ROYAL SOCIETY OF CHEMISTRY

Historical Group

RSC Historical Group Newsletter No. 66 Summer 2014

Contents

status as the International Year of Crystallography. Reports also appear of the two recent RSCHG meetings: "A Revolution in Chemical Analysis and Instrumentation" and "Chemistry as a Hobby".

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 at: http://www.chem.qmul.ac.uk/rschg/Guidelines.html
The deadline for the winter 2015 issue will be Friday 12 December 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

Outbreak! Education Project launches at Catalyst Centre

On 14 February 2014, RSC past President David Phillips and twenty eight children from Victoria Road Primary School in Runcorn had a chance to try out the brand new Outbreak! Education project at the Catalyst Science Discovery Centre in Widnes, Cheshire. The project was designed to promote team-building skills in a chemistry context, with teams working together to discover what the outbreak is (a deadly disease) and how they can prevent it.

In 2012, the RSC Historical Group and the RSC Chemical Information and Computer Applications Group, won £10,000 from the International Year of Chemistry Challenge Fund, to carry out a project in collaboration with Catalyst to promote public understanding and awareness of chemistry. Outbreak! was subsequently developed with that prize money and plans for the project include the Outbreak! Package being distributed to schools and science centres across the UK. For more information please visit www.catalyst.org

Adapted from an item in RSC News, April 2014, 4.

MBE awarded to Dr Diana Leitch

Dr Diana Leitch, a long standing member of the Historical Group, was awarded an MBE in the Queen's Birthday Honours for "services to chemistry". Diana, an Edinburgh graduate, made her career in the field of chemical information, and since retiring as Assistant Director of the John Rylands University Library of Manchester is helping to promote her original academic discipline. She is Treasurer of the RSC Chemical Information and Computer Applications Group (CICAG). She has always been keenly interested in the history of chemistry, especially the history of the chemical industry in the North West of England, where she was brought up. She is a Trustee of Catalyst at Widnes, which is both a science discovery centre and a museum of the chemical industry. Last year she acted as joint organiser for the Historical Group's successful conference at Catalyst on the history of the chemical industry in the Runcorn-Widnes area. She played a major role in developing the recent very successful Origins and Outbreak! projects at Catalyst, which aim to introduce children to chemical experiment8( )-63(s)-6(u)-8(c)-7(c)-7112(( )-94(

5. Future Meetings.

6. Election of Officers and other Members of the Committee.

7. Any Other Business.

8. Date, time and place of next meeting.

Minutes of the Thirty-Seventh Annual General Meeting of the RSC Historical Group

Held in the Chemistry Centre, Burlington House at 14.00 on Wednesday 23 October 2013.

1. **Apologies for Absence** from Peter Morris, Anna Simmons.

2. **Minutes of AGM** at Burlington House, Friday 28 September 2012. These had been published in the summer 2013

Alwyn Davies
University College, London

Eine fehlende Prüfungsaufgabe (A Missing Examination Paper)

The second is a set of seven metal devices, two of which are shown in the picture. The cylindrical base is 20 mm in diameter and 45 mm high and the surmounted tubes are 145 mm long with 4 mm od and 3 mm id. Each weighs 150 g. XPS analysis by Daren Caruana shows that, remarkably, they are pure silver. Presumably they were made for some experiment, but why in sud , theTJ 0 and science throughout Europe and other parts of the world. As an influential speaker, Dr Homburg is known for his conciseness and fresh viewpoints, with an ability to change viewpoints without any display of ego or discourtesy.

ARCHIVE NEWS

The Brunner-Mond Film Archive

Sir John Tomlinson Brunner (1842-1919) was a British chemical industrialist and politician. At Hutchinson's alkali works in Widnes he rose to the position of general manager. There he met Ludwig Mond (1839-1909) who was working as a research chemist, initially on the recovery of sulfur from the waste products of the Leblanc process.

Together they formed a partnership in 1873 to create the chemical company Brunner Mond & Co., initially making alkali by the

Ambix is an internationally-recognised, peer-reviewed journal that facilitates the publication of high-quality research and discussion in all areas relevant to the history of alchemy and chemistry: including ancient, medieval and early modern alchemy, the Chemical Revolution, the impact of atomism, the rise of organic chemistry, the chemical industry, quantum chemistry, and interactions between the chemical sciences and other disciplines. The Journal's scope extends to the history of pharmacy and chemical medicine, environmental studies of the chemical industry, and the material and visual culture of chemistry. *Ambix* regularly publishes special issues; these may address a specific historical period, a significant theme in the history of alchemy and chemistry, or historiographical and methodological approaches. Recent special issues have focused on environmental history, ancient and early medieval alchemy, and chemistry in the aftermath of the World Wars. For more information, please visit the journal homepage: www.maneyonline.com/amb

Ambix is the journal of the Society for the History of Alchemy and Chemistry which was founded in November 1935. The Society, chaired by the eminent physical chemist and historian of chemistry, James Riddick Partington, held its first meeting the following year and launched *Ambix* in May 1937 under the editorship of the distinguished historian of Greek alchemy (and later Director of the Science Museum), Frank Sherwood Taylor.

SHAC Individual Membership

Alternatively you can join the Society for the History of Alchemy and Chemistry. Full Membership costs £35 for 2014 (students £22). All members receive four issues of *Ambix* per year and can access the complete *Ambix* back catalogue online. In 2014 members also receive a copy of the supplement *Sources of Alchemy and Chemistry*. Full details can be found at www.ambix.org or email membership@ambix.org

Editor's Choice articles free to read online

Maney Publishing is offering five free articles online for the duration of 2014. These articles have been hand-picked for their quality, high citations and topical content, and collectively they demonstrate the breadth of the journal:

Resurrected Bodies and Roger Bacon's Elixir, Z. Matus

SHAC is pleased to announce that Ambix will have a new online submission system in 2014. Benefits to authors include ease in online submission, the ability to track the status of an article and our Advance Article service which means papers can be published online prior to being placed in an issue. Authors can submit their paper online at www.editorialmanager.com/amb.

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SHORT ESSAYS

Whatever happened to "Dropsy" ?

On 11 February 1784, the famous essayist and dictionary compiler, Samuel Johnson, was an unhappy man. He wrote to Boswell: "The breathlessness, however, is not the worst. A dropsy gains ground on my legs and thighs are very much swollen with water which I should be content if I could keep it there, but IÕm afraid it will soon be higher". Indeed, his prediction was correct and he died on 13 December that year. Dropsy features prominently in contemporary medical texts and those of the succeeding century, but it is unheard of today. This is not because it has been eradicated like smallpox. Rather, instead of referring to dropsy (swelling due to fluid retained in the body), we now talk about its causes, such as congestive heart failure, renal failure, widespread cancer, diseases affecting the lymphatic system, etc. The most common of these is congestive heart failure (CHF) which in the USA contributes to some 287,000 deaths per year [1].

Moreover, about half the patients diagnosed with CHF will be dead within five years. Prolonged high blood pressure can lead to thickened (hypertrophied) heart muscle, and this thickening means the heart cannot relax enough to fill with blood before it contracts again, leading to inefficient pumping and thus impaired circulation. Impaired blood supply to the kidneys damages them, leading to fluid retention, which leads to swelling of the lower parts of the body, particularly the ankles and lower legs if the left side of the heart is more damaged, or in the lungs if the right side is more damaged. Commonly, both sides are damaged to some degree. Additional fluid in the lungs

Two Successful Cases

Case 115, 20 June 1783. Mrs H---, aged 46. A very fat, short woman; had suffered severely through the last winter and spring from what had been called asthma, but for some time past a universal anasarca (= generalised swelling) prevailed and she had not lain down for several weeks. After trying vitriolic acid (= H_2SO_4), tincture of cantharides, squills etc without advantage, she took half a pint of infusion of digitalis in three days. In a week afterwards the dropsical symptoms disappeared, her breath became easy, her appetite returned and she recovered perfect health.

Case 154, but dated 3 November 1781. Mary Crockett, aged 40. Ascites (= accumulation of fluid in the abdomen) and universal anasarca. For one week she took sal diureticus (= potassium ethanoate) and tincture of cantharides, but without advantage. On the 10th (she took) the infusion of digitalis, an ounce every fourth hour. The urine began to be discharged copiously. The medicine was stopped.... and on the 24th she was discharged, cured.

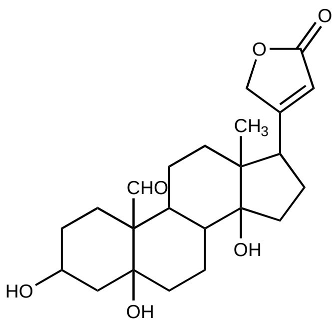
One might well question whether 'cure' was really achieved, but these women would have achieved a remarkable improvement, at least for a while.

The Chemists get to Work

In 1820 the French pharmacists, Pierre-Joseph Pelletier and Joseph-Bienaimé Caventou isolated the active principle from the bark of the cinchona tree and named it quinine. Having a pure compound available made accurate prescribing possible for the first time, making treatment more predictable and safer. This stimulated attempts to isolate a similarly active principle from the foxglove, but this proved difficult. In 1835 the Société Pharmacie Parisian offered a 500 franc prize to encourage progress, doubling this five years later. The following year, in 1841, chemists Eugène Homolle and Théodore Quevenne of the Hôpitale de la Charité were deemed to have made enough progress to earn the award for isolating a partly crystalline material from the plant leaves. It was undoubtedly impure - probably a mixture of closely-related compounds - however it showed a remarkably 'concentrated' pharmacological effect.

Further progress remained a challenge over the next 120 years. The first step was determining the correct molecular formula. Then, from about 1870, chemists began to use bonds to show atom-to-atom connectivity, so the goal became to 'elucidate' its full structural formula. Heinrich Kiliani of the University of Freiburg is generally accepted as being the first chemist to achieve a reasonably pure product, by now named digitoxin, by using a multistep procedure that, in part, involved dialysis. In the late 1890s he used combustion analysis to calculate its molecular formula: $C_{35}H_{56}O_{14}$. Moreover, he was able to break down his material into two glucose-like sugars, and a sugar-free 'core', an aglycone, which he named digitalgenin ($C_{23}H_{34}O_5$) [4]. Some 30 years were to elapse before the true picture emerged. The famous natural product chemist and later Nobel laureate, Adolf Windaus, re-analyzed the purest digitoxin he could obtain, and obtained a molecular formula $C_{41}H_{64}O_{13}$. On hydrolysis this gave digitalgenin and three, not two, glucose-like molecules: [5]

$$C_{41}H_{64}O_{13} + 3H_2O = C_{23}H_{34}O_4 + 3C_6H_{12}O_4$$



Insight into one product's structure can sometimes provide clues pertaining to another. So in 1934, strophanthidin (a digitalgenin equivalent, obtained from an African arrow poison) was dehydrogenated by heating with selenium dioxide to form Diels' hydrocarbon [6]. This confirmed what had hitherto been mere speculation: that sterols and the bile acids shared with the cardiac glycosides the same fused four-ring 'core' structure. Further comparative work showed the location of two methyl groups, two –OH groups (one of which linked the sugar moiety) and a lactone ring.

The sugar problem

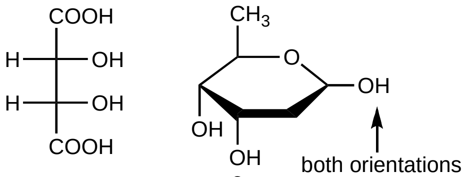
The sugar residues, each identical, of formula $C_6H_{12}O_4$, were investigated by Kiliani. He found that:

they reacted with phenyl hydrazine in a manner suggesting the presence of an aldehyde group

oxidation with silver oxide yielded ethanoic acid

oxidation with nitric acid gave meso-tartaric acid.

The first and second points indicated the presence of $–CH_2CHO$ in the molecule. Meso-tartaric acid has the formula **1.**



1 2

This indicates a four carbon unit within the sugar, with the end atoms occurring as groupings capable of being oxidised to carboxylic acid group. Moreover it suggests that two adjacent OH groups in the sugar have a similar stereochemistry.

Putting these facts together suggested a formula $CH_3(CHOH)_3CH_2CHO$. This is correct as far as it goes, but as written, it gives no indication of the stereochemistry of the material. Moreover, by the late 1800s there was increasing evidence that hexose sugars were in eq

Biochemical mode of action

This is a mixture of fact and speculation and we start with the facts. The three-unit sugar tail to the molecule, if isolated, has no effect on the heart at all. The aglycone portion is described as being 'weakly cardiac-active'. Together, though, they have a profound effect on the heart [8]. Only one sugar molecule need be attached to the aglycone and indeed this species has the greatest cardiac action. The full sequence is:

Monoglycoside > diglycoside > triglycoside >> aglycone (least active)

This indicates that the sugar adjacent to the aglycone unit is of crucial importance for good binding to a target cellular site within the body, but the nature of this binding, and what happens next, is still not entirely clear.

In heart muscle cells digoxin inhibits the Na^+/K^+ ATPase pump, which results in an increased level of sodium inside these cells. This increases the amount of sodium then swopped, through an exchange protein, for calcium. This increases the amount of calcium released with each electrical excitation, increasing the force of each contraction of the heart. Digoxin also reduces the activity of the sympathetic nervous system and increases the activity of the vagal nerve, so slowing the heart. It also has a direct effect on the heart's pacemaker (the Atrioventricular node) and conduction system, also slowing the heart. This all results in more time for the heart to fill with blood between contractions, and stronger contractions when they do occur [9].

Digoxin remains a valued drug in the second line treatment of heart failure with normal heart rhythm, and in chronic atrial fibrillation, when contraction of the atria loses synchronization with ventricular contraction. It is a first line agent when these conditions occur together. However, its place has been controversial in the recent past. Older physicians recall its place in treatment changing between sets of specialist examinations, to their frustration, and also prescribing folia digitalis (essentially raw dried foxglove, of varying potency) and facing the same problems in

The final category for chemical literature is, of course, original research. No scientific journals are published in Yiddish, so there is no reporting of chemistry research in Yiddish. Apparently, though, at the first meeting of the International Union of Crystallography in 1948, where many scientists were Jews, their common tongue was Yiddish, so some informal discussions of research were held in the Yiddish language [16].

What is the prospect for Yiddish chemical terminology? The majority of current Yiddish speakers are Hasidim, the insular group of Jews who eschew secular studies. Hence chemistry (other than what chemicals might be used as food additives for kosher foods) holds no interest for them. There is a tiny but growing cadre of younger people (including myself) in the Jewish secular world who have begun raising their children in a Yiddish-speaking environment, promoted by Yugntruf - Youth for Yiddish (http://yugntruf.org/), based in New York, USA. In my own case, I often give chemistry demonstrations for young and old at Yugntruf's annual *Yidish-Vokh* (Yiddish Week - a family-oriented retreat) to expand the attendees' chemical awareness and their Yiddish chemical vocabulary [17]. We hope that they take the work on chemical vocabulary begun by previous generations, and use it to enrich their lives, both culturally and scientifically.

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his ‘wife’ in the census) and October 1860, when he writes his will. She is not registered as living with the family in Clapham Park in the 1861 census.

In 1866, two years after Alphonse’s death, there is however a certified marriage record of Louisa Taynton Normandy to a Scot called Alexander Fotheringham [20], whose wife died in 1865. The certificate states she has been living in Islington as a spinster, not a widow. Perhaps this relationship with Alexander caused the rift between Louisa and her husband. Their three children moved with Alphonse from Bloomsbury to Clapham Park late in 1859, and were presumably looked after by their French grandmother, Eugenie le Mire, as the youngest son, Frank Normandy was only 8 at the time.

Louisa was not married to Alexander for long, as in April 1872 he apparently committed suicide one night by cutting his own throat in the WC [21]. Louisa lived for another twenty years. Alphonse Louis Normandy, her eldest son, was present at his mother’s death in 1892 so despite the break-up of the family in the 1850s, there appears to have been a level of ongoing contact [22].

Dr Alphonse Normandy died in May 1864 and was buried in West Norwood Cemetery. His gravestone was destroyed by Lambeth Council in 1991 but eventually reinstated in 2002, under pressure from the Friends of West Norwood Cemetery, English Heritage and Elizabeth Panourgias-Morrison, Dr Normandy’s great-great-granddaughter, who wrote a detailed article about her distant relative in the *Friends of West Norwood Cemetery Newsletter* in January 2003 [23].

The obituary in *The Lancet* describes Dr Normandy as having formed “an intimate friendship with the late Dr Ure, with whom he was subsequently associated in many important chemical analyses” [24]. Normandy did indeed contribute material to Andrew Ure’s posthumous fifth edition of *Dictionary of Arts, Manufacturers and Mines*, published in 1860. However, exploration of Ure’s papers in Glasgow and contact with the Royal Society of Physicians has produced nothing of relevance. Normandy and Ure were both consultant analytical chemists in London during the 1850s; they lived relatively close by (Bloomsbury and Fitzrovia) and were both asked to endorse commercial products. As such, they had much in common and it is very likely they met socially and professionally. However, we have as yet discovered no specific evidence to support the theory of a close friendship, which is a frustrating anomaly.

Unfortunately, the living descendants of Dr Normandy - some of whom we have contacted - are unable to provide any letters or further information about his personal or professional life and it is possible that all relevant material was destroyed during the nineteenth century. Although he does have an entry in the *Oxford Dictionary of National Biography*, we are keen to revive interest in Dr Normandy and would welcome any suggestions of sources of further information, particular in connection with any research currently being carried out about the lives of chemists such as Andrew Ure and Henry Minchin Noad.

This research has been carried out by Debbie Radcliffe in collaboration with Jim Birkett, a USA-based researcher with a focus on industrial archaeology of desalination processes. In October 2013 a paper that included some of their findings was presented by Dr Birkett at the World Congress of the International Desalination Association in Tianjin, China. This has subsequently been published as “Normandy’s Patent Marine Aërated Fresh Water Company: A Family Business for 60 years, 1851-1910”, *IDA Journal of Desalination & Water Reuse*, 2014, **6**(1), 24-32.

If you can help Debbie please contact her directly on drjudd91@aol.com

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21. *The Lancet*, 21 May 1864, 598-599.

Debbie Radcliffe and Jim Birkett

Edmund Albert Letts (1852-1918): A Pioneer Environmental Analytical Chemist

Letts is one of the less well-known and undervalued chemists who practised in Ireland in the late Victorian period, being in the shadow of his famous predecessor in the Belfast Chair of Chemistry, Thomas Andrews.

Education and Career prior to Appointment at Queen's

Letts was born at Clare Lodge, Sydenham, Kent in 1852[1-7]. His education began at Bishop Stortford School from where he went to King's College, London. After this he undertook further studies at the Universities of Vienna and Berlin. In 1872 he was appointed chief assistant to Professor Crum Brown in Edinburgh. Four years later, Letts was selected to be the first Professor of Chemistry at University College, Bristol. In 1879, he was appointed to succeed Thomas Andrews at the Queen's College, Belfast, a post he held until retirement in 1917. He was also a Lecturer in Sanitary Science at the Medical School from 1896 to 1909. He was chosen for the Queen's Chair of Chemistry on Andrews' advice from a short list containing William Ramsay and W.A. Tilden. A retrospective view suggests that Ramsay might have been the better choice [8]. To sustain such a view, however, requires the gift of combined fore and hindsight and that, Ramsay's work was, or would have been, independent of his environment. E.A. Letts, FRSE (1874) arrived in Belfast with an excellent pedigree as indicated later in the citation for the *Keith Prize* of the Royal Society of Edinburgh, 1887-1889. He was active in the Institute of Chemistry and its Vice-President in 1904-1907.

Scientific Work

Letts' scientific work can be divided into three main sections [9].

a) Up to 1890: on the organic compounds of phosphorus and sulphur.
b) From 1895-1902: on the accurate determination of carbon dioxide in air and in water.
c) From 1900 onwards: on the analyses of estuarine and tidal waters for environmental purposes.

Letts' research up to 1890 concerned organic compounds of phosphorus and sulphur. His most important contribution being that on benzyl phosphines and their derivatives [10], for which he was awarded the Keith Prize of the Royal Society of Edinburgh. At the presentation it was stated "the work was difficult (due to the spontaneous inflammability of most phosphine derivatives), very thoroughly done, and the results are of great interest". It also noted that he overcame the difficult analytical problem of determining their phosphorus contents [11, 12].

He then studied the determination of carbon dioxide in great detail [13] and became the recognized 'master of the subject'. This followed from a request, to determine the carbon dioxide in the air of a linen weaving shed when the initial sets of results were not reproducible. His first paper on carbon dioxide was in effect a monograph of 163 pages. Letts studied the random and systematic errors meticulously until he was satisfied he had obtained a method

Letts was best known as an authority on questions connected with the pollution of rivers, especially estuarine and tidal waters. He was initially concerned with the increased growth of the seaweed *ulva latissima*, 'sea lettuce', which caused problems after it was washed ashore [16]. Banks of the weed, several feet thick, extended for miles in Belfast Lough and also in Dublin Bay. The *ulva* decomposed in warm weather giving rise to an overpowering smell. Over the years the various nutrient and decomposition parameters were studied and appropriate analytical methods devised [17-22]. At the request of the Royal Commission on Sewage Disposal, as one of the authorities on the subject, Letts, along with W.E. Adney, was asked to make extensive studies of the important estuaries round the British Isles [21, 22]. At the behest of the Belfast Public Health Committee, Letts along with L. Smith and later with W. Mair [23] undertook respectively the chemical and bacteriological studies of an experimental sewage treatment plant which resulted in the design of a new sprinkler based system [24-26]. Letts was assisted in his applied chemistry researches by several former students, for example Robert F. Blake, Joseph H. Totton and John Hawthorne, who all became important in official analytical posts in Northern Ireland [27], and Florence W. Rea, with whom he wrote his last four papers [7] .

The Teacher

Letts was known to irreverent students as Teddy. It is reported that he was the only Professor in the Faculty at the time who could keep order in his classes. His method of entry to lectures has come down in legend. Entering in his gown he strode to the lecture desk, called the register and then, with due ceremony, his gown was removed by the lecture attendant before Letts commenced the lecture proper. He was well regarded as a lecturer and interested in student affairs, taking a large part in establishing the Students Union in Belfast [5]. According to F.G. Donnan, one

The Head of Department

Letts was active in the affairs of the University and concerned with the well-being of his Department. From 1888 he demonstrated the tenacity of purpose, shown in his researches, to what was almost a second career: that of pleading, cajoling or bludgeoning the Lord Lieutenant, the Treasury and all bodies and individuals that he, and the Principal, Thomas Hamilton, thought might listen to the pressing need for a new building for chemistry [30]. In the end they won the battle. A new building was provided, but in stages which can be followed via the Book of the Fair 1894 [31]. This publication shows photographs of parts of the new, but incomplete, building. In 1905 a saviour appeared, Sir Donald Currie, a Scottish ship builder, who offered the college £20,000 provided that an equal sum was raised elsewhere before Christmas of that year. It was. The Book of the Fete from 1907 [32] shows the completed building

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occasionally behaviour, somewhere between idiosyncratic and curmudgeonly – probably tending toward the latter". Certainly, he was one to seek out cause for disputes and he seems to have had a personality clash with colleague Linus Pauling, indisputably the leading light within the department.

The book is an entertaining read and I recommend it to inorganic chemists who want to engage with the history of their subject. But whether they will be inclined to put their hands in their pockets and come up with £44 for just 77 pages of text is another matter….

Alan Dronsfield

André Authier, Early Days of XRay Crystallography (Oxford: Oxford University Press, 2013), Pp. xiv + 441, ISBN 978-0-19-965984-5, £45.

This year (2014) marks the centenary of the award of the Nobel Prize in Physics to Max van Laue for the discovery of the diffraction of X-rays by crystals. Some fifty scientists have been associated with the twenty-nine Chemistry and Physics Nobel Prizes which have so far been awarded for some aspect of X-ray investigations. The very first prize, in Physics, went to Wilhelm Röntgen in 1901 for his discovery in 1895 of these mysterious rays. Laue's prize of 1914 was swiftly followed in 1915 by one shared by the Braggs (Sir William Henry and his son William Lawrence) for "analysis of crystal structures by X-rays".

This highly detailed, compendious and handsomely produced book of twelve chapters introduces the subject, describes various historical approaches to the concept of space lattices, and considers the dual nature of light from earliest times up to Einstein and the photoelectric effect (1905). The last part of this introductory material deals with Röntgen, the discovery of X-rays, and their wave or corpuscular nature. It is not until the sixth chapter some eighty pages later that we reach the heart of the book, "The discovery of X-ray diffraction and the birth of X-ray analysis": this and the next three chapters concern the early fundamental work.

In April 1912 Max von Laue (with Paul Knipping and Walter Friedrich) showed that X-rays directed on to a crystal would produce on a photographic plate diffraction patterns from $CuSO_4.5H_2O$ (the first crystal to be studied), and also from ZnS, NaCl and diamond. By October that year, William Henry Bragg had contacted Laue, and a few months later he and his son used the new technique for the first time to elicit molecular structures. They performed structural X-ray analyses of KCl, NaCl (which showed different diffraction patterns because of their different structures); work on ZnS, diamond and other materials followed. Many other famous names were involved in the early development of the subject including Moseley, de Broglie, Brillouin, Bravais, Compton, Wychkoff, Debye, Scherrer, Lorentz, Compton, Weissenberg, C. G. Darwin, and a multitude of others, most of whom make an appearance in this book.

Early applications of X-ray crystallography are reviewed in chemistry, mineralogy and biology. The last two chapters take several steps backwards in time and might more logically have been placed much earlier in the book: they cover the history of crystals from earliest times to the eighteenth century, and finally the birth and rise of the space lattice concept.

This is a long, detailed and authoritative book, well-written but, historically, oddly-arranged. It gives a good overview of the subject, and is well-referenced and 2 0 Tdururd. It ur a4(u)-8(r)--5 0Rnx(e)-7(n)-8(c)-7(e)-7(d)-8(r)-5 0 Td -5(

point came when, in 1932 in Cambridge, she worked for that doyen of crystallographers, J.D. Bernal. Two years later, Dorothy returned to Oxford and started to collect money for her own x-ray apparatus, initially with the help of the distinguished professor of organic chemistry, Robert Robinson. She continued the research that she began at Cambridge with Bernal on sterols and other biologically interesting molecules, including insulin. She progressed to penicillin in 1942 and to attack the problem of the structural elucidation of vitamin B-12 in 1948. Despite suffering from severe rheumatoid arthritis, she spent her entire career pushing the limits of x-ray analysis and is regarded as a pioneer in the study of biomolecules using x-ray crystallography. She announced the first three-dimensional structure of penicillin in 1949 and in 1954 began to publish the results of her researches into the structure of the vitamin. The outstanding nature of her work led to the award of the 1964 Nobel Prize "for her determinations by X-ray techniques of the structures of important biochemical substances". She was the third woman ever to win the prize in chemistry (after Marie Curie and Irène Joliot-Curie). A year later, she was made a member of the Order of Merit(she was only the second woman recipient of this Award, which is restricted just to 24 living individuals). Insulin was perhaps the most extraordinary of her research projects. It began in 1934 when she was offered a small sample of crystalline insulin by Robert Robinson. The hormone captured her imagination because of the intricate and wide-ranging effect it has in the body. However, at this stage X-ray crystallography had not been developed far enough to cope with the complexity of the insulin molecule. She and others spent many years improving the technique and in 1969 – five years after the award of her Nobel Prize – the structure of insulin was finally resolved. Dorothy Hodgkin, kindly mentor, mother and grandmother, was not only a brilliant scientist and a woman with broad cultural interests; she was also a fighter for peace. From 1976 to 1988, she was president of the Pugwash Conferences, an international organisation devoted to working against armed conflicts and making the world a safer place.

The Plaque was presented by Robert Parker, Chief Executive Officer, RSC, and unveiled by Professor Tim Softley, Head of Chemistry, and reads:

National Chemical Landmark
Dorothy Crowfoot Hodgkin
OM, FRS
(1910-1994)
Led pioneering work in this building from 1956-1972
and elsewhere in Oxford on the structures of
antibiotics, vitamins and proteins including
penicillin, vitamin B12 and insulin, using
X-ray diffraction techniques for which she
received the Nobel Prize in Chemistry
in 1964.
6 May 2014

The Historical Group was represented by Michael Jewess, Ron Neal and Alan Dronsfield.

was described in the context of the key enabling developments of instrumentation and the contributions of leading researchers of the period (including those of Walsh, L'vov, Willis, Manning, Koirtyohann, Massmann, Slavin,

The History of Partition Chromatography

Chromatography is generally considered to have started with the pioneering work of Mikhail Tswett (1872-1919). He was a botanist from Russia and, while working as an assistant at the University of Warsaw, in 1901 he developed column chromatography to separate plant pigments. The column he used was filled with powdered silica, and eluting with organic solvents separated the pigments.

There was little progress until the pioneering work of Archer Martin (1910-2002) and Richard Synge (1914-94) around 1940. They were both Cambridge PhD graduates in biochemistry and working at the Wool Industries Research Association in Leeds. Martin was, by one year, the senior of the two, and he had had a long fascination with fractional distillation. As a youth, he had undertaken fractional distillations at home using a column made from old coffee tins, welded together and filled with powdered charcoal. He had made himself familiar with the theory of fractional distillation and the method of determining column efficiency as used by chemical engineers. This involves assuming that a column comprises a series of theoretical 'plates' rising to the top, each with liquid in contact with its vapour at equilibrium. The vapour at a particular theoretical plate is assumed to condense to form the liquid of the plate immediately above it, and there to establish a new equilibrium with vapour of the appropriate composition. In this way the vapour becomes increasingly rich in the more volatile component as the mixture rises in the column. Column efficiency is then determined by measuring the "height equivalent to a theoretical plate".

Martin and Synge's particular interest was the separation of amino acids from wool, for which they attempted to use a counter-current separator. It was messy, leaked badly and gave unusable results. Next they moved to a system in which a liquid was bound to a silica powder support, and a different liquid passed down the column. They got excellent separations. Moreover, Martin recognised the analogy with fractional distillation and saw that the process could be viewed as involving partitions of the components between the bound and the mobile liquids, which differed in polarity. Their classic paper describing this work (Martin and Synge, Biochem. J.1941, 35, 1358) discusses not only the separations but also the underlying theory. This paper won them election as Fellows of the Royal Society in 1950 and the Nobel Prize for Chemistry in 1952.

Both Martin and Synge moved on from the Wool Industries RA relatively quickly, and by 1952 Martin was at the National Institute for Medical Research at Mill Hill. There, he turned again to chromatography. Working with A.T. James, he developed gas-liquid chromatography, expanding on an idea suggested in his 1941 paper. In this early work, they used a 4-foot long, 4-mm internal diameter glass tube, packed with Celite, on which they put a liquid paraffin stationary phase. Using nitrogen as the carrier gas, they separated a series of closely related volatile fatty acids, with detection by titration. Titration was time-consuming, as it involved many hundreds of samples. As James wrote, "Although the resolving power was high, it took an inordinate amount of time and nearly drove the assistant staff mad when they had to sit doing the multiple titrations day in and day out". The work was published (Martin and James, Biochem. J.1952, 50, 679) and this marked the origin of the technique of gas-liquid chromatography, GLC.

GLC was taken very readily by industry, with BP Research at Sunbury under D.H. Desty and the ICI Alkali Division under N.H. Ray being very early into the field. There was also significant activity at the Chemical Research Laboratory, Teddington, led by Douglas Ambrose.

Then, in the 1960s, there was renewed interest in the process of liquid chromatography. It offered the advantage of being applicable to non-volatile substances, but as originally used by Tswett, was far too slow. However Martin and Synge showed that this could be improved by reducing the particle size of the column packing considerably and maintaining throughput by applying pressure. Thus HPLC (high performance liquid chromatography) was born. A crucial development was the use of small particle column packing as pioneered by Dr Joseph Huber of the Technical University of Eindhoven and reported firstly at a lecture at what is now Liverpool John Moores University in 1965. A fuller account was presented at the International Symposium on Physical Separation Methods in Analytical Chemistry held in Amsterdam in April 1967, and this is usually considered to mark the beginning of HPLC.

This technique was also quickly taken up by industry, with notable pioneers being J.J. Kirkland and Lloyd Snyder. Kirkland, who worked at Du Pont, developed improved column packings and soon afterwards Snyder developed gradient elution as a means of shortening overall run times and sharpening later peaks. Kirkland and Snyder co-operated on books about the technique, and in running workshops to promote the technique to practitioners, mainly in industry.

By 1977, HPLC had become routine across both industrial and academic laboratories, and no less an authority than R.B. Woodward (1917-1979) could write "The power of these high pressure liquid chromatographic methods hardly can be imagined by the chemist who has not had experience with them".

John Nicholson, St Mary's University, Twickenham

Chemistry as a Hobby

This half-day meeting was organized by the RSC Historical Group on Thursday 19 June 2014 and

Discussions continued over tea and coffee in the library. The Historical Group is grateful to the Society of Antiquaries of London for hosting the meeting and to Jola Zdunek (Executive Assistant) for her help with the organization.

Peter Reed

From Candles to Cabinets

'Familiar chemistry' flourished in early Victorian Britain. This set of texts and practices advocated drawing scientific lessons from the habitual activities of daily life, in which the hidden chemical contents of common objects and quotidian processes were revealed. Through sensory interactions in the family environment – enlightening conversation and hands-on explorations – a wide range of phenomena could be introduced to childish bodies and minds. In this talk, Dr Keene argued that familiar chemistry succeeded by reworking the popular literary genre of the familiar introduction with an emphasis on embodied interactions with emphatically real things, and gave a central role to the familial domestic context. In these ways, children could first learn elementary chemistry from candles and cups of tea, before moving on to specialist chemical cabinets and youth's laboratories, and even to a chemical career.

Melanie Keene, University of Cambridge

Michael Faraday and the Chemical History of a Candle

Frank James talked about Faraday's *The Chemical History of a Candle* which must count as one of the most successful science books ever published. It has been continuously in print in England and America since it was first published in 1861 and has been translated into many languages including French, German, Polish, Japanese, Bulgarian and Basic English. More recently it has been translated into Portuguese and a new Japanese edition has been issued, since the first 1930s edition was translated from the German text.

James outlined how the series of Christmas lectures at the Royal Institution, on which the book was based, came to be delivered. It was not inevitable that Faraday would give the Christmas lectures during the 1860-61 season, but the internal politics of the Royal Institution forced this outcome. Faraday was thus given short notice that he would be delivering them and so used a notebook for a course that he had delivered twice before. The notebook, which has been published in facsimile in James's sesquicentenary edition of the *Candle* shows signs of having been too close to a candle.

Professor James considered how Faraday's attitude towards publishing lectures changed: he was opposed to this in 1859, but shortly after changed his mind. This was probably a response to the rise of spiritualism during the decade and illustrates how the lectures fitted in with Faraday's deeply theistic view of the world. Finally Professor James discussed the reasons why this book remains so popular, something which he attributed to it covering a wide range of basic scientific knowledge, much of which is still correct and of relevance today. For example Faraday's calculation of the amount of carbon dioxide produced in London each year. Furthermore, many of the experiments that are described in it are spectacular, if not dangerous, and involve loud bangs, always attractive to an audience.

Frank James, Royal Institution

When Chemistry sets Became Toys

This talk examined the transition from the first commercial 'chemical cabinets' produced during the nineteenth century to the mass-produced and more affordable toy 'chemistry sets marketed from around the First World War. Concentrating on the dominant American brands A.C. Gilbert and Porter Chemcraft, the talk described how toy manufacturers initially sought to exploit early twentieth-century enthusiasm for conjuring by advertising their sets as 'chemical magic' kits. But these companies quickly expanded the range of sets they sold, from basic kits for younger users to large-scale and more expensive 'laboratories' intended to encourage older children to see themselves as 'junior chemists' on the path to a career in professional science.

Marketing their kits as ngarkre( )-1568 0 T6.277(i)-1846 an old converted dairy and a few years after that to an old house on the farm - including lab fixtures and fittings of beautiful teak benches from his School Methodist College which was refurbishing its old labs. After amassing an amount of chemicals and equipment from old schools and hospitals and setting up a charity called Saving Science, which sends old lab equipment to Ugandan Schools, it was time to build the lab of his dreams - including at one end a large 2 manual 30 stop pipe organ from St. Peter's College, Oxford. It was during this phase that the speaker posted many videos on his YouTube channel (plasticraincoat1) showing many unusual and exciting chemical demonstrations. After a serious robbery and break-in, the lab was closed and the speaker moved house. He then went on to set up his present laboratory (including a smaller pipe organ and grand piano!). It was a lot of hard work and taught him many DIY skills, but the amount of enjoyment it has brought has been well worth it.

Newcomen Society Meeting

Wednesday 12 November 2014 at 17.45

Science Museum Offices, South Kensington

Lecture: "The Derbyshire Oilwells of 1918 – Britain's first oilfield", by Cliff Lea. Further details from the Newcomen Society: office@newcomen.com

Society for the History of Alchemy and Chemistry Meetings

Brazil Meeting

SHAC is delighted to announce that its first meeting in Latin America, Crossing Oceans: Exchange of Products, Instruments, Procedures and Ideas in the History of Chemistry and Related Science, will take place on 24-28 August 2014. This international conference will be hosted and organised by CESIMA (Centre Simao Mathias of Studies in the History of Science) and co-sponsored by SHAC and the Centre of Logic, Epistemology and History of Science, Unicamp (CLE). The conference will mark the occasion of CESIMA's twentieth anniversary in 2014. http://www4.pucsp.br/pos/cesima/

December 2014 Meeting

SHAC will also be holding a meeting jointly with the ADHOC Discussion Group on December 2014 at University College London. The Society's AGM will also be held on this day. For further information see www.ambix.org nearer the time or contact SHAC's Honorary Secretary, Simon Werrett on s.werrett@ucl.ac.uk

FORTHCOMING CONFERENCES

International Conference on the History of Physics

4-5 September 2014, Trinity College, Cambridge

Organised by the Institute of Physics History of Physics Group in collaboration with the EPS History of Physics Group

This conference will inaugurate a new international series, bringing together professional historians of science, practising physicists, science museum staff, lecturers, teachers and others with interests in any aspects and periods of physics history. The leading theme of the conference will be "Electromagnetism: the Road to Power". The registration deadline is 15 August 2014. For more information see: http://historyofphysics2014.iopconfs.org/home

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