of Chemistry (and as lecturer in Geology too). Turner was an inspired choice, and the first of the book's fifteen chapters is devoted to him. Few professors of chemistry can have had a bust of himself paid for by his students after his death: it can still be seen in the department. His book on *Elements of Chemistry*, first published in 1827, became internationally famous and ran to many editions.

The treatment in this book is broadly chronological, with the heads of department up to 1971 (Turner, Thomas Graham, Alexander Williamson, William Ramsay – then Norman Collie, Frederick Donnan, Christopher Ingold, Ted Hughes, Ron Nyholm) forming nine of the chapter headings. Other members of staff and celebrated students under their reigns are covered too. It is remarkable, and fortunate, that the three London colleges founded in the nineteenth century all had, in that period, great and still-remembered chemists as professors: J.F. Daniell, W.A. Miller, C.L. Bloxam and J.M. Thomson at King's College London (founded 1831) and A.W. Hofmann, E. Frankland and T. E. Thorpe at the Royal College of Chemistry (founded 1845, now Imperial College).

Thomas Graham (1805-1869) followed Turner in 1837. He was one of the founders in 1841 of the Chemical Society (now the RSC) and its first President when just 35 years old. He was elected its President again in 1845. After he left UC in 1855 to become Master of the Mint Alexander Williamson followed, making fundamental contributions to organic chemistry. In 1887 Sir William Ramsay became Professor, and apart from being one of its most celebrated heads of department was an accomplished musician, both composer and performer - he wrote a military march to words by Kipling and sang at the annual laboratory dinners. In 1904 he was awarded the Nobel Prize for discovering the noble gases. Other erstwhile UCL students became Nobel laureates – Frederick Soddy (1921), Robert Robinson (1947) and Jaroslav Heyrovsky (1959). Norman Collie followed Ramsay in 1912 – a man of wide-ranging chemistry, who did intricate glass blowing while still smoking his pipe, and in 1928 the physical chemist Frederick Donnan. The redoubtable Christopher Ingold (who should have been awarded a Nobel Prize but never was) followed in 1937 and then, in 1961, Ted Hughes: the book contains a masterly summary of Ingold-Hughes chemistry. The tragically short tenure of Sir Ronald Nyholm from 1963 to 1971 is described with insight and affection: Nyholm coined the expression ‘the Renaissance of inorganic chemistry’ in his inaugural lecture. One of the book’s authors (and RSCHG member), Alwyn Davies, was acting Head from 1971-1974, but with typical modesty he says little about this. This part of the book closes with the accession in 1974 of Max McGlashan.

One of the book’s strengths is that it describes the achievements of the most celebrated UC staff and students – including Edward Teller, Otto Hahn, Kathleen Lonsdale, Sir Stafford Cripps and many, many others. It is not afraid to include chemical formulae, structures and explanations. A number of songs, verses and cartoons are included, and some good stories well told. Pleasingly there are reminiscences of the often forgotten but essential technicians, and anecdotes from students. The annual Laboratory Dinner, started before 1895 and still held, is described, as is the student Chemical and Physical Society. The latter was founded in 1876 and is the oldest still-functioning group of its type in the UK. At the end of each chapter there is a ‘bibliography’ – some 15-20 for the earlier chapters but sadly far fewer for later ones. Unfortunately these are not numbered or keyed into the text so this is really a book without references, which considerably limits its use to a historian. It is well produced, though with rather tight page margins, and there is an excellent, detailed index.

It is a thoroughly enjoyable and endearing volume: the authors have done UCL chemistry proud. The price, for a volume bountifully provided with illustrations, many in colour, is amazingly low. Warmly recommended to everyone.

Bill Griffith
Imperial College, London

Prakash Kumar, *Indigo Plantations and Science in Colonial India* (Cambridge: Cambridge University Press, 2012). Pp. xiv + 334. ISBN 978-1-1-7-02325-3. £68 (hardback).

Indigo has always been a revered dye and its origin goes back at least to the second millennium BC. Since indigo is a plant of the tropics, Europeans relied on woad as their blue dye until the importation of natural indigo from India and other parts of Asia. Much has been written of the dye’s history: natural indigo production and dyeing from earliest times and in different cultures, elucidation of the chemical structure of indigo and the manufacture of synthetic indigo by BASF from 1897 following work by Karl Heumann in 1890 using a process pathway based on naphthalene.

Prakash Kumar’s multi-layered book focuses on the indigo trade of the Indian subcontinent from the seventeenth century when the authoritative indigo text by the French naturalist, Jean Baptiste Labat was circulating. The book concentrates on the many facets of indigo cultivation and processing: improving plant species, optimizing the cultivation environment, improving processing and reducing labour costs – all with the objective of improved quality at the lowest price. These changes over time are also considered in the context of colonial power and the tension arising from native traditions, how new knowledge of science and technology was adopted and the role of institutions seeking to ensure Indian indigo remained an acceptable product for international markets. The market threat to Indian indigo became acute from 1897 when BASF started selling its synthetic indigo into the British dye and print trade.

A particular interesting part of this book concerns the switch on the part of British dyers and printers from using Indian natural indigo to German synthetic indigo. Remarkably, the switch was not sudden but played out over many years leading up to the First World War. It is also interesting to note that during the war period when stocks of German dye were unavailable (and British companies were striving to put the sequestrated German factory in Britain back into production) Indian natural indigo achieved a resurgence, albeit for a brief period. Kumar chronicles in some detail the gradual shift towards the German product as commodity prices fell, at times even below production cost, due to the aggressing action of BASF while the Indian growers fought a strong rear-guard action. Many users of Indian indigo in Yorkshire remained loyal because of their general satisfaction with a dye they had learned to use to good effect over many years and did not see the need for change.

This book is based on a PhD dissertation and although the adaptation generally works well, if there is one criticism it is that the conclusion does not really do justice to the many important themes of the book and attempt to draw them together into a final statement. Nevertheless, the book is thoroughly recommended to historians of chemistry and in particular to those with an interest in the history of dyes and dyeing.

Peter Reed

Eric Scerri, *A Tale of 7 Elements* (Oxford: University Press, 2013). Pp 270. ISBN 978-0-19-539131-2. £12.99 (hardback).

Undoubtedly, two of the most significant advances in chemistry in the last century and a half are Mendeleev's publication of his periodic table of the elements (1869) and Moseley's experimental support for what we now term *atomic number* (1913). The former is well known for containing gaps of still undiscovered elements (though some earlier workers had produced tables that also contained similar gaps) and the latter, a means of unambiguously identifying an element from the wavelengths of the principal lines in its x-ray spectrum. Assuming a 'new' element was available in sufficient quantities for such analysis, this could be a test for its true novelty. Moseley reported that he hadn't any evidence for four elements – those we associate with atomic numbers 43, 61, 72 and 75. These elements are four of those which Eric Scerri discusses in this book. He restricts himself to those naturally occurring elements up to uranium (elements 1-92). Thus he extends the Moseley list of four elements (technetium, promethium, hafnium and rhenium) by a further three: astatine (85), francium (87) and protactinium (91), making seven elements in all.

After raising and attempting to answer the questions "what exactly constitutes the actual *discovery* of an element?" and the follow-up one "who should therefore get the credit for it?", Scerri devotes a chapter each to his elements. Though we have passing glances at their chemical properties and uses, the bulk of his consideration concerns the routes to their discoveries. It was difficult work, mainly on account of their low natural abundances and also because the workers concerned chose to look for their presence in minerals associated with other (higher) elements in their Group columns, and gave insufficient regard to the possibility that they might connect more to their horizontal neighbours in the Table. Moreover, some were highly radioactive. Some workers placed all their faith in now-discredited physical methods of analysis. This led Fred Allison, using the phenomenon (or rather, chimera) pioneered by him, the *Allison Effect*, to announce that he had discovered both "virginium" (87) and "alabamium" (85). Coincidentally I reviewed both his technique and his conclusions in our last Newsletter [1].

There is always a striving to be first in a particular field and this applies certainly to the discovery of new elements. Sometimes it's driven by egotism and sometimes by nationalism. This latter can give rise to acrimonious disputes, such as hafnium being claimed at various times by an Austrian (Auer von Welsbach), a Frenchman (Urbain) and an Hungarian (von Hevesy). Historical Group member Eric Scerri tells here a succession of good, engaging stories and this is one of those books not easy to put down once started – and you can't say that about many other contemporary books dealing with the history of our subject. Moreover, it's just been announced that this book has made it into the top 12 science books of 2013, as judged by the magazine *New Scientist*. Priced at £12.99, and sometimes less, I strongly recommend it.

Reference

1. A. Dronsfield and M. Hill, *RSCHG Newsletter*, Summer 2013, 27-34.

Alan Dronsfield

SHORT ESSAY REVIEW

Mauveine Again

The oft-visited story of the discovery of mauveine by William Henry Perkin in 1856 was repeated on 2 October 2013 in the BBC2 television programme *Science Britannica* with Professor Brian Cox narrating. The overall message was correct – Perkin discovered mauveine – but the devil was in the detail. Perkin's attempted quinine synthesis actually started with *N*-allyl-toluidine (not mentioned). In 1862, a year before the dye was named *mauveine* in 1863, he succinctly described his discovery [1]:

> In the early part of 1856, I commenced an investigation on the artificial formation of quinine. To obtain this base, I proposed to act on toluidine with iodide of allyl, so as to form allyl-toluidine, which has the formula :-
>
> $$\left.\begin{matrix} C_7H_7 \\ C_3H_5 \\ H \end{matrix}\right\} = C_{10}H_{13}N,$$
>
> thinking it not improbable that by oxidising this, I might obtain the desired result, thus :-
>
> $$\underset{\text{Allyl-toluidine.}}{\underline{2(C_{10}H_{13}N)}} + O_3 = \underset{\text{Quinine.}}{\underline{C_{20}H_{24}N_2O_2}} + H_2O$$
>
> For this purpose, I mixed the neutral sulphate of allyl-toluidine with bichromate of potassium; but, instead of quinine, I obtained a dirty reddish brown precipitate. Nevertheless, being anxious to know more about this curious reaction, I proceeded to examine a more simple base under the same circumstances. For this

purpose I selected aniline, and treated its sulphate with bichromate of potassium. This mixture produced nothing but a very unpromising black precipitate; but, on investigating this precipitate, I found it to contain that substance which is now, I may say, a commercial necessity, namely, *aniline purple*.

Another noteworthy aspect of the mauveine discovery was that had Perkin used pure aniline, no colour would have resulted and the world may never have seen the purple dye. This was also not mentioned in the programme. Perkin's "aniline" was obtained from coal tar naphtha which was distilled to give a fraction containing benzene, toluene and, perhaps, a little xylene. Nitration of this mixture gave the mononitro derivatives. Perkin's favoured procedure for the reduction of the $–NO_2$ group to $–NH_2$ was that of Pierre Jacques Antoine Béchamp (1816–1908) using ferrous acetate. This leads to a mixture of aniline, *o*- and *p*-toluidine. Then the bichromate reaction gives not one but over a dozen very similar purple products.

The dyeing demonstration was underwhelming, but perhaps only a few milligrams of mauveine were available. It seems that much of the interesting detail was left out. Was this due to time constraints or fear that the non-chemist would find it incomprehensible?

1. W.H. Perkin, "On Colouring Matters derived from Coal Tar", *Q. J. Chem. Soc.*, 1862, 14, 230–255. DOI: 10.1039/QJ8621400230

Chris Cooksey

RSC NATIONAL HISTORICAL CHEMICAL LANDMARKS

RSC Chemical Landmark Plaque at the University of Southampton

On Wednesday 24 July 2013 an RSC Landmark plaque was unveiled at the Department of Chemistry, University of Southampton, to commemorate the fiftieth anniversary of the discovery on 29 August 1973 of the phenomenon of Surface Enhanced Raman Spectroscopy (SERS), by the late Martin Fleischmann and by Pat Hendra and James McQuillan. I represented the RSCHG at this unveiling and subsequent conference.

The plaque was to have been unveiled by David Phillips but he was held up by heavy traffic, so Claire Viney of the RSC and Professor Phillip Gale outlined the main features of the RSC Chemical Landmarks, and the SERS plaque was duly unveiled by Professor Philip Nelson, pro-Vice Chancellor of the University. There followed short reminiscent addresses by the two surviving members of the three who had discovered the SERS phenomenon, Professors Pat Hendra and Jim McQuillan. The original discovery, made at 20.30 on 29 August 1973 (at night because the Raman spectrometer, owned by Professor Ian Beattie who was also at the meeting, was in constant daytime use). In this and subsequent experiments very intensity-enhanced laser-excited Raman spectra were observed of pyridine in the locality of a roughened silver electrode. The technique is now used for many purposes, for example to detect tiny quantities of molecules in many areas including forensics, drug detection and in understanding the origins of works of art. It has also been used in oligonucleotide targeting (detecting DNA and RNA sequences).

The mechanism, for which special selection rules apply, is still a matter of some debate, but it is generally thought that two main mechanisms operate. In the electromagnetic effect, which probably always operates in SERS, localised surface plasmons are involved; in the 'chemical theory' mechanism, charge-transfer complexes with some sort of a substrate-surface chemical bond, are implicated. The effect probably involves both mechanisms.

In the afternoon meeting on SERS which followed, Professor Andrea Russell (Southampton) spoke on the subsequent development of the technique at Southampton; Professor Zhong Qun Tian of Xiamen University, China, who had worked on SERS with Martin Fleischmann at Southampton in the 1980s talked of his experiences there and subsequent work; Professor Duncan Graham (Southampton) talked about SERS analysis of biomaterials, cells and tissue; Professor Phil Bartlett (Southampton) spoke about nanostructured surfaces for SERS, and finally one of the discoverers, Professor Jim McQuillan, now at the University of Otago, talked on recent *in situ* infrared work in TiO_2/aqueous solution photocatalysis.

Bill Griffith

Chemical Landmark Plaques Honour the Discovery and Progress of the Drug Ibuprofen

As part of the MediCity opening celebrations, Boots UK was recognised on 21 November 2013 by the Royal Society of Chemistry with Chemical Landmark Plaques for the discovery of ibuprofen. The development of ibuprofen by Boots UK took place in a number of buildings across Nottingham, including the premises that BioCity Nottingham is based in now, and the historic D6 building on the Boots site in Beeston. Both buildings will display Chemical Landmark Plaques for the discovery of ibuprofen.

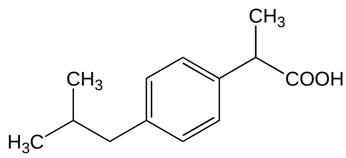
Professor Dave Garner, a Past President of the RSC, presented the *Chemical Landmark* plaques to commemorate the research and discovery of ibuprofen. He said:

> Innovation and scientific discovery are woven into the fabric of Nottingham, as manifested by the range of major developments pioneered by organisations like Boots UK and BioCity. One of our Royal Society of Chemistry blue plaques will mark the discovery of ibuprofen by Boots some 50 years ago by Dr Stewart Adams and his team on the old Nottingham Pennyfoot Street site (now the location of BioCity). The second plaque will mark the thirtieth anniversary of ibuprofen becoming the first prescription medicine to be available over-the-counter and will be erected on the D6 Beeston building, location for many years of the ibuprofen production line. The plaques are a fitting tribute to Dr Stewart Adams and his team's original and innovative research.

Ken Murphy, Managing Director, Health & Beauty International and Brands, Alliance Boots said:

> I am delighted to be receiving this plaque from the Royal Chemistry Society in recognition of Boots' long history of innovation, and it is a great honour that Dr Stewart Adams has joined us for this ceremony. We hope that through our collaboration with MediCity we can continue to innovate and bring customers and patients new products, services and technology in the field of health, beauty and wellness.

Dr Glenn Crocker, CEO, BioCity says: "We are honoured that the work developed on our Pennyfoot Street site by Dr Adams and his team is being recognised in this way with a plaque at BioCity. This is also recognition of the ongoing collaboration between BioCity and Boots UK, of which MediCity is the latest chapter in the story".



Dr Adams provided a brief history of the drug, initially developed as for pain relief for rheumatoid arthritis, and also commented how he tested it on himself when suffering from a 'hang-over headache'. Today ibuprofen is used primarily for fever, pain, dysmenorrhea and inflammatory diseases such as osteoarthritis and rheumatoid arthritis. At low doses it is associated with fewer gastric disturbances, compared to other anti-inflammatories such as aspirin. World-wide we consume about 18,000 metric tonnes annually and it is regarded as a 'core' medicine in the World Health Organization's *Model List of Essential Medicines* necessary to meet the minimum medical needs of a basic healthcare system.

Figure 1: *National Chemical Landmark Plaque for Ibuprofen at Pennyfoot Street, Nottingham*

Figure 2: *National Chemical Landmark Plaque for Ibuprofen at Boots, Beeston*

Figure 3: Dr Stewart Adams (left) and Prof Dave Garner (picture credit: Redpix/Medicity)

Alan Dronsfield and Edwin Sylvester

MEETING AND CONFERENCE REPORTS

Chemistry Meets Medicine: Some Historical Perspectives

This whole-day conference was held on the 23 October 2013 in Burlington House and attracted about 65 attendees. We were particularly pleased to welcome friends from the History of Anaesthesia Society and from the History Section of the Royal Society of Medicine.

Alan Dronsfield

From Serendipity to Science - Inhalational Anaesthesia in the mid to late Nineteenth Century

The discovery of inhalational anaesthetic agents in the 1840s derived from fortuitous observation and empirical trial and error, but thereafter the search for new agents was based on scientific experimentation. That anaesthetic activity might be related to chemical composition and structure was suspected in the 1840s, but progress was limited until the 1860s when advances in chemistry enabled recognition of structure-activity relationships.

In 1847 Flourens (1794–1867) used anaesthetic agents as an investigative tool in his work on the functions of the medulla oblongata. Having compared sulphuric, nitric and hydrochloric ether, his experience with the last of these led him to experiment with chloroform.

Thomas Nunneley's conceptualisation of the possible relationships between chemical composition and anaesthetic effect (and possibly also of the concept of a relationship between structure and effect) was far in advance of his contemporaries in the late 1840s. However the conclusions from his experiments in 1848 were limited because he did not have an accurate understanding of the chemical structure of most of the chemicals with which he experimented.

John Snow initially rejected Dutch Liquid, 1,2-dichloroethane ($C_2H_4Cl_2$), as a suitable agent for anaesthesia and then investigated the 'monochloruretted chloride of ethyle' (1,1-dichloroethane, CH_3CHCl_2). He also synthesised bromoform ($CHBr_3$) in order to compare it with chloroform.

The discovery of the concepts of valency, the periodic table and an accurate knowledge of atomic weights allowed Benjamin Ward Richardson to construct more pertinent experiments because chemical composition could now be more accurately determined. By studying the amyl, methyl, ethyl and butyl compounds of different salts, he was able to establish a relationship, albeit a very simple one, between chemical composition and pharmacological activity. By studying isomers he also recognised that not only composition but also structure was important. Noting that Dumas had developed a 'law of substitution', Richardson suggested that there might be some analogous 'physiological law', which would make the investigation and application of medicinal remedies 'more sure and certain'. His suggestion was important because it presupposed the possibility of prediction in pharmacological research. It also assumed that only part of a molecule might be pharmacologically active and that such activity, whether beneficial or toxic, might be modified by small changes in the chemical composition of the molecule. Finally and perhaps most importantly, it implied that it would be worth investigating whole families of related compounds. Although he did not discover any universal 'physiological law of substitution', he did show that toxicity in hydrocarbons with anaesthetic properties increased in proportion to the number of carbon atoms in a straight carbon chain until eventually a point came where the physical properties of the compound changed. He also showed that, among the chlorinated hydrocarbon anaesthetics, the anaesthetic property resided in the hydrocarbon moiety, whereas toxicity was related to the amount of chlorine in the molecule. He used his findings to predict whether a liquid hydrocarbon had anaesthetic properties and, if it had, how much would be needed to produce narcotism and the time needed for induction of anaesthesia and recovery. His findings allowed him to introduce two new anaesthetic agents into clinical practice between 1867 and 1870. Furthermore his work with chloral helped to establish the concept of a pro-drug.
Work on the development of new anaesthetic agents had therefore made significant contributions to the genesis of the new specialties of experimental and clinical pharmacology.

Henry Connor

Leo Sternbach

Leo Sternbach (1908-2005) working for Roche, synthesized the benzodiazepines, an important advance in the pharmacology of anxiolytics. He was born in Abbazia, a spa resort on the Adriatic coast of the Austro-Hungarian Empire to Michael and Piri Sternbach. This Jewish family were well off, but aware of anti-Semitic feelings. At the end of the war, Abbazia became Italian, and was occupied by Italian soldiers, who supplied the boys with explosives to play with. Education was now in Italian, which Leo did not speak, so he went first to Villach and then to Graz to be educated in German. Anti-Jewish feeling here was very pronounced, so he moved to Bielsko-Biala in Poland, finishing his schooling in German, while learning Polish.

The family returned to Krakow and Leo enrolled at the university to read pharmacy, only allowed because his father was a pharmacist. He was then allowed to study organic chemistry, obtaining his doctorate in 1931, and worked as a research assistant and lecturer in Krakow, until 1936 when the post was given to a Christian. Financed by a scholarship from a Jewish textile magnate, and later the Rockefeller Foundation he moved to Vienna, in 1937 for a few months, then to Zurich, to the Federal Institute of technology. Here he met Herta, his wife.

Hoffman la Roche employed him as a research chemist in Basel in 1940, working on the synthesis of riboflavin. Switzerland was surrounded by Axis Powers, so Roche moved most of their scientists to the USA. Leo, with a visa as an Italian born Austrian and a specialist on the synthesis of vitamins, and Herta were given Swiss aliens passports, valid for three months, which did not mention the holder's nationality or religion. They went through France in a sealed railway carriage, crossed the border at Port Bou, crossed Spain and Portugal, and then crossed the Atlantic on a Portuguese ship, landing in New Jersey.

He worked for Roche for more than 60 years, synthesized Arfonad and then Librium and Valium. He was responsible for 240 patents covering 5,093 abroad, and he made the company what it is. An unshakeable realist, he said *Life is how it is.* This was what someone at Roche said of him: *He was one of the nicest men I have ever known.*

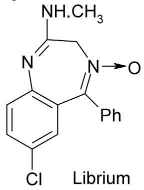
Ann Ferguson

The Discovery of the Benzodiazepines

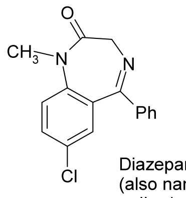
As late as 1950 mental institutions were crammed with patients suffering from schizophrenia, for whom there was no effective treatment: merely sedation, usually with either potassium bromide or chloral hydrate. In 1951 a new drug, chlorpromazine, was tried out on these patients. It was astonishingly successful and, as long as they continued to take the tablets, they could be released into the community. By 1956 it was being taken by 4 million patients in the USA alone, and yielding a handsome profit for its manufacturers, Rhône-Poulenc. Leo Sternbach's employers, the chemical firm Roche, wondered if another 'mental' condition might be treated by chemical therapy and yield a nice profit for them, too. He was charged with developing a drug that could be used to treat anxiety states.

At that time there were two major approaches to drug discovery. Either substances in the firm's 'library' of chemical compounds could be tried speculatively on volunteers suffering from a condition or a disease, or the structure of an existing drug might be manipulated to devise an alternative that could treat or cure the disease. The first approach yielded no lead compound and the second one, mainly 'playing around' with the structure of chlorpromazine, was equally unfruitful. Sternbach wondered if success might come from some of the compounds he had made during his Krakow period when he was conducting research into dyestuffs chemistry. With an eye to the structure of the chlorpromazine molecule, he decided that a successful candidate for evaluation would probably contain a tertiary amine group somewhere. But sadly, nothing came from this strand of research. Some two years later, during a laboratory clean-up, it was noticed that one of his compounds had not been submitted for clinical evaluation. With no expectation of success, as it was a secondary, rather than tertiary amine, it went off. It came back from the testing laboratory with a glowing report. Indeed it could be used to treat anxiety, particularly when the condition was causing the patient a distressing sleeplessness. It was first marketed in 1960 as the drug *Librium*.

If it had a drawback, it was that its effects persisted rather too long. If the sleeplessness was adequately controlled, then the patient was apt to be 'dozy' the following day.

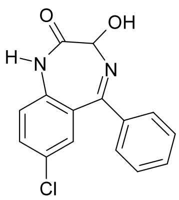


Librium

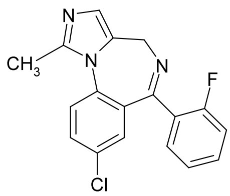


Diazepam (also named *valium*)

Librium's structure was enthusiastically manipulated to come up with other drugs with 'tailor-made' properties. *Valium* was first marketed in 1963. It fulfilled the same roles as Librium, but without the 'day-after doziness'. *Lorazepam* (1977), in contrast, added a long-acting sedation to its effects, making it useful in intensive care wards to prevent the patients disconnecting themselves from the tubes and monitors to which they were wired up.



Lorazepam



Midazolam

Midazolam was introduced in 1977. This was a very short acting benzodiazepine that found application to prepare patients for minor operations such as those conducted in dentists' surgeries. In sufficient doses it could sedate patients to the point of unconsciousness, but more commonly it was used to relax an apprehensive patient prior to, say, injection of a local anaesthetic for a tooth extraction or a filling. Being short-acting, once its immediate effects had worn off, he or she could leave the surgery with minimal post-operative supervision.

Alan Dronsfield

Chloroform before Simpson

Within a month of the administration on 21 December 1846 of diethyl ether vapour at University College Hospital, London, for the painless amputation of a leg, a letter in the London Medical Gazette by S.J. Tracy, the ether administrator at St Bartholomew's Hospital, indicated that the vapour of a number of other volatile liquids had been tested for anaesthetic properties very soon afterwards. Among these was a preparation called 'chloric ether'. What was not understood was that there were two different compounds which bore that name.

The first had been prepared during the early 1790s, by a group in Amsterdam who became known as the Society of Dutch Chemists. By reacting alcohol with concentrated sulphuric acid they obtained what they called olefiant (oil-producing) gas, which we now call ethylene. Reacting olefiant gas with chlorine produced a colourless volatile sweet-tasting liquid with a pleasant smell which became known as *Dutch Liquid*, and today is called dichloroethane, or ethylene dichloride.

The name 'chloric ether' was proposed by Thomas Thomson, professor of chemistry in Glasgow, in the sixth edition of his textbook, published in 1820, and this chloric ether, taken by mouth, became well known in the

United States as a pleasant mild stimulant. Its medicinal use was promoted by the leading American chemist, Professor Benjamin Silliman of Yale.

Thinking that the manufacture of chloric ether might be profitable, Dr. Samuel Guthrie, a medical entrepreneur and manufacturing chemist with a large establishment in Sacket's Harbour, a settlement on the American shore of Lake Ontario, experimented with variants of the standard ingredients. He found that distilling chloride of lime with alcohol in the form of best-quality whisky produced a pleasant-tasting ethereal liquid, which, when redistilled and neutralised, gave a highly concentrated volatile product. Although Guthrie had started with different reagents from the classic method, both he and Silliman, to whom he communicated his progress, assumed that the product was chloric ether, although there can be no doubt that he had produced pure chloroform. Some months later the same compound was produced independently by the French chemist Eugène Soubeiran and the German chemist Justus von Liebig, but the date of Guthrie's publication, 1 July 1831, gives him clear priority of several months.

The new 'chloric ether' became very popular in the New England States as a pleasant medicament, but was unknown in the United Kingdom, so a prescription containing it presented a problem at the Liverpool Apothecaries' Hall in the late 1830s. The head chemist found chloric ether in the United States Dispensatory, and produced a liquid which became popular among Liverpool patients, and was prescribed by the physicians as chloric ether. It was especially effective by inhalation for the treatment of neuralgia and bronchial complaints. Dr David Waldie, the successor to the chief chemist, refined the method of preparation and produced a purer and more concentrated liquid, which continued to be prescribed under the name 'chloric ether'.

Immediately after Liston's successful use of ether as an inhalational anaesthetic on 21 December 1846 he was visited by his friend James Young Simpson, professor of obstetrics at Edinburgh, who had been looking for a method of alleviating the pains of childbirth. Simpson returned home with some ether, and used it both during surgical operations and for women in labour with some success, but its irritation of the respiratory passages was a disadvantage for the latter purpose, so Simpson tested other vapours, culminating, at the suggestion of Waldie, in the successful trial of chloroform on himself and his assistants on 4 November 1847. After putting it into clinical use he announced his discovery on 15 November.

But in the meantime a solution of chloroform in alcohol, in the preparation known as chloric ether, had been in use at St Bartholomew's Hospital by the surgeon William Lawrence, on a number of his patients, between May and November. It was administered by his assistant, Holmes Coote, on the suggestion of a medical student, Michael Cudmore Furnell, who had come across it while testing ether vaporizers on himself, and had been struck by the absence of any irritation during breathing. In clinical use it was found to be too weak, and Lawrence and Coote were contemplating reducing the proportion of alcohol and other diluents when Simpson made his announcement.

Simpson has always been so exclusively credited with the introduction of chloroform that it has become a form of *lèse majesté* to suggest anything else. So many extravagant claims were made by some of the organizers of the Simpson bi-centenary celebrations in Edinburgh in June 2011 - a poster produced by the City Council even claimed that he had *invented* chloroform - that it would have been foolhardy to have attempted to present this paper on that occasion.

A fuller account of this subject can be found in the 2012 *Proceedings of the History of Anaesthesia Society*, available on the Society's web site, at www.histansoc.org.uk volume 45, pages 52-65.

David Zuck

Chemistry and the Treatment of Cancer, c. 1940s-1970s

Between 1971 and 2007 median survival times for all cancers increased from 13 months to 69 months. For some cancers such has Non-Hodgkin Lymphoma progress has been even more dramatic, with a ten-fold increase from 12 to 120 months. This progress is attributable to a variety of factors, including drugs. However, many of the drugs that are part of the therapeutic arsenal today were discovered well before 1971. This paper focused on these drugs, which helped to establish modern cancer chemotherapy between 1940 and 1970. In this period, childhood leukaemia became the first cancer to be 'cured' thanks to drugs, used at first on their own, and then in combination therapy. Hence the question underpinning the paper was that of chemistry's role in the treatment of cancer, and how this role changed over time.
After describing earlier forms of treatment, from surgery, to radiotherapy, and a variety of pills and potions including 'Doctor Fowler's Solution' (an early nineteenth century hydro-alcoholic solution of potassium arsenite that was used for the treatment of leukaemia as well as other conditions), the paper moved to the five main groups of compounds discovered between 1940 and 1970, which are distinguishable by their mode of action (although it was often worked out after they were used in cancer treatment). Their discovery occurred in three distinct phases, each representing a step change in the style and scale of research and development, from largely local experimentation, to national and then international collaborative schemes, involving teams of researchers in both public and private institutions.

Based on this overview of the early history of cancer chemotherapy, the paper therefore concluded that chemical knowledge and know-how had played a major role, by: (1) making molecules and their analogues in search of more effective/safer anti-cancer agents; (2) mass-screening molecules in search of further anti-cancer agents; (3)

providing a chemical understanding of their mode of action in cancer cells in order to develop new and more effective anti-cancer agents.

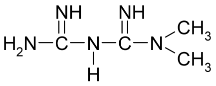
The paper ended with some remarks about the role of chemistry following the period under study, i.e. from the 1980s onwards. Although, with the appearance of new treatments and approaches such as monoclonal antibodies and interferon, (bio)medicine could be said to have 'caught up with' or even 'overtaken' chemistry in its contribution to the treatment of cancer, drugs have remained an essential part of the therapeutic armamentarium, with some old drugs and poisons such as bendamustine (a nitrogen mustard), arsenic trioxide, and thalidomide, making a come-back in the continuing battle against resistant or recalcitrant cancers.

Viviane Quirke

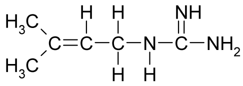
Type 2 Diabetes and the Discovery of Metformin

At present there are about 2.9 million sufferers from Type 2 diabetes in the UK, and with the increasing obesity of the population, it is estimated that by 2025 this figure will have risen to 4 million. If it is poorly controlled, it can lead to blindness, limb and digit amputations, heart problems and a premature death. If a change to a 'healthy' diet and a vigorous exercise regime cannot bring the blood glucose levels down to acceptable concentrations, then oral medication with the drug *Metformin* is usually the initial line of attack.

This drug was discovered because of a malaria connection. Success with the sulfonamides in the 1930s led to the notion that chemists might come up with an alternative to the natural product anti-malaria drug, quinine. Several were synthesised, some more effective than others. *Paludrine* was one of the most successful outcomes, a cheap, well-tolerated drug, widely available post-WW2. Eusebio Garcia was a physician working in the Philippines and happened to be treating some patients for malaria and others for influenza. He decided, on a whim, to try some of the 'experimental' anti-malarial drugs that he had managed to acquire on some of his flu patients. He reported an astonishing success with one of them which he named *Flumamine*. In his paper describing its effects against the flu virus, he noted that when it acted as an anti-malarial, it probably did so by reducing the blood sugar to levels so low that they were incompatible with life of the parasite causing the disease. This remark was picked up by the Parisian physician, Jean Sterne. He was a specialist in the treatment of diabetes and had earlier worked with the natural product galegine, which was one of the active ingredients in the *Goat's Rue*, a plant with mild anti-diabetic properties. However, galegine itself was poorly tolerated in doses that might be associated with therapeutic effects.



Metformin
(Flumamine)



Galegine

Presumably Sterne noted a slight structural similarity between his galegine and Garcia's flumamine and, after animal tests that showed it had no adverse effects, he tried it out on a selection of his diabetic patients. It had no effect on those suffering from the Type 1 variant, but it lowered the blood glucose levels in his Type 2 patients. Often (at least initially) this was the sole medication needed, but sometimes it had to be combined with other oral anti-diabetic medicines. Either way, it was effective against Type 2 diabetes, and today it is the most widely prescribed oral drug to treat this disease.

Paper given by Alan-Shaun Wilkinson, summary prepared by Alan Dronsfield

Sir James Black and the Discovery of Cimetidine

Dr Black was a medically qualified physiologist who was passionate about solving medical problems. He had spent a few years at ICI pharmaceuticals and had discovered that by collaborating with a chemist, he could obtain pharmacological tools that could be therapeutically useful. For his approach and success in drug discovery he shared the Nobel Prize for Physiology or Medicine in 1988.

Adrenergic responses had been classified by Alquist in 1948 as involving two types of receptors, α and β. There were two very important features that led to Black's first major drug discovery. At the β-receptor, isoprenaline was more potent than adrenaline and, in 1958, the dichloro analogue, DCI, was reported to have reduced stimulant ability at the β-receptor. Black wanted to block the β-receptor so he asked a chemist at ICI, Stephenson, to modify DCI. Stephenson replaced the two chlorine atoms by fusing on a benzene ring giving a naphthalene, this was pronethalol, the first prototype β-blocker.

Black thought that he could repeat this for histamine. Antihistamines were developed in the 1940s, and are well known drugs for hay fever sufferers. They block histamine in stimulating smooth muscle contraction but do not block histamine's stimulation of gastric acid secretion. Black argued that perhaps there were 2 types of histamine receptors, like for adrenaline, and, if we could block histamine selectively at its other receptor, it might block acid secretion and allow peptic ulcers to heal.

Histamine is not the only natural stimulant of acid secretion; acetylcholine and gastrin were also known stimulants. ICI were interested in gastrin, but NOT histamine. That was the view of gastroenterologists too. Black was having to battle for his idea about histamine and so he came to SmithKline & French Laboratories in Welwyn Garden City for research support.

Black set up two main bioassays. In those days it was heroic work, no simple screen using laboratory robotics. The main assay was *in vivo*, gastric acid secretion in the rat. Black also set up an *in vitro* assay using the guinea-pig right atrium, whose rate of beating is stimulated by histamine since it contains the pacemaker. My chemist colleague, Dr Graham Durant, with his two assistants started working with Black. Black said “We don’t need more chemists, just make a few compounds and we will have our prototype drug by Christmas”. He was applying what he had learned about adrenaline at ICI. “Just leave the side chain as it is and change the ring”. But such compounds were not active. Christmas came and went, but no lead had been discovered.
More chemists joined in and the project became a full-blown research programme. Nearly four years and 200 compounds later, there was still no lead. The management in the parent company in Philadelphia, USA, ordered the research to stop. However, as determined scientists we carried on! Black decided to modify the rat test and re-examine the polar compounds. The simple guanidine analogue (N^{α}-guanyl histamine) was then found to be weakly active as a blocker, although it was also a stimulant. It was actually the sixth compound synthesised and tested but its activity had been missed. Thus in contrast to adrenergic receptors, for histamine we had to leave the ring and alter the side chain.

Some of the major studies leading to cimetidine were presented. Structure-property-activity studies led to a series of more potent longer chain imidazolylalkylamidine blockers. These were all, however, also stimulants. They were all strong bases and therefore non-basic analogues were examined, so affording burimamide, which was not a stimulant: it was the first prototype histamine H_2-receptor antagonist that was also taken into human studies. It was, however, not potent enough for oral use; consideration of imidazole tautomerism led to metiamide which was taken into clinical trials. Duodenal ulcers were found to be healed within twenty-eight days, a fabulous result, but unfortunately there were seven cases (out of 700 patients) of granulocytopaenia, and consequently patients had to be closely monitored. Replacing the thiourea moiety in metiamide by cyanoguanidine led to cimetidine, which revolutionised the treatment of duodenal ulcer disease. From start of the research programme in 1964 to the first marketing of cimetidine (Tagamet®) took nearly thirteen years.

Robin Ganellin

The Discovery of Prostaglandins

The potent smooth muscle contractile activity of seminal plasma had been noticed by researchers as long ago as 1930. Whilst studying in London, a young Swedish medical student, Ulf von Euler, had discovered what he called ‘substance P’ in extracts of intestines. Following his return to Stockholm he continued his search for other biologically active factors in different organs. After testing a wide variety of tissue extracts, including some accessory genital organs, Euler tested human seminal fluid and noted a dramatic hypotensive action in rabbits and a contractile action on the rabbit jejunum. This biological activity was also detectable in extracts of human, dog and rabbit prostate tissue, as well as the vesicular glands of (sexually mature) bulls. Euler demonstrated that this biological activity seemed to be a totally new type of pharmacologically active agent, a low molecular weight lipid soluble acid. Because it was (apparently) abundantly present in extracts of the prostate he named it ‘prostaglandin’. As it happens he was mistaken, as the main source of the extract was actually the vesicular gland. Nevertheless the name stuck.

After the war, which interrupted his research, Euler encouraged Sune Bergström, a colleague with expertise in lipid biochemistry, to take a fresh look at the samples of ‘prostaglandins’ that he had stored in the deep freeze. In 1957, Bergström and his collaborators isolated a prostaglandin in a crystalline form, and in 1960 they reported the isolation from sheep vesicular glands of two factors named prostaglandin E and prostaglandin F.

The Stockholm group also noticed the resemblance of prostaglandins to the twenty carbon ‘essential’ fatty acids. It suggested to them that these lipids could be the precursors from which prostaglandins were generated. Bengt Samuelsson and his team then demonstrated that radioactive arachidonic acid was indeed converted enzymatically into labelled prostaglandin E_2. This enzyme system was at first called ‘prostaglandin synthetase’, but today it is generally known as fatty acid cyclo-oxygenase (often shortened to Cox).

Working on an entirely different problem in London in the 1970s, John Vane was pondering the mechanism of action of the anti-inflammatory drug aspirin. Despite widespread clinical use, little was known about how aspirin and the ‘aspirin-like’ drugs actually worked. Vane and his colleagues noted that prostaglandins were released into the arterial circulation of an anaesthetised dog if it was mildly hyperventilated and that when aspirin was given, the release of these substances was greatly reduced. This experiment suggested to Vane that aspirin might be blocking the prostaglandin synthetase enzyme. This finding, developed by him and his group in the succeeding years, eventually provided a comprehensive explanation for the therapeutic and side effects of aspirin and the aspirin like drugs.

In 1982, Vane, Samuelsson and Bergström were awarded the Nobel Prize for Physiology or Medicine for their pioneering work on prostaglandins. The award not only celebrated a lifetime of highly significant achievements on the part of the three investigators but also the fact that the prostaglandins were the first family of lipid mediators to be so closely characterized.

Rod Flower

The 24th International Congress of History of Science, Technology and Medicine, Manchester 21-28 July 2013

1750 delegates from all corners of the globe, 1400 papers in 23 parallel sessions, uncomfortable humidity and daily temperatures around 30ºC in non-air-conditioned classrooms, this was the largest congress of historians of science, and technology and medicine ever assembled since such international meetings began in 1929. Besides papers on every conceivable topic imaginable (the general "catch-all" theme was "Knowledge at Work"), there were receptions, museum visits, lecture demonstrations, theatrical events (including a new opera based upon the life of Turing), campus tours and historical walks, stand-up comedy and music in university pubs, All the main publishers associated with history of science displayed their wares and an enterprising antiquarian dealer displayed a mouth-watering collection of primary and secondary sources. For those wishing to escape six days of papers, there were opportunities to visit the iconic Jodrell Bank telescope, the Quarry Mills, and further afield, the Duke of Devonshire's Chatsworth House in Derbyshire. There was so much to do and choose that the organisers dispensed with a printed programme (which would have been too bulky to carry around) and gave each delegate a USB for their personal laptop instead. (Expect this to become the norm at future conferences.)

Although overall the history of chemistry formed only a small percentage of the crowded proceedings, it did figure prominently over four of the days. Professor Hasok Chang, the current President of the British Society for the History of Science, which was hosting the congress, gave an impressive keynote address at the opening of the conference in which he made a plea to put "science back into the history of science" and drew on examples from the history of electrochemistry. The remainder of the day (at least for historians of chemistry) was devoted to three sessions sponsored by CHF, SHAC and the Forum for the History of the Chemical Sciences on "Reworking the history of chemistry: practice, revolution, visualization and exchange". "Practice" involved the recovery of early alchemy and chemistry with papers exploring the interactions between dyeing, medicine and pharmacology in the Graeco-Egyptian period (M. Martelli, Germany); a study of Michael Maier's allegorical laboratory in the *Atalanta Fugiens* (D. Bilak, USA); and the theory and practice of Stuart mining activity at Hilderston in Scotland (C. Pastorino, UK). The second session on "visualization" had Alan Rocke recapitulating and extending his study of the significance of visualization and representation in nineteenth-century molecular modelling; Ann Robinson (USA) explored the different ways the lanthanides had been delineated in textbook periodic tables; and M. Morange (France) traced the role that visualization and signalling diagrams had played in the development of molecular biology. The final Monday session on "exchange" saw papers from the orientalist scholar G. Ferrario (UK) on how knowledge of lapis lazuli reached the Latin West; Y. Kikuchi (Netherlands) showed how useful the illustrated manual of Ronalds and Richardson, *Chemical Technology*, had been in training chemical engineers in both the UK and in Japan; finally Anna Geltzer (USA) explored the uneasy relationship in the Soviet-American cooperation in cancer drug development in the 1970s.

On the Tuesday SHAC sponsored a thrilling demonstration lecture called "Strange Ice" by Andrea Sella (UCL). Although not historical, it reminded the audience of what a strange material ice is and of what a problem it had presented (and continues to present) to physical scientists. There was then a day's gap before, on Thursday the Waters Corporation (the American analytical industrial specialists) sponsored three papers on "Aspects of the history of modern chemistry". The first (A. Rodny, Russia) laid down a scheme for the formation and development of the chemical community, suggesting that chemists were now experiencing a "post-disciplinary" phase; T. Serviant-Fine (France) unravelled the Woods-Fine theory of the chemotherapy of the sulphonamides in the 1930s; and N. Kirsch (Israel) showed how Chaim Weizmann had returned to chemical research in the 1930s after a decade's political activity.

The whole of Friday was devoted to "Materials and Chemistry from bench to brand and back", sponsored by the Commission on the History of Modern Chemistry. It began with two papers on early synthetic (or rather, artificial) materials with P. Laszlo (France) examining the case of cellophane and viscose; and J. Mercelis (Belgium) on Baekeland's uneasy relationship between the industrial exploitation of Bakelite and the pursuit of academic respectability at the University of Columbia. The morning closed with three papers on more advanced synthetics such as non-oxide glasses (P. Teissier, France), microelectronics (C. Mody, USA), and lithium batteries (M. Eisler, USA). Friday afternoon was devoted to chemistry's involvement in technical infrastructure, instrumentation and ideas (with papers on state-sponsored materials science in the USA during the Cold War, and on the use of phthalocyanines in enhancing the resolution of electron microscopes; as well as the modelling of natural materials exemplified by biotechnology and the development of carbon nanochemistry.

The final Saturday included a session sponsored by the BSHS devoted to "Re-creating past science and technology" mainly using chemistry as exemplars. In the challenging first paper, Hasok Chang returned to his Congress opening theme and argued that repeating historical experiments offered the possibility of "recovering lost phenomena"; this was similarly illustrated in a paper by Jennifer Rampling (UK) which was concerned with replicating alchemical recipes for making the philosophers' stone; in contrast James Sumner (UK) gave an entertaining demonstration of the way he raises issues about science (and especially chemophobia) by showing how nineteenth-century brewers manipulated beers by the use of artificial colours, flavouring and foaming agents. After coffee, Laurence Totelin (Wales) described what she had learned about ancient cosmetics by repeating ancient Egyptian recipes; and Haileigh Robertson (UK) examined the practical problems in replicating experiments on gunpowder conducted by Boyle and Hooke. R. Wittje (Germany) placed his own replication of the electric waves investigations of Hertz in the context of material culture studies. In the final chemical session of the Congress on Saturday afternoon four young scholars from Greece, Taiwan, Belgium and France explored the relations between working and knowing in alchemical activity from late antiquity until the seventeenth century. The papers covered such diverse subjects as the alchemical lectures of Stephanus of Alexandria in the seventh century (V. Koutalis); the Chinese alchemical image of the dragon (ouroborus) (Hsiao-Yun Cheng); an important paper on the linkage between the physical and chemical properties of mercury and the mercury theory of metals in Arabic and Latin medieval alchemy (S. Moureau); and the continuing economic usefulness of alchemy in 18th-century France R. Franckowiak). The session was heavy going since a full appreciation of the speakers' findings required skills in philology, anthropology, art history and economics; but it demonstrated the enthusiasm and scholarship that is being brought to bear on alchemy by young scholars from all over the world. My foregoing description also suggests that the history of twentieth and twenty-first century chemical science is alive and well. The lacuna of papers on the chemical revolution and nineteenth-century chemistry was puzzling, but may have been (one hopes) merely due to the way sponsors structured the sessions and issued the calls for papers.

At the Congress dinner, which some 400 delegates attended at Old Trafford football ground, well-deserved thanks were expressed to the local organizers, Jeff Hughes and James Sumner, for the sterling work they had done over a two-year period in organizing such an intellectually and socially stimulating meeting. The next meeting, in August 2017, will be in Rio de Janeiro, Brazil.

W.H. Brock
University of Leicester

Report on Other Congress Sessions

As Bill has pointed out above, given the extensive programme (and even with a memory stick version) it was very challenging deciding which sessions to attend. This part of the report reflects on some of the sessions I attended including one as participant and one as chairman. On Tuesday, the symposium "Remembering Rachel Carson: the Green Revolution and the politics of industrial agriculture" had two papers concerned with pesticides. Ruth Barton (New Zealand) addressed issues arising from the Smarden Affair in Kent during 1963 when dogs and farm animals died suddenly near the village of Smarden in the Weald of Kent. Rachel Carson's *Silent Spring* was published in the USA in 1962 and in Britain in 1963, and is thought to have spawned the eco-activist movement in Britain even though the British government felt it already had in place adequate measures to control the use of pesticides. However, with the Smarden Affair during 1963 it became increasingly clear that these measures were inadequate and science was not serving agriculture. Carson's dire warnings were yet to be heeded. In the next paper Nathalie Jas (France) drew attention to the use of pesticides in France between the 1950s and 1970s, a period during which proponents of "organic agriculture", supported by activist movements from abroad such as Friends of the Earth, had linked health concerns with food production. Nevertheless, different players in the modernization of French agriculture managed to control the detrimental effects of pesticides to their own advantage. The French science theme continued on Wednesday in the symposium "Modern French Science: Economy and Institutions", when Andrew Butrica (USA) discussed the lesser-known role of Jean-Baptiste Dumas in the chemical industry and in particular his transformation of the Société d'Encouragement from an institution concerned solely with national industrial policy to one addressing the demands for mass consumer goods, taking as examples electroplating and production of wallpaper.

On Thursday *Notes and Records of the Royal Society* sponsored the symposium "Putting knowledge to war: research development and the image of science in the First World War". In the morning session Roy Macleod (Australia) traced the origin and history of the government factory at Gretna that covered 30 square kilometres, employed over 30,000 workers and cost over £9 million. It only manufactured cordite (a propellant mixture of nitroglycerine and guncotton) or "devil's porridge" (attribution to Sir Arthur Conan Doyle), and Gretna's production exceeded the combined output of the other British propellant plants. The next paper switched to Germany with Jeffrey Johnson (USA) who considered the mobilization of propellant production at Saxony's Gnaschwitz State Powder Factory and picric acid at Bayer's plant at Dormagen, two companies for which records survive. The location of these plants necessitated trade-offs between security and access to resources, with those resources facing acute shortage necessitating alternative production pathways. Peter Reed (UK) continued this theme of alternative pathways in his analysis of the Central Laboratory of the United Alkali Company as it adapted to the conditions of wartime production imposed by the Ministry of Munitions (and its Trench Warfare Department) as it tried to meet the escalating demands for oleum (for explosives) and for chemical warfare agents such as chlorine, phosgene and mustard gas. Staff of the Central Laboratory had to focus on scientific and technical innovation (new reaction and process pathways), building plant and putting it into operation, and fully reaching production levels, all as quickly as possible. Overall, the war period demanded a careful balance of production for wartime and peace-time chemicals to meet both the battlefield needs and the demands at home. In the final paper of the first session, Heather Perry (USA) traced the role of women in Germany during the war.

They were not employed in munitions factories but were mobilized in their own homes where attention was focused on the nutritional value of food. Analyzing cookbooks, medical studies by nutritionists and records of the War Food Office has revealed how the government re-shaped the food available in the home.
The second part of the symposium began with Don Leggett (UK) analysing the role of H.G. Wells as a campaigner for the importance of invention and scientific organization during wartime. At such a challenging time it was important to draw on the inventiveness of the whole country. While inventive ideas flourished, access to the Ministry of Munitions and its numerous committees proved very difficult. Wells became a science commentator attempting to shape the relation between science, warfare and the state. In the next paper Robert Bud (UK) explored the distinction between pure and applied science during and after the First World War. While many in industry dismissed the distinction, the public was influenced by lay writers (such as J.R.R. Tolkien) who expressed their horror of war but were willing to celebrate pure science.

On Friday there was a special screening of the second part of a three-part documentary on Ernest Rutherford. The screening was introduced by John Campbell who produced the documentary and based it on his book, *Rutherford: Scientist Supreme*. The part shown, "The Alchemist" covering Rutherford's life and work at McGill and at Manchester, was very well received. Although it has yet to get a TV network screening it is well-worth viewing if an opportunity arises.

Peter Reed

Sites of Twentieth Century Chemistry, Uppsala, 21 August 2013

This was the third in a series of conferences on the theme of sites of chemistry and was concerned with sites of twentieth-century chemistry. While the original intention was to hold the conference at the Karolinska Institutet in Stockholm, with fewer proposals than expected submitted and with the 9th International Conference on the History of Chemistry in Uppsala later the same week it was decided to hold both conferences in Uppsala. Uppsala is the fourth largest city in Sweden and about 40 miles north of Stockholm. The university was founded in 1477 and is the oldest in Scandinavia. The venue was the outstanding university museum, Museum Gustavianum, where the work of many outstanding Swedish scientists, including Carl Linnaeus, Anders Celsius and Svante Arrhenius is commemorated.

The conference started on Tuesday evening with a dinner at a restaurant in a pleasant setting by the River Fyrisån. This allowed participants to meet up in a relaxed social setting in advance of the formal proceedings the next morning. The conference had four sessions – Industrial Sites, Sites and Networks, Sites and Circulations and Sites and Disciplines – each had a number of short talks acting as summaries of pre-circulated papers with a commentator and followed by plenty of time for questions and discussion. This format was tried at the earlier conferences and found to work very well as it also did at the Uppsala conference, though it does rely on participants reading the papers beforehand.

The first session - Industrial Sites - focused on chemistry undertaken on different industrial sites and had four papers: Muriel Le Roux (Paris) on sites of aluminium manufacture in France, Erik Langlinay (Paris) on French chemical factories between 1900 and 1930, Peter Reed (UK) on the United Alkali Company's Central Laboratory in Widnes during WW1 and Ute Engelen (Mainz) on chemical companies in the Mainz region after WW2; with the commentary by Ernst Homberg (Maastricht). Much of the discussion centred on factors determining the geographical location of sites, the migration of sites over time, operational relationships between sites and government influences.
The second session - Sites and Networks - considered networks that emerged from chemical sites and had two papers: Yoshiyuki Kikuchi (Leiden) on the evolving networks of sites in Japan between 1868 and 1926, and Robin Mackie and Gerrylynn Roberts (UK) on the relationship between membership of professional bodies and the sectors chemists worked in; with Geert Vanpaemel (Louvain) providing the commentary.

The third session - Sites and Circulations - concerned the circulation of chemical ideas between different sites and had three papers: Ana Carneiro and Isabel Amaral (Lisbon) on The Institute Rocha Cabral, a site of biochemistry between 1925 and 1950, Daniele Cozzoli (Barcelona), on Daniel Bovet's research on curare between the 1940s and 1960s, and Thibaut Serviant-Fine (Lyon) on the chemistry of metabolites in the laboratory and in the clinic between 1940 and 1960; with the commentary by Olof Ljungstrom (Stockholm).

The fourth session - Sites and Disciplines - focused on the influence of changes in disciplines on the nature of the sites and had three papers: Daniel Normark (Stockholm) on the "Lab 60" project at the Karolinska, Peter Morris (UK) on the Central Chemical Laboratories at Oxford 2004, and Jean Pierre Llored (Paris) on the importance of sites in studying nanochemistry; with the commentary by Antonio Belmar (Alicante).

As with earlier conferences, there were no dramatic conclusions to the proceedings, but the conference provided a useful forum for sharing current research with other researchers and to receive critical comment that might add value to the work being undertaken. In due course a small selection of papers will appear in a future edition of *Ambix*. Thanks are due to John Perkins for his attention to detail in administering the conference, particularly given the last minute change of location.

Peter Reed

9th International Conference on the History of Chemistry Uppsala, 22-25 August 2013

About 80 delegates attended the 9th International Conference on the History of Chemistry held at the Uppsala University's museum, Museum Gustavianum. The centrepieces of the conference were two keynote lectures and the Morris Award lecture. The first keynote lecture was by Lawrence Principe (John Hopkins University) on "Uncovering and Trading Secret Materials in the Seventeenth Century, or, How to make the Bologna stone". It related Principe's attempts to reproduce the well-known experiment of the seventeenth century, including the difficulties when using reconstructed equipment and searching for sources of raw materials used in the original experiment. The second was given by Marta Lournço (University of Lisbon) entitled "The Invisible Heritage: Increasing Relevance and Use of Material Sources in the History of Science". It reviewed how material sources can be used effectively to study the history of science, though they are often neglected. The Morris Award lecture was given by Mary Jo Nye (Oregon State University) on "Mine, Thine, and Ours: Collaboration and the Material Culture of the Twentieth Century Chemical Laboratory". This was a fascinating lecture about the work of the three chemists, Dorothy Hodgkin, Michael Polanyi and Linus Pauling, and how the hierarchical use of their name amongst the other authors associated with a particular book or article varied, whether alphabetical, or with Hodgkin, Polanyi and Pauling's name first or with the order reflecting the relative contributions. The lecture is to be published in full in *Ambix* in due course.

The remaining part of the three days was split into two parallel sessions that concentrated on a wide range of themes, including Objects and Philosophy of Chemistry, Twentieth-Century Physical Chemistry, Environmental Chemistry, Sites of Innovation and Production, Discipline Building and Discipline Busting, and Materials in the Twentieth and Twenty-first Centuries. With such a rich and varied menu there was something of interest for every historian of chemistry. Besides the formal talks, coffee and lunch breaks provided plenty of time for discussion and exchange of ideas in the pleasant and relaxed surroundings of Uppsala.

Peter Reed

FORTHCOMING MEETINGS

Royal Society of Chemistry Historical Group Meetings

A Revolution in Chemical Analysis and Instrumentation

Wednesday 19 March 2014

This afternoon meeting will be held at the Royal Society of Chemistry, Burlington House, Piccadilly, London, W1J 0BA, beginning at 1.30 pm. It will examine the dramatic changes in chemical analysis and instrumentation between the 1940s and 1980s. There will be no charge for the meeting *but*, as always, pre-registration is essential by e-mail to the Historical Group Secretary, John Nicholson john.nicholson@smuc.ac.uk before Monday 10 March. Full details are given below (printed flyer enclosed with the hard-copy version).

A Revolution in Chemical Analysis and Instrumentation

13.30: Registration

14.00: Introduction by the Chair

14.05: Peter Morris (Science Museum), *Infra-red spectroscopy*

14.30: John Marshall (Glasgow Caledonian University), *Atomic absorption spectroscopy*

15.00: Keith Jennings (University of Warwick), *Mass spectrometry*

15.40: **Tea and Coffee Break**

15:55: Gareth Morris (University of Manchester), *Nuclear magnetic resonance*

16.35: John Nicholson, *Partition chromatography and the origins of HPLC*

17:05: General discussion

17:20: Close of meeting

REGISTRATION

There is no charge for the meeting, but registering in advance **is essential.**

Please register by e-mail to Historical Group Secretary, John Nicholson (john.nicholson@smuc.ac.uk**),** before **Monday 10th March 2014**.

If **registering by post** please use the form below to Professor John Nicholson, School of Sport, Health and Applied Science, **St Mary's University College,** Waldegrave Road, Strawberry Hill, Twickenham TW1 4SX, **enclosing a stamped, addressed envelope,** by **Monday 10th March**

Joint RSC Kent Section and SCI Meeting
The History of Chemistry - Is it a Lecture or a Concert?
Big Band, Chemistry, and All That Jazz

Sunday 6 April 2014 at 3 pm, Universities Medway Campus, Chatham

This unique multi-media event celebrates – in music, words and pictures – the history of chemistry, its links with some known and unknown chemists and the simultaneous explosion of jazz and big band music. Come and hear about the history of Big Band and Jazz, and lesser known information on key musicians with a 'chemical' history, and how chemistry has helped with making musical instruments. Enjoy researched images from archives, old film footage and a plethora of little known facts and sit back and listen to great jazz and swing played by the Band.

For ticket reservations email Fred Parrett: bigband@gre.ac.uk. There is no charge for tickets, but there will be a retiring collection for the Rochester Wisdom Hospice.
http://www.rsc.org/ConferencesAndEvents/conference/alldetails.cfm?evid=115491

American Chemical Society – Division of the History of Chemistry

Dallas, 16-20 March 2014

Sessions on HIST Tutorial and General Papers; History of Chemistry in North Texas; Fifty Years of the James Flack Norris Award: The Foundations of Physical Organic Chemistry; and Bringing Chemistry to the Public: A Historical Look at the Popularization of Chemistry.

San Francisco, 10-14 August 2014

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

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

CALLS FOR PAPERS

British Society for the History of Science Annual Conference 2014

3–6 July 2014, University of St Andrews

The Programme Committee invites proposals for individual papers and for sessions from historians of science, technology and medicine, and from their colleagues in the wider scholarly community, on any theme, topic or period. The deadline for proposals is 10 February 2014. Further details on how to submit individual abstracts and session proposals are available on the BSHS website at:

http://www.bshs.org.uk/conferences/annual-conference/2014-StAndrews.

FORTHCOMING CONFERENCES

Sites of Chemistry in the Seventeenth Century

17-19 July 2014, Maison Française, Oxford

This is the fourth conference of the project Sites of Chemistry, 1600-2000 which investigates the multitude of sites, spaces and places where chemistry has been practised since the beginning of the seventeenth century. A final conference will be held in 2015 to explore themes and developments over the whole period and on a broader comparative scale. The focus of this fourth conference is on the variety of physical sites where chemistry was practised in the seventeenth and early eighteenth centuries.

In the first conference in the series, on the eighteenth century, the majority of papers were on the second part of the century. To redress this, the conference will go beyond the end of the seventeenth century and cover the early decades of the eighteenth. There will be five non-parallel sessions over the two days of the conference with 3 or 4 papers in each session. Each session will consist of a 15-minute presentation of each paper, followed by a 15-minute report on all the papers by a commentator then a general discussion. Full versions of papers are due to be submitted for pre-circulation by 15 June 2014 and they will be made available to registered participants in the conference via a restricted section of the project's website three weeks before the conference.

The conference will open with registration and a reception at the Oxford Museum of the History of Science on the evening of Thursday 17 July and there will be a conference dinner on Friday 18 July. For more information see: www.ambix.org

Tenth International Conference on the History of Chemistry

9-13 September 2015, Aveiro, Portugal

The 10ICHC, organised by the Working Party for the History of Chemistry of EuCheMS, will start on Wednesday 9 September 2015 with the traditional welcome reception. It will close late afternoon on Saturday 12 September, leaving Sunday 13 September for an excursion. The conference will be hosted by Isabel Malaquias as Chair of the Local Organising Committee, while Peter Morris has agreed to act as the Chair of the Programme Committee. Further details in future *RSCHG Newsletters*.

STOP PRESS

The American Chemical Society History of Chemistry (HIST) Division is pleased to announce that the 2014 HIST Award for Outstanding Achievement in the History of Chemistry has been awarded. to Historical Group Committee member Ernst Homburg (University of Maastricht) for his wide-ranging work in the history of chemistry and the history of the chemical industry. The award ceremony will take place on Tuesday, August 12th, at the ACS National Meeting in San Francisco. An Award Address by Professor Homburg, and a symposium and a dinner in his honour will also take place that day.