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RSC INTEREST GROUP
HISTORICAL

Historical Group

NEWSLETTER and SUMMARY OF PAPERS

Editor: Dr Anna Simmons

No. 86 Summer 2024

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COMMITTEE

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

RSC Historical Group Newsletter No. 86 Summer 2024

Contents

From the Editor

Welcome to the summer 2024 RSC Historical Group Newsletter. Continuing the section "Two books that markedly influenced my chemical career", in this issue Nigel Jopson follows up Henry Rzepa's tales of childhood of chemistry experiments writing about *The Pictorial Encyclopaedia of Scientific Knowledge* published by Sampson Low and *The Young Chemist* by F. Sherwood Taylor. Amongst the illustrations accompanying his article there are photographs of two round and two conical flasks which remarkably survive from his youthful experiments. Alan Dronsfield provides an intriguing insight into NAAFI Tea and the Bromide Myth, a brand which has recently been 'reimagined' as a *Great British Tea* to raise money to support the armed forces. Chris Cooksey looks at another chemical myth, this time in relation to dyes, with his article "Fickle Tyrian Purple is Sometimes Blue". Brian Beagley explores how crystallography helped win the Nobel Prize for Vitamin C, with a particular focus on Birmingham. There is also a contribution from our equivalent German Chemical Society Historical Group which showcases their excellent series of publications, *Lives in Chemistry*. This summer issue begins with tributes to key figures in chemistry and its history from both sides of the Atlantic, Alwyn Davies from UCL and Ned Heindel, former President of the American Chemical Society and long-time supporter of the Chemical Heritage Foundation (now Science History Institute). Readers will find a report of the group's meeting on Chemical Notebooks held at Burlington House in March 2024 and summaries of its popular monthly online seminars. Reviews of Magdolna Hargittai's *Meeting the Challenge: Top Women in Science* and *Science: Has its Present Past a Future? Selected Essays by Arnold Thackray,* edited by Jeffrey L. Sturchio and Bruce V. Lewenstein, also appear, along with information on publications of interest and forthcoming conferences.

The group's next meeting will take place on Wednesday 16 October 2024 at Burlington House on the topic "Chemistry, Medicine and History". The meeting will include talks on anaesthetics, monitoring blood and urine glucose levels in diabetes and the drug treatment of TB, as well as insights into the careers of chemists working in medicine over the nineteenth and twentieth centuries. A programme and booking details can be found later in the newsletter.

If you would like to contribute items such as short articles, book reviews, news items and reports to subsequent issues please contact me. The deadline for the winter 2025 issue will be **Friday 6 December 2024**. Please send your contributions to a.simmons@ucl.ac.uk as an attachment in Word. As ever, I am indebted to Gerry Moss for his assistance in pagination and production and to Alice Halman for all her help as membership secretary.

Group members should receive an e-alert from the RSC informing them when the latest newsletter is available, but for the record the Newsletter appears twice each year – usually in January and July. It is often available online before official notification is sent out by the RSC, so please look out for the newsletter on both the RSC and Queen Mary Historical Group websites: http://www.rsc.org/historical or https://rschg.qmul.ac.uk. We'll also be using the Group's new LinkedIn page managed by Andrea Gallio to keep you updated and share items from the newsletter. Further details on LinkedIn in the next item.

Anna Simmons, UCL

ROYAL SOCIETY OF CHEMISTRY HISTORICAL GROUP NEWS

LinkedIn

The Historical Group is pleased to invite you to join our growing community on LinkedIn. We have recently launched a page to build our online presence, share the latest updates on the group's activities, news, and scholarly content, and publicise events. By following us on LinkedIn, historical interest group members can stay regularly informed on developments from the group, access content and connect with fellow enthusiasts for the history of chemistry.

The page is called 'Royal Society of Chemistry Historical Group' and can be accessed through the following link https://www.linkedin.com/company/the-royal-society-of-chemistry-historical-group/about/.Subscribers to the newsletter with a LinkedIn profile are encouraged to follow the page and engage with it by interacting with posts they might find interesting and circulating to their own network. The page is currently being managed by committee member Dr Andrea E. Gallio. For any further information please do not hesitate to get in touch.

From the Chair – Thank You to Bill Griffith

Prof. Bill Griffth, who has been a committee member of the Historical Group for many years, serving as Secretary from 2002 to 2012 and then as Membership Secretary until 2024, stood down at our committee meeting in

March. Bill has given outstanding service to the Historical Group and to the RSC more broadly, for which he was given an Award for Exceptional Service in 2020. Bill has written many chemical-historical papers, been a frequent contributor to our newsletter, organised various group meetings and in 2017 wrote a book with Hannah Gay entitled, *The Chemistry Department at Imperial College London: A History 1845-2000*. We will miss him at committee meetings and are extremely grateful for everything he has done for the Historical Group. To read more about Bill's contributions to the Historical Group and the RSC see: https://www.rsc.org/awards-funding/awards/2020-winners/professor-william-griffith/#undefined

John Nicholson

Introducing the Historical Group's New Membership Secretary

Dr Alice Halman recently joined the Historical Group committee after being a member of the group since 2019 and was appointed as Membership Secretary in March 2024. She currently works at Sellafield Ld., having obtained a PhD in Materials Chemistry from the University of Central Lancashire, specifically in the field of zeolites. Her interest in history is wide-ranging: she's fascinated by the development of chemistry from its roots in alchemy up to the twentieth century. She also enjoys delving into the history of her work, including zeolites and the origin of plasma during her PhD and the history of the nuclear industry through her employment.

Alice writes: *Thank you to everyone who is part of the Historical Group for making me feel so welcome and a special thank you to Bill Griffith for his support as I've taken up the mantle of Membership Secretary. As I get to grips with the role, I would welcome any feedback from members on what I might do to improve your engagement with the Historical Group. Contact me via* alicemhalman@hotmail.com

RSC Library News

Royal Society of Chemistry Historical Collection

The newly re-designed Historical Collection went live on 14 June 2024. It can be accessed directly from https://historical-collection.rsc.org/, from the Library page https://www.rsc.org/library or from the Members' area https://members.rsc.org/ (Insight and Information). New content includes the Roscoe Letters (within the Roscoe Collection) and the Abel Papers.

The RSC Historical Collection is an extensive range of historical items including books, journals, letters, lecture notes, pamphlets, monographs and magazines. The collection covers the evolution of the chemical sciences from the sixteenth to the twentieth century and includes publications from the Royal Society of Chemistry and its precursor societies. Society publications include *Chemistry in Britain*, and there are also Council minutes, lists of Fellows and annual reports. Historical books, papers and letters owned by the RSC include the Nathan Collection, the Davy Bookcase and a collection of manuscript letters written to Chemical Society officials.

ROYAL SOCIETY OF CHEMISTRY HISTORICAL GROUP MEETINGS AND ONLINE LECTURES

Chemistry, Medicine and History

This one-day in-person meeting organised by the Historical Group will take place on Wednesday 16 October 2024, 10.15-17.00, at Burlington House, Piccadilly, London W1J 0BA.

Without chemistry's contributions to medicine, especially with respect to drug-discovery and development, life indeed would have remained, to use Thomas Hobbes' 1651 phrase, "Poor, brutish and short". Only a few effective medicaments were in use up to the mid-nineteenth century. These were mainly of natural origin such as: quinine as both a cure for (and a prophylactic against) malaria, castor oil as a purgative (and its cousin, the more mildly-acting senna, extracted from the shrub *Senna alexandrina*) and laudanum (an alcoholic tincture from opium poppies) to alleviate pain and induce euphoria. This meeting, starting with registration and coffee from 10.15 will consider how the development of chemistry in the nineteenth and twentieth centuries contributed to the amelioration of disease, and the prolonging of life.

For more information please visit:
https://www.rsc.org/events/detail/79434/chemistry-medicine-and-history
To book please email Peter Morris, Historical Group Secretary, directly at doctor@peterjtmorris.plus.com, giving your name, email address and any special requirements. The event is free of charge. Coffee and tea will be available, but lunch is not included, although there are plenty of cafes nearby in Piccadilly and adjoining streets.

Programme

Morning Session – Chair John Nicholson

10.15: Coffee

10.45: Welcome – John Nicholson

10.50: "Diabetes: An Overview with a Glance at the Chemistry" - Miranda Rosenthal

11.25: "Diabetes: A History of the Monitoring of Blood and Urine for Glucose" **-** John Dungate

12.00 Lunch (not supplied)

Afternoon Session 1 – Chair Alan Dronsfield

13.20: "Chloroform as an Anaesthetic – Some Historical Perspectives" - Alistair McKenzie

13.55: "Medicine, Chemistry and Apothecaries: William Thomas Brande and John Nussey" - Anna Simmons

14.30: Tea

Afternoon Session 2 – Chair Anna Simmons

14.55: "Chemists in the Early Pharmaceutical Industry: A Case Study from Burroughs, Wellcome & Co" - Tilli Tansey

15.30: "A History of the Treatment of TB, Principally Using Drugs" - Alan Dronsfield

16.05: "Science, Art and Drug Discovery: A Personal Perspective" - Sir Simon Campbell

16.50-16.55: Final remarks – *John Nicholson*

Online Lectures

These are continuing on the third Tuesday of each month at 2 pm, although there will be a break in August. The 17 September lecture will be Zvi Koren on Tyrian Purple The lectures are presented on the RSC Zoom Platform at 2 pm. Please start to log on at **2 pm sharp**. Look out for the Zoom links in the e-alerts circulated by the RSC on behalf of the Historical Group.

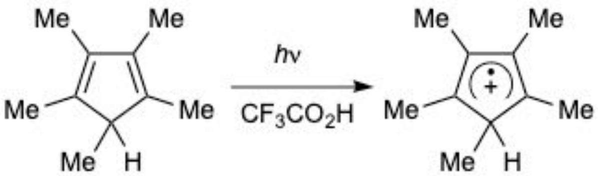
TRIBUTES

Alwyn Davies (13 May 1926 – 1 September 2023) [1], [2]

Historical Group member Alwyn Davies was one of the last surviving members of Christopher Ingold's research group at University College London (UCL is today an independent university). This group transformed understanding of mechanistic organic chemistry and laid the foundation for much of what is taught to students today. Born in Ormsby in Norfolk in 1926, Alwyn died aged ninety-seven on 1 September 2023.

Despite initial evacuation of UCL to Aberystwyth, and substantial bomb damage to some parts of the college in 1940, Alwyn began his university chemical studies during the Second World War at UCL's Ramsay and Foster Laboratories in Gower Place, where Ingold was then head of the chemistry department. When Alwyn graduated with a first class degree in 1946, Ingold invited him to do a PhD, an honour reserved for very few. Alwyn's thesis "The steric course of halogen substitution in unsaturated chloro compounds" was submitted in 1949.

Alwyn was a lecturer at Battersea Polytechnic from 1949 to 1953. He returned to UCL in 1953 with promotion to Reader in 1964 and Professor in 1968. Davies was interim Head of Department from 1971 to 1974, after Ronald Nyholm's death in a car crash. He was elected FRS in 1989. He retired in 1993 but continued writing, editing, refereeing, and advising. Over his long practising career, he edited the *Journal of Organometallic Chemistry*, authored two monographs (*Organic Peroxides* (1961) and *Organotin Chemistry* (1997, 2nd edition 2004)), and published at least 300 research papers on peroxides, main group organometallic compounds, reaction mechanisms, and electron paramagnetic resonance studies of free radicals. Initially, Alwyn and his group worked on electrically neutral free radicals (such as arise for instance in peroxide chemistry). Later, importantly, they discovered and/or studied many anionic and cationic free radicals produced in reactions such as



(in which no atoms are lost from the starting material but the four π electrons in the starting material are reduced to three) [3].

His specific knowledge of peroxides and of tin chemistry led, respectively, to associations with Interox Chemicals Limited (now Solvay Interox Limited) and with the International Tin Research Institute (now the International Tin Association). He was also consulted by the Royal Commission investigating the 1974 disaster at Flixborough in Lincolnshire, England; the disaster involved a cyclohexane vapour – air explosion and killed twenty-eight workers.

Alwyn was UCL Chemistry's honorary historian and archivist. He gave regular talks to visitors about William Ramsay (1852-1916, Professor at UCL 1880-1913, Nobel Prize for Chemistry 1904). Many undergraduates got to know Alwyn through his annual lecture on the history of the Department. He enlivened his account of Ramsay's isolation of the noble gases with a demonstration in a darkened lecture theatre, in which he passed the probe of a Tesla coil (generating a high-frequency high alternating voltage) over sealed tubes of the noble gases at low pressure believed to date back to Ramsay himself: each of the gases glowed with its characteristic colour. Alwyn was involved in the celebration on 9 February 2011 of the erection of an English Heritage blue plaque at Ramsay's house in Notting Hill [4].

With Peter Garratt he wrote a history of the UCL Chemistry Department, covering its history as the oldest surviving chemistry department in London, from its opening in 1828 with Edward Turner (1796-1837) as Professor of Chemistry (and as lecturer in Geology too). The book described the history of the department up to 1974 and the achievements of the most celebrated UCL staff and students – including Edward Teller, Otto Hahn, Kathleen Lonsdale, Sir Stafford Cripps - with profiles of staff extended to 2013. Alongside this there were a number of songs, verses, cartoons and reminiscences of the often forgotten but essential technicians, and anecdotes from students. Alwyn had known many of the people mentioned in the book personally.

Alwyn was a longstanding member of the Historical Group and a frequent contributor to its newsletter, particularly on matters related to Chemistry at UCL. A typical example can be found in the winter 2014 newsletter [5] which included two articles by Alwyn: one on the first chemistry examination paper set by Edward Turner at UCL for the 1829-1830 session and a second on Alexander Williamson and the modernisation of Japan, which highlighted the 2013 commemorations of the 150th anniversary of the arrival of the Chosu Five at UCL. These were the first group of students to leave the then-closed country to spend time with Alexander Williamson at UCL in the 1860s, and who went back to modernize Japan. Alwyn's research and outreach drew attention to UCL's role in Japan's conversion from an isolated, industrially backward country to an open one that could join the industrial revolution. He regularly hosted visits by groups of students and academic visitors and was delighted when Prime Minister of Japan, Abe Shinzo, sent the Department a scroll to acknowledge Japan's debt to UCL and to Williamson.

One of us (MJ) recalls being especially pleased to re-make Alwyn's acquaintance as a result of the Ramsay blue plaque event in 2011; they had last spoken thirty-odd years earlier when he consulted Alwyn on behalf of Interox Chemicals Limited (about the oxidation of cyclohexanone to ε-caprolactone by the Baeyer-Villiger reaction). Subsequently, they corresponded productively on various topics: Julius Thomsen's identification of Ramsay's noble gases with a new group in the periodic table [6]; mysterious silver objects found in a UCL safe [7]; and the use of "sealed packets" to establish a degree of priority but without publication, as used by Ramsay in relation to the discovery of argon [8]. Throughout, Alwyn displayed his characteristic enthusiasm and curiosity.

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7. *RSCHG Newsletter*, Summer 2014, 66, 7-8 and Winter 2015, 67, 4.
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Michael Jewess and Anna Simmons

Ned D. Heindel (4 September 1937 – 27 June 2023)

The history of chemistry lost a major champion at the passing of Ned Duane Heindel, Howard S. Bunn Professor of Chemistry Emeritus and Distinguished Senior Research Scientist at Lehigh University in Bethlehem, Pennsylvania; former president of the American Chemical Society (1994); noted historian, collector, and conservationist; and long-time supporter of the Science History Institute from its earliest days. Ned died at his home on 27 June 2023, at the age of eighty-five. He is survived by his wife, Linda (Heefner) Heindel, to whom he was married for sixty-three years.

Ned Heindel played a critical role in the creation of the Center for History of Chemistry at the University of Pennsylvania, which has evolved into the Science History Institute. Beginning in 1978, the American Chemical Society's Division of the History of Chemistry began to advocate for the establishment of a chemical history centre. Ned, then a professor of chemistry at Lehigh University and an accomplished historian of chemistry by avocation, saw at once the value of such a centre and was well-placed to help guide the complex and competitive process of advocacy and negotiation that led from early 1979 until the signing of the Memorandum of Understanding between the ACS and the University of Pennsylvania that created the Center for History of Chemistry in January 1982. As the 1978 chairman of the ACS Division of the History of Chemistry and an ACS Councillor, Ned was a natural choice in March 1981 to lead the task force created by ACS leadership in 1979 to "define future directions for ACS activities in the history of chemistry". Together with former ACS president Charles C. Price and Arnold Thackray, Ned's persistence and quiet persuasion were key in the months of "door-openings, direction-pointing, and skid-greasing" (as he put it in a letter to Clara Craver) through the rest of 1981 that led ACS leadership to join Penn in creating the new Center for History of Chemistry. He was present at the creation – and remained a steadfast and loyal supporter of SHI throughout its evolution over the next forty years, serving on the Board of Directors (of both the Chemical Heritage Foundation and its successor, the Science History Institute), the Heritage Council (now Affiliates Council), Othmer Giving Society, and Bolton Society. He was serving as a member of the SHI Collections Committee at the time of his death.

Ned Heindel was born on 4 September 1937 in Red Lion, Pennsylvania, and graduated from Red Lion High School. He then pursued the study of chemistry at Lebanon Valley College (B.S., 1959); the University of Delaware (Ph.D. in organic chemistry, 1963); and Princeton University, where he completed a postdoctoral fellowship with Professor E. C. Taylor. Following his postdoc, Ned held a series of teaching positions at the University of Delaware – Wilmington, Ohio University, and Marshall University, before moving to Lehigh University in 1966, where he spent the rest of his highly productive career in teaching and research. Ned's manifold contributions to the life of chemistry through teaching and research are covered well in the memoirs written by friends and colleagues at the time of his death in 2023 (see References). He was an enthusiastic and energetic participant in the life of the chemistry profession beyond Lehigh. As noted above, he became President of the American Chemical Society in 1994, following decades of engagement on the ACS Board and Council, as well as its Division of the History of Chemistry (which he served as Chairman).

Ned also had a lifelong and eclectic interest in history – not just the history of chemistry, pharmacy, and medicine, but also local history, Pennsylvania Dutch folklore and books of secrets, and patent medicines. He published a number of books on these subjects and was a frequent contributor to *Pennsylvania Folklife* and *The Pastfinder*, the magazine of the William Township Historical Society. He was a stalwart supporter of the Northampton Country Historical and Genealogical Society in Easton, Pennsylvania (and its Sigal Museum). His interest in the environment and culture of Northampton Country led to an important role in conservation – together with his wife, Linda, Ned donated the Hexenkopf Ridge, the Hexenkopf Rock, and the surrounding seventy-seven acres of land to the county in 2020 for a nature preserve.

I'd like to close with some personal reflections on Ned as a mentor, colleague, and friend. I first came to know him in the late 1970s, when I was finishing graduate school and beginning to establish myself in the academic world. Through our mutual connection to Arnold Thackray, who was then launching the Center for History of Chemistry, Ned and I began to work together on the campaign to build the Center's networks and programs. He was always available for advice when called upon, and took a helpful interest in the work I was doing (first as editor of *CHOC News*, then as the Associate Director and Acting Director of CHOC after I returned to Penn in 1984).

Ned also welcomed me into the activities of the ACS Division of the History of Chemistry and we worked together with Ann Messore and Anne Marie Menting of the ACS staff in establishing the ACS's National Historical Chemical Landmarks program in the early 1990s. I'm sure that Ned was also instrumental in my appointment to an advisory role on the ACS's collaboration with the Smithsonian's National Museum of American History on the *Science in American Life* exhibit. That turned out to be a controversial project due to the differing expectations of ACS leadership and the Smithsonian's curators. In observing Ned's efforts to mediate incommensurate points of view, it was wonderful to see his tact, diplomacy, historical sensibilities, and common sense come together to help navigate the group through a challenging experience.

By that time, I had moved to Merck & Co., Inc., and my responsibilities took me away from history into the world of pharmaceutical policy and global health. But I remained engaged with the Chemical Heritage Foundation and (later) the Science History Institute, joining Ned on the Board of Directors in 2017. As someone who had been present since the beginning of the Science History Institute, he offered institutional memory and wisdom to the SHI Board. As so many others have observed, he was an extraordinary colleague and friend – always generous with his time, willing to share insights and advice, interested in what others were working on and eager to tell you in turn about his latest research. I wish that I had been able to collaborate with him more often – it was fun to work with him on the paper we published in 2018 on the professionalization of chemistry in America (together with our late colleague and friend, Jim Bohning, whom Ned had helped persuade to come to the Beckman Center in the 1980s, first for a sabbatical year, then to stay to establish the Center's oral history program).

One of the last times I saw him, Ned gave me a copy of his latest book, on the patent medicine purveyor, "Money" Munyon, whose life and work he had studied for decades. He had a twinkle in his eye as he described some of Munyon's schemes and you could tell that Ned's interest in history was motivated by his interest in his fellow humans. Like all of his friends and colleagues, I miss Ned and I'm grateful for his friendship and support over the years. And for his central role as one of the team of believers that led to the creation of the Center for History of Chemistry, the entire global community of the history of chemistry is in his debt.

Jeffrey L. Sturchio

Figure 1: Signing of the agreement between the University of Pennsylvania and the American Chemical Society to create the Center for History of Chemistry, Edgar Fahs Smith Memorial Collection of the History of Chemistry, Van Pelt Library, University of Pennsylvania, Philadelphia, Pennsylvania, January 1982. Left to right: Robert H. Dyson, Dean of the Faculty of Arts and Sciences; Thomas Ehrlich, Provost; and Sheldon Hackney President, all University of Pennsylvania; and Ned D. Heindel, Lehigh University.

Courtesy Science History Institute

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SHORT ESSAYS

Two Books that Markedly Influenced My Chemical Career

In this new section we invite RSC Historical Group Newsletter readers to share their thoughts on two books that have influenced their careers in chemistry and science. The publications lined up for future issues are Cotton and Wilkinson's *Advanced Inorganic Chemistry*, R.V. Jones, *Most Secret War*, Abraham Païs, *Subtle is the Lord – The Life and Science of Albert Einstein* and Frank Sherwood Taylor, *The Young Chemist*, which is proving a popular choice. Contributors can get in touch via a.simmons@ucl.ac.uk.

Mee Too

I read with great interest Henry Rzepa's article *Two books that markedly influenced my Chemical Career* in number 85, the winter 2024 edition of the

Historical Group newsletter. My nominations for this accolade are *The Pictorial Encyclopaedia of Scientific Knowledge* published by Sampson Low and, inevitably, *The Young Chemist* by F. Sherwood Taylor, published by Nelson. The former book I inherited from my elder brother. It was exactly what it said on the title page, an illustrated guide to everything from Astronomy to Zoology. It was a literary Pitt-Rivers museum of the state of the sciences in the mid-1950s and included a section entitled *The Chemist at Work* that grabbed the attention of a very youthful and technically inquisitive yours truly. The second volume needs little introduction to this group, being a favourite of Prof. Alan Dronsfield no less! It will be the subject of a later contribution to this series. *The Young Chemist* was acquired from a local bookshop by a ten-year-old me on a familial visit to Norwich. I still have both my volumes, the Sherwood Taylor being somewhat battle-stained. Incidentally, the photograph opposite page nineteen of Sherwood Taylor shows two young gentlemen in white lab coats (impossibly clean) disporting themselves with test-tubes and beaker, while on the blackboard behind are equations describing the preparation of As_2S_5 from As_2S_3 . Imagine the uproar if arsenic compounds were introduced into a present-day school laboratory!

I guess my first exposure to experimental chemistry was courtesy of my elder brother. He had both Merit (J&R Randall) and Lotts' Chemistry sets promiscuously. His brass Merit Bunsen has survived with the honourable scars of battle. It was designed to run on coal gas but runs perfectly well on natural gas. It isn't supposed to but Bunsens don't read books on combustion theory.

Later I became a fairly solid Merit man with the exception of one set from Messrs Kay (Sports and Games) Ltd of London. The choice of chemicals in the Merit sets was interesting in that it seemed to shadow the requirements of classical wet qualitative analysis. For example, both sodium bisulphate and tartaric acid were the acid provided. This duplication might be

-16-explained by the use of organic acids to control the precipitation and solubility of metal ions from mixtures in wet analysis, e.g. Fe, Sb, Sn, Al or Zn. Messrs. Lotts were more catholic in their offerings which included potassium permanganate, flowers of sulphur. Congo Red and sulphanilic acid, the latter for those wishing to enter the colourful world of dyestuffs. An attractive feature of such sets was the alluring way in which the chemicals were presented. Merit and Kays offered theirs in test-tubes but Lotts' used intriguing paper pots.

In my early teens, I was presented with the largest of the Merit sets – nirvana! However, inevitably, I wanted more, spurred on by the *Pictorial Encyclopaedia* and the *Young Chemist* . Like Henry Rzepa, I had recourse to A.N. Beck & Sons of Stoke Newington. If memory serves, I came upon them through an advertisement in the *Meccano Magazine*. They provided access to a wider range of chemistry and I still have some of them in their wee brown bottles - Becks' mark-up on these chemicals must have been considerable!

They also offered 'grown-up' glassware such as the 250 ml flasks and beakers recommended by F. Sherwood Taylor and would even provide 'Quickfit' apparatus. Amazingly, two of my round and two conical flasks have survived to this day. I also have a 'Quickfit' flask and condenser. Where now are 'Monax', 'Firmisil' and 'Davisil'?

I suggest that the glassware itself has a certain aesthetic appeal, my particular favourite being the conical or 'Erlenmeyer' flasks in all sizes.

Round-bottom flasks and the old-style retorts are possessed of a classical grace, while a massed array of 'Quickfit' is impressive, compelling and intriguing. The ability to handle the glassware is appealing to the neophyte, even such a mundane task such as filtration with a filter paper can be endowed with a certain quasi-religious mysticism. Don't knock the romanticism ye hard-bitten academics, if it brings youngsters into the fold!

I was fond of brewing hydrogen from caustic soda and aluminium till one day I lit the gas issuing from the delivery tube too soon and had to watch the blue flame march inexorably up said tube and into the flask…. pop it went! No-one was hurt but I never knew the school friends present could move so fast……..! My dear parents were philosophical about the minor damage to the kitchen décor. I was displeased by the loss of a thistle tube but the flask was intact. To the teenage practitioner, the involvement with like-minded friends affords a means of exchanging insights and ideas. I joined one school friend in the manufacture of bromine. We loaded the ingredients into a large flask in his bedroom (with the windows wide open) connected the delivery tube to another flask in ice, lit the burner under the reaction vessel and retired post-haste to the back garden. After a significant pause, we crept gingerly back to his bedroom and were rewarded by a puddle of fuming brown liquid in bottom of the receiving flask. Success! Any spiders, mice and bugs around would have been obliterated by the copious fumes of HBr that were a by-product of the proceedings. A pity we didn't try the reaction of bromine with aluminium metal!

The *Pictorial Encyclopaedia* was inspirational in steering me towards the applied chemistry that ultimately led to a career in a process industry. It also informed my teenage experimental activities. My bromine-brewing friend gave me a recipe from one of his chemistry books for making a red-brown dye from aspirin. This entailed de-acetylating aspirin (acetyl salicylic acid) with sodium carbonate solution, nitrating it with dilute nitric acid, reducing it to the amine with zinc and hydrochloric acid, diazotising the amino-

salicylic acid in ice with sodium nitrite (courtesy of A.N. Beck) and coupling it with beta-napthol from the same source. I note that the article on page thirty-three of Historical Group winter newsletter described para-aminosalicylic acid as ''difficult to synthesize'' so presumably I had made some other isomer. I made sufficient dye to experiment with various mordants, e.g. ferrous salts gave a green not red shade to a strip of cotton cloth. My other *tours-de-force* included styrene monomer by pyrolysis of the plastic sprue from model kits, recovery of cresylic and other tar acids from creosote, distillation of coal to tar and gas (as in the Merit instruction manual and the *Young Chemist*) and separation of silica from back garden clay using a system derived from the ore-dressing process used in Cornish tin mines!

The *Young Chemist* fired an interest in organic chemistry so I turned out acetone, ethyl acetate, chloroform, iodoform, acetaldehyde and, in small quantity an isocyanate . Part of my motivation was to find out what these compounds smelt like. Thanks be unto Becks for providing benzene and aniline on demand. A further literary source worthy of mention was the local library. Here I could lay hands not only on chemistry books for children but also, by courtesy of my parents, tomes intended for adults including an American text on laboratory demonstrations for teachers. How I wish I had made a note of title and author! This treasure-trove yielded a heroic demonstration involving melting potassium nitrate in a test tube and dropping in a sliver of wood. Caramba! An intense white light resulted with clouds of black smoke, although the tube was a write-off.

There is a serious didactic point to be made by all this. For many people, including yours truly, having too much theory dumped upon one too soon is very off-putting. Do the practical first, e.g. the separation of different metals from solution, *then* invite the student to explore the theory behind the experiment, i.e. the influence of the Law of Mass Action, Solubility Constants, Electrochemical Theory etc. In this way the practical experiments furnish a conceptual 'hook' on which to hang the theory. This especially true at 'A' level or equivalent. Some old texts are better than modern ones in this regard, e.g. Arthur Vogel [1]. Perhaps in this way, the drop-out rate for chemistry courses can be reduced. To reduce the scope and frequency of practical chemistry sessions for reasons of 'budget' or 'Elf and Safety' is simply criminal.

So inspired was I by Henry Rzepa's enthusiasm for A.J. Mee's *Practical Organic Chemistry* and Parks and Mellor, *Modern Inorganic Chemistry* that

I hastened on-line and acquired second-hand copies of each title. When I opened it, the Mee actually smelt of a chemical laboratory (wonderful). I shall peruse both avidly.

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Nigel Jopson

NAAFI Tea and the Bromide Myth

Few Newsletter readers will have encountered “NAAFI Tea”. You might, if you had served in the armed services as conscripted soldiers or later, as professional soldiers [1]. NAAFI stood for “Navy, Army and Air Force Institutes” and was predominantly a series of canteens where off-duty service men and women could go to relax [2]. Famous amongst its provisions was its own blend of NAAFI tea, which is has recently been re-released to the general public for online purchase (15 November 2023). In an earlier launch it was described as being a “premium quality blend with a rich, strong taste and a real military flavour” [3]. But was this “military flavour” the result of it being spiked with additives? Whilst the new tea is described as “reimagined”, rumours about what was added to tea by the armed forces go back over one hundred years.

Figure 1: RAF personnel being served tea and refreshments in the NAAFI canteen at Oakington, Cambridgeshire, February 1941.

Courtesy of Imperial War Museum:
https://www.iwm.org.uk/collections/item/object/205212709

The notion that soldiers’ tea was laced with “bromide” (presumably potassium bromide, KBr) seems to have originated in the First World War, interestingly some few years before the NAAFI organization was set up. A correspondent to The Times conjectured:

> As a young apprentice I was sternly warned by comrades, when I joined the RAF about forty years ago, never to drink the tea on a Saturday. It was said to contain bromide, designed to act as, shall we say, an 'anti-inflammatory' and a cooling agent on one’s ardour. [4]

So there we have it: the bromide (if indeed it was present) was put there to turn the service men and women’s thoughts away from sex. Let us probe a little deeper. Would a dose of potassium bromide act as an anti-aphrodisiac? The answer is “undoubtedly yes, given enough of it”. That the compound could act in this way was reported by French physician Georges Huette in 1850. Writing in the Parisian Medical Gazette he stated:

> The bromide of potassium possessed the remarkable power of inducing torpidity of the genital organs. A patient tormented by a vivid imagination and subject to frequent consequent masturbation found himself quite free from his infirmity having taken 16 grains (= 1 gram) per day for three days. [5]

This observation had an important medical consequence. At that time, some forms of epilepsy were considered to have a sexual association: seizures were thought to have a menstrual connection. Surgeon/obstetrician Sir Charles Locock decided to test this hypothesis by giving some of his female patients doses of potassium bromide with the intention of “inducing torpidity of the genital organs” in the hope that in doing so he might cure their epilepsy and indeed he was successful, spectacularly so. He announced, in 1857, that doses of KBr ranging from 0.3 to 0.6g taken three times a day rendered fourteen out of his fifteen patients free from seizures [6]. This was, in fact, the first effective treatment for the disease and bromide therapy was used as first-line therapy for the next fifty years. But it was not without significant cost to the patient. At some doses necessary to control epilepsy, the bromide acted as a sedative and this gave rise to its second medical application. It was used by the sackful between the wars in mental hospitals to sedate the patients and restore calmness to the wards.

Yes, bromide administered in tea or by other means will reduce soldiers’ libido, but in doing so they will become remarkably sleepy. And what the army doesn’t want is sleepy soldiers. It is possible, of course, that some maverick medical officer might have tried the effect on some troops, but my intermittent searches of WW1 medical records have so far failed to confirm the notion.

I'm pretty sure that tea was never spiked with bromide, and you can certainly consume today's NAAFI tea without risk. If you do, as the years advance, experience a "torpidity of the genital organs" you may be pretty sure that it will be entirely tea-unconnected. There's never been bromide in tea, NAAFI, Typhoo or any other brand.

For those anxious to experience tea, army-style, I offer the following Internet recollection:

> We would put 5 or 6 quarter pound packets of NAAFI tea in a three gallon dixie can full of boiling water. Add 2 one-pound bags of sugar and 3 or 4 tins of condensed milk and bring it back to the boil. [7]

References and Notes

1. From January 1949, all physically fit males between the ages of seventeen and twenty-one had to serve in one of the armed services for a period of eighteen months. The scheme was called "National Service" and ended gradually from 1957.
2. The British Government established NAAFI on 9 December 1920 by combining the Expeditionary Force Canteens (EFC) and the Navy and Army Canteen Board (NACB) to run the recreational establishments needed by the Armed Forces, and to sell goods to servicemen and their families. See https://naafi.co.uk/history/ .
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Alan Dronsfield

Fickle Tyrian Purple is Sometimes Blue

Tyrian purple started to be manufactured from shellfish about four thousand years ago and the subject has generated an extensive literature about the process and, more recently, about the chemistry that it entails. The name Tyrian is derived from the place-name Tyre in Lebanon which is 83 km south of the capital, Beirut. The locations and identification of twenty-five Tyrian purple artefacts, mostly dated BCE, in the eastern Mediterranean area have been tabulated [1]. For example, a wall painting at Raos, Thera, Greece dated seventeenth century BCE (or earlier); pottery sherds with purple deposits at Sarepta (Sarafand), Lebanon dated as thirteenth century BCE; and casket fabric from the tomb of Philip II, at Vergina, Macedonia, Greece dated 336 BCE.

The colour which is obtained from shellfish, except *Hexaplex trunculus*, is mainly due to 6,6'-dibromoindigo (DBI) with smaller amounts of 6-bromoindigo (MBI) and indigo (IND) and with even smaller amounts of indirubin and the three bromoindirubins. The structures of these pigments are shown in Figure 1. In this article two different routes from shellfish to dye are described along with the species involved.

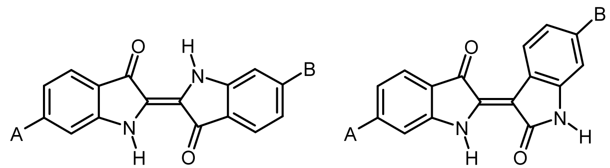

Figure 1: Structures of indigos (left) and indirubins (right).
Atoms A and B can be hydrogen or bromine.

Dominique Cardon's summary of the better-known purple molluscs gives the composition of the dye or pigment that they afford [2]. This shows that, apart from *Hexaplex trunculus*, the major component of the dye or the pigment obtained from the species is DBI, 77-99%. Her work also includes *Plicopurpura pansa* which is a Mexican species [3]. *Plicopurpura pansa* is unusual in that the mollusc does not need to be destroyed to obtain the colour precursors. Simply blowing on the animal causes it to release a fluid which can be applied to the textile to be dyed, then exposure to light and oxygen generates the colour and the shellfish can be returned to the rocks by the sea. The milking process can be repeated at monthly intervals.

Terada Takako lists sixteen different Japanese species from twenty-three locations and supplies analytical data obtained using HPLC for the DBI, MBI, IND and indirubin content of the pigment obtained from each [4]. Rolf Haubrichs lists thirty-three species of purple molluscs which are found worldwide, in every continent except Antarctica, with illustrations of all [5]. The author's samples of species mentioned in this article are illustrated in Figure 2.

Figure 2: Purple shellfish. Top: *Nucella lapillus*, middle left: *Hexaplex trunculus*, middle right: *Stramonita haemastoma*, bottom: *Bolinus brandaris*.

From Sea Shells to Dye

This article gives two different procedures for utilizing shellfish in the dyeing process. The first process is the one that was used in antiquity to dye textiles. The five steps were described in detail by Pliny the Elder in the first century CE [6]. The key operations described for the production of the purple by this process are:

- The hypobranchial gland is extracted from the fresh mollusc.
- The gland is soaked with salt in water for three days.
- The mixture is boiled in a tin vessel.
- The product is warmed at an "even and moderate heat" for at least ten days.
- Wool is dipped in for five hours followed by taking it out and exposure to air.

In the first two steps the colour precursors in the hypobranchial glands are converted into the purple pigment. The necessary ingredient is sunshine which is not mentioned. It is at this stage that the legendary stench is produced which stays right through to the final dyed textile. The odour is usually supposed to be due to dimethyl disulphide, but is more likely to be caused by smaller amounts of the trisulfide. In the next two steps the bromoindigos are reduced to give water soluble *leuco*-bromoindigos. John Edmonds (1931–2009) and others have explained that the reduction of indigos to give *leuco*-indigos is a microbial process and is analogous to that of indigo reduction in the woad vat. The optimum conditions are a pH of 7.8 and a temperature of 50 ºC [7].

In the final step the *leuco*- bromoindigos are absorbed by the wool which, when taken out of the vat and exposed to air, are oxidized back to the pigment bromoindigos. Despite the extensive instructions, many modern experimenters have struggled to successfully repeat this recipe. Details of the personal experiences from catching the shellfish, *Hexaplex trunculus* in this case, to the production of the dye leading to the dyed fabric [8] along with he details of the chemistry involved have been described [9]. It has been suggested that Pliny was highly unlikely to have actually observed the dyeing process and was in fact an "armchair naturalist" [10]. The procedure described by Pliny involved Mediterranean molluscs now known as *Bolinus brandaris*, *Hexaplex trunculus* and *Stramonita haemastoma*. Here we use the names that malacologists currently use. Prior to 2010, they were better known as *Murex brandaris*, *Murex trunculus* and *Purpura haemastoma*. *Hexaplex trunculus* can contain varying amounts of non-brominated colour precursors depending on the location and the time of year and consequently the colour obtained is often blue, due to indigo, rather than purple.

The second process for making Tyrian purple requires that the contents of the hypobranchial gland of the mollusc are transferred to a textile or to another surface followed by exposure to air and sunlight. Mr William Cole collected natural things and in 1684 at Minehead he showed two ladies his collection of sea shells. One lady mentioned that a woman in Ireland had a process of marking clothing using a dye directly from sea shells which gave a fast permanent colour. Cole had never heard of this process and proceeded to try local species of sea shells and found that one worked: *Nucella lapillus*. Cole described in detail the colour changes leading to the purple:

> The Letters, figures, or what else shall be made on the Linnen or Silk, (as much forced in, as can be by the pencill,) will presently appear of a pleasant light green colour; and, if placed in the sun, will change into the following colours ; i.e. if in Winter, about noon, if in the Summer, an hour or two after Sun rising, and so much before setting, (for in the heat of the day, in Summer, the colours will come on so fast, that the succession of each colour, will scarce be distinguished;) next to the first light green, it will appear of a deep green; and in a few minutes change into a full Sea-green; after which in a few minutes more, it will alter into a Watchet blew; from that in a little time more, it will be a Purplish red: after which, lying an hour or two, (supposing the Sun still shining) it will be a very deep Purple red, beyond which the Sun can do no more. [11]

This would suggest that when the DBI is first formed it is blue which with the initial hypobranchial gland colour, yellow, gives a green which persists until all the yellow has gone after which it appears blue. After more time passes, the blue colour changes to purple. Cole illustrated his molluscs as shown in figure 3. He was very pleased with his success and planned to transport some live shellfish to London to demonstrate the process to King Charles II. Sadly the King died in February 1685 so the demonstration never happened.

Figure 3: William Cole's illustration of *Nucella lapillus* (1685) [ref. 11]

A similar colour progression was reported by A. and G. de Negri in 1876 for production of the purple from *Bolinus brandaris* which contains a high proportion of DBI precursors [12].

In 1879 Edward Schunck (1820-1903) also investigated the dog whelk, *Nucella lapillus*. Schunck's father, Martin, moved from Malta to Manchester in 1808 where he set up a business in the calico printing industry which earned him a considerable fortune. The young Schunck became interested in chemistry through a family friend, William Henry, who had a laboratory. Following a fee-paying school education, Edward was sent to Berlin to study chemistry and then he worked with Justus Liebig at Giessen, where he obtained a PhD degree in 1841. In that year he published his first paper, a study of the reaction of nitric acid with aloes which gave chrysammic acid. In 1842 he returned to Kersal, 10 km from Manchester, and proceeded to study lichen purple, then madder (1846) followed by indigo (1855) and finally Tyrian purple (1879). His final publication score was 191 papers, but frequently the same paper was published in three different journals. His last twenty years were devoted to a study of chlorophyll, but it was not a big success.

He experimented on *Nucella lapillus* which were collected from the seashore at Hastings between low tide and high tide marks. His extraction procedure was:

> I cut out the veins of a number of animals, extracted them in the dark with cold alcohol, and exposed the yellow alcoholic solution after filtration to the sun's rays, when the colouring matter was deposited, ……….
>
> After working up the veins of 400 animals in the way described, my patience was exhausted, and I therefore contented myself with the quantity of substance, minute as it was, I had obtained. [13]

He had obtained 7 milligrams.

The Blue and the Purple.

There are more blue aspects of DBI, MBI and IND to be found in dilute solutions in dimethyl sulfoxide – they are *all* blue and the four indirubins are all pink [14].

By the end of the nineteenth century the various procedures for obtaining a dye or pigment from shellfish had been described in detail many times, but the chemical identity of the purple was unknown. The identity was revealed by Paul Friedlander (1857-1923), working in Trieste, in 1908 while he was professor at the Museum of Industrial Technology in Vienna. He obtained 1.4 grams of DBI from about 12,000 *Bolinus brandaris* and discovered that it surprisingly contained bromine. The chemistry of the conversion of the colour precursors into the pigment was only unravelled much later in the century.

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Chris Cooksey

How Crystallography Helped to Win the Nobel Prize for Vitamin C

Introduction

All new crystallographic research carried out is built upon what others have done in the past. Crystallographers should realise this and feel that they are not alone but have inherited the developments of the field's pioneers. All of this starts with the Braggs, father and son, William Henry (1862-1942) and William Lawrence (1890-1971). After twenty-three years in Australia, the father, William Henry, brought his family to England in 1908 and occupied the Cavendish Chair in Physics at the University of Leeds from 1909-1915 [1]. William Lawrence entered Trinity College Cambridge in 1909. It is reputed that he thought out the basis of Bragg's Law whilst strolling by the river Cam. Back in Leeds, by 1913, father and son had worked out several cubic crystal structures. World War I intervened, involving them both; nevertheless, in 1915 they were jointly awarded the Nobel Prize for Physics, "for their services in the analysis of crystal structure by means of X-rays". After the Great War, William Henry moved variously to University College (UCL) and the Royal Institution. In 1919, William (later Sir) Lawrence Bragg became Professor of Physics at the Victoria University in Manchester, succeeding Ernest Rutherford. Both Braggs attracted numerous students who, once trained, began to spread their newly acquired crystallographic expertise to other universities in Great Britain and around the world. This led to a network of schools of crystallography world-wide. Many years later, Max F. Perutz (1914-2002) of the Cavendish Laboratory at Cambridge, wrote of Lawrence Bragg: "Most X-ray crystallographers all over the world are 'descended' from his or his father's pupils. He regarded them all as one family and took the first steps in founding the International Union of Crystallography" [2]. One of William Henry's first students at the Royal Institution was William T. Astbury (1898-1981) [3]. Henry set him to use X-rays to study fibrous materials (e.g. wool) and biological materials. Astbury developed to be an eminent crystallographer in textile physics. Later, some say, he became the father of Molecular Biology.

Crystallography Comes to Birmingham

After the Great War, at the time Henry Bragg was becoming established at the Royal Institution, Percy Faraday Frankland (1858-1946) [4] was retiring from his long and distinguished chemistry career spanning from 1880 to

1919. The last period of his career had been from 1894 to 1919 at the Mason Science College in Birmingham, which became the University of Birmingham. William Wardlaw (1892-1958) [5], a young inorganic chemist, joined the chemistry department in 1918. Wardlaw knew about the Braggs' work, but the development of X-ray crystallography had not progressed much beyond what the Braggs had done for cubic crystals. Results were limited to the measurement of unit cell parameters and some symmetry properties, perhaps leading to the appropriate "space groups". Unless the symmetry information revealed where atoms were situated in the unit cells, little information was discovered about where other atoms were in the structures.

Haworth Appoints a Crystallographer

In 1925, Walter N. (later Sir Norman) Haworth (1883-1950) was appointed Mason Professor of Chemistry at Birmingham (a position held until 1948) [6]. By the time Haworth arrived, Wardlaw and his co-workers had developed the inorganic chemistry group and Wardlaw was becoming interested in X-ray crystallography as a method of characterising the chemicals they synthesised. Haworth's interests were with organic chemistry, particularly in studies of sugars and their structures, and he knew he also needed a crystallographer to progress his work. In 1929, Haworth appointed the physicist Ernest G. (later Sir Gordon) Cox (1906-1996) [7]. Cox would assist both organic and inorganic chemists and would advance the application of X-ray crystallography at Birmingham. New developments would be introduced, and, later, students would help to spread X-ray crystallographic expertise beyond Birmingham and across the world. It was a period of steady advancement of crystallographic methods beyond those which elucidated the simple structures of cubic crystals.

Gordon Cox had graduated in physics from Bristol University and had been one of Henry Bragg's pupils at the Royal Institution, where he had been apprenticed in 1927 to Astbury. With Astbury, he made his first X-ray measurements on aluminium acetylacetone. Then, Henry set Cox the task of determining the crystal structure of benzene. With a special rotation camera built by C.J. Jenkinson, which kept benzene crystals at 251K (-22C) long enough for X-ray photographs to be taken, Cox obtained results favouring a flat six-membered ring with the C-C bond length of about 1.42 Angstroms. This result, important for organic chemists, must have been a factor which influenced Norman Haworth's decision to invite Cox to Birmingham in 1929. to help him with his work on sugars and Vitamin C.

Cox was able to assist Wardlaw and his inorganic chemistry colleagues in the development of X-ray powder diffraction techniques and introduce single-crystal studies with rotation cameras. A highlight of these X-ray studies of inorganic substances was the study of Magnus' green salt, known since 1828, with empirical formula $PtCl_2.2NH_3$, reported by Cox, Wardlaw and co-workers in 1932 [8]. The complex was found to crystallise in a tetragonal form implying 4-fold symmetry, immediately suggesting a structure of square planar units of $Pt(NH_3)_4$ and $PtCl_4$. The arrangement of these units in the crystal was inferred. The 1932 discovery of the square planer units (ions) was confirmed by American workers in 1957 [9], by which time crystallographic methods had been advanced producing fuller structural details.

Wardlaw took his acquired crystallographic experience to Birkbeck College, London, becoming Professor of Physical Chemistry, where he remained until he retired twenty years later. Crystallography continues to develop with the passage of time – right up to the present day.

The Crystallography of Sugars

Haworth, of course, wanted Cox to use X-ray crystallography to enhance his work on sugars and Vitamin C. The difficulties and successes of Cox's X-ray studies for Haworth are perhaps summed up in a series of four papers (Parts I -IV) in *Journal of the Chemical Society*, published in 1935-1937. Their headline title is "The Crystalline Structure of Sugars". All four papers were co-authored by Cox and Thomas Henry Goodwin, Cox's research student. A co-author of parts I and II was another student (Miss) A.I. Wagstaff. Part IV was co-authored by F.J. Llewellyn. RSC members can access the journal articles through their membership subscription.

Part I entitled "Preliminary Data", points out that although sugars and their derivatives, "merit close study by X-ray methods" [10] such studies were much more complicated than those of the inorganic substances. Details of the arrangement of the molecules in the crystals may depend on the extent of "co-ordination or dipole association of hydroxyl groups" (meaning what we now call hydrogen bonding?) and "no great advance has been made". Even so, the X-ray methods available at the time enabled cell dimensions for "over 60" compounds to be obtained and discussed. The chemical structures of most of them had been characterised by the researches of Haworth and Hirst and their collaborators. For example, a typical carbohydrate sugar $C_6(H_2O)_6$ may have a C_5O pyranose ring with OH and CH_2-OH substituents.

However, there was little understanding of how the chemical structures fitted into their crystals. The authors noted that some groups of compounds which have similar cell parameters, have similar arrangements of their hydroxyl substituents and only differ in other ways.

Part II is entitled "Methylated Sugars and the Conformation of the Pyranose Ring" [11]. The authors suggest that in the methylated sugars "extensive dipole interactions of the hydroxyl groups" (hydrogen bonds?) are much less important (i.e. hydroxyl groups are blocked from interacting). Available X-ray data is presented to test their hypothesis. The authors found that although the number of asymmetric molecules per unit cell are the same (two or four) as in the parent sugars, there is a short unit, cell dimension, p =4-5 A. The methylated crystals mostly formed needles with p perpendicular to the needle direction. The authors suggest that p is a measure of the thickness of the pyranose ring C_5O with the C atoms nearly planar with the O atom displaced out of the plane, in these methylated sugars.

Vitamin C

While the research work on the sugars reported in Parts I and II was being completed, a compound called hexuronic acid was receiving attention in connection with its medicinal value as a treatment for scurvy, an affliction developed by mariners on long sea voyages and which was historically treated by drinking orange or lemon juice. It was found by the Hungarian biochemist Albert Szent-Györgyi (1893-1986) in 1928 [12] that the organic compound called hexuronic acid is the "antiscorbutic" factor in lemon juice. Cox had, in 1932, reported a preliminary X-ray crystallographic investigation [13] on hexuronic acid (later renamed ascorbic acid), obtaining cell parameters of a=17.71, b=6.32, c=6.38 Å, and β=102.5° a monoclinic cell. The space group is P_21, with four molecules of $C_6H_8O_6$ in the unit cell. The space group requires only two molecules, so two different molecules (say A and B) of ascorbic acid form the asymmetric unit, i.e. atomic coordinates for two sets of atoms of $C_6H_8O_6$ (24 non-H) must be found – a tall order! In Part II, this problem was found to occur often for sugars. Cox had, however, discovered other important properties about its structure. Microscopical studies suggested that the molecules are nearly flat and lie in the (010) plane, and that the "molecule has a ring structure with fewer groups projecting out of the ring than a normal carbohydrate, and contains double- bonds, possibly in carbonyl groups" [14]. Its chemical identity was not established until 1933 [15]. From the X-ray results, the thickness of the molecule must be less than 0.5b (3.16Å) which is less than the 4-5Å found in Part II; i.e. flatter than in a sugar. Importantly, long exposure X-ray photographs show no reflexions from (hk0) planes for which h is odd. Cox wrote in 1932: "This indicates an almost perfect glide-plane of symmetry perpendicular to the c-axis, and therefore a pseudo-plane of symmetry in the molecule itself, at right angles to the plane of the ring" [16]. Vital information, perhaps for ascertaining to the way the molecules are arranged inside the crystals.

Part III of the series of papers on sugars had become entitled "Ascorbic Acid and Related Compounds" [17]. Hexuronic acid had by 1936 been renamed ascorbic acid, officially, and identified as Vitamin C. It was thought to have a flatter, five-membered C_4O, ring than in the sugars with O linking C1 to C4 and C2 to C3 being a double bond. The authors, Cox and Goodwin, in Part III, realised, particularly, that finding two sets of $C_6H_8O_6$ atoms required recording lots more X-ray reflections. They had only fifteen, yet they had to determine x, y, and z coordinates for each of the twenty-four C and O atoms (seventy-two coordinates in all) to pinpoint the arrangement of the molecules in the crystals. They set about building a simplified lab-sized-model of the structure, based on what they knew from the observations Cox had reported in 1932 [18]. Overall, the molecules had to fit into the unit cell obeying the pseudo-glide plane which is perpendicular to the plane of the five-membered ring. Their figure of the situation, with the atom numbering, is presented on page 771 of Part III. They are ignoring the variations of the bond lengths and treating C and O atoms as equivalent. The pseudo guide-plane bisects the C1-C2 bond and passes through C4 and the CHOH – CH_2OH side chain

The way the simplified molecules lie in the unit cell was decided by the observation noted above that the flatt(ish) rings are in the (020) crystal planes, perpendicular to the b-axis (3.16Å) thick, fixing y=0 for the ring (although it could be 0.5, perhaps). The packing arrangement within the unit cell was decided from the scale models they had built of the molecules, assuming sensible bond lengths (2cm = 1Å) with hydroxyl groups of radius 5cm (2.5Å). The model molecules, A and B, were adjusted in the "unit-cell" space to obtain suitable packing and the atomic coordinates obtained by measurement from photographs and are tabulated in the 1936 paper [19]. A relationship was given such that if (u, v, w) represents an atom in the primary molecule (A), then the corresponding atom in molecule (B), generated by the operation of the pseudo-glide plane, has coordinates

(u+0.5, v, w+0.814). Each of these is related by screw axes to a further pair of molecules, according to the space group, providing the total of four, by (-u. v+0.5, -w).

A new investigation of the crystal structure of ascorbic acid by Hvoslef in Norway, was published in 1968 [20]. The general observations of Cox and Goodwin's 1936 paper were confirmed, but the advance of time made possible a determination of much greater accuracy. Particularly, 1500 X-ray reflections were measured compared with Cox and Goodwin's fifteen. The data was still photographic (but with advanced cameras). The structure was solved with difficulty by direct methods and refinement progressed slowly initially. Accurate atomic coordinates were obtained for molecules A and B. Bond lengths and angles were obtained and the hydrogen bonding arrangement elucidated. The relationship (if any) between the new coordinates and those of the Birmingham study of the 1930s seems to warrant further consideration. For example, many atoms of molecule A have y=0 or close in both studies. Also, is there evidence in Hvoslef's study to explain the pseudo-glide plane?

Nobel Prizes

The co-recipients of the Nobel Prize for Chemistry in 1937 were Norman Howarth, "for his investigations on carbohydrates and Vitamin C", and Paul Karrer, "for his investigations on carotenoids, flavins and Vitamins A and B2". Cox and Goodwin's crystallographic results, published in the *Journal of the Chemical of Society* in 1936, were available for consideration with Howarth and his group's extensive chemical results in the deliberations for Howarth's Nobel Prize. The Nobel Prize for Medicine in 1937 was awarded to Albert Szent-Györgyi, "for his discoveries in connection with the biological combustion processes, with special reference to Vitamin C and the catalysis of fumaric acid".

"Hydroxyl" Bonds and the Pyranose Ring

The work on ascorbic acid, Vitamin C, had held up the group's work advancing these two topics. In 1937, the fourth part of the series of papers highlighted as "The Crystalline Structure of Sugars" appeared. Part IV, was entitled "Pentaerythritol and the Hydroxyl Bond" [21]. In Part I it had been noted that the crystal structures of sugars may depend on the extent of co-ordination of "dipole association of hydroxyl groups". By Part IV, the term had been simplified to "Hydroxyl Bonds". The importance of "Hydrogen Bonds", as in later times we have come to call them, was being realised. For pentaerythritol, $C(CH_2OH)_4$, in later-times we would expect to find the five carbon atoms in a tetrahedral arrangement and to find hydrogen bonds linking the molecules in their crystals. However, at the time of this X-ray study what is obvious now, was not then! The authors' tables of about 120 observed reflections demonstrate the pattern of absences indicating that the molecules possess a fourfold alternating axis, namely the tetrahedral arrangement.

By 1937, the authors had knowledge of some advanced mathematical techniques which enabled them to use their 120 reflections, by arduous calculations, to obtain electron density maps of the C an O atoms in pentaerythritol. The figure on page 888 of Part IV shows their arrangement in the molecule. A further figure on page 893 shows the "hydroxyl bonds" in the molecule of length 2.69 A. This figure is perhaps one of the first ever published in the literature from a structure determination which emphasises, with evidence, the importance of hydrogen bonds as links between molecules in a crystal.

In 1939, W.N. Haworth, W.H.G. Lake and S. Peat characterised chitosamine as 2-amino-glucose, namely glucosamine, which has a pyranose six-membered ring [22]. Later in 1939, the crystal structure of glucosamine hydrobromide was determined by E.G. Cox and G.A. Jeffrey [23]. X-ray data were collected for both the hydrobromide and the hydrochloride, 900 reflections for each. The structure of the hydrobromide was solved in much the same way as that for pentaerythritol (see above). The two salts have similar structures, so reflections for both salts (1800) contributed to the structure solution, enough for determining the coordinates of the twelve non-hydrogen atoms in glucosamine, which are listed in their paper.

The figure (map) on page 895 of Cox and Jeffrey's 1939 *Nature* article shows a projection of the coordinates for glucosamine [24]. The authors' work reveals important information about the shape of the pyranose ring. They comment that their results show that the pyranose ring in glucosamine is definitely not boat-shaped, but more like the flattened description considered in Part II of "The Crystalline Structures of Sugars" series, above. (An irregular chair-shaped ring, perhaps?) A tremendous amount of calculation, all done by hand, was necessary. It was still years before digital computers became available.

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Brian Beagley

"Lives in Chemistry"—A New Series of Chemical Autobiographies

Introduction

Book-length biographies and autobiographies of eminent chemists give multiple insights into the inner workings of our science. For example, W.H. Brock's work on Justus vin Liebig [1], A.J. Rocke on Adolphe Wurtz [2], and Hermann Kolbe [3], and D. Stoltzenberg on Fritz Haber [4]. Whilst these books tend to examine the lives of chemists from the distant past, autobiographies, cover not only chemists such as Emil Fischer [5] and Richard Willstätter [6] but also chemists who have shaped our science more recently. In the 1990s J.I. Seeman edited twenty autobiographies in the series "Profiles, Pathways, and Dreams" published by the American Chemical Society [7]. Five authors were Nobel laureates, and almost all contributors were organic chemists. Since the turn of the millennium only a few (extended) autobiographies were published by chemists until very recently, and those were mostly authored by Nobel laureates, for example books by George A. Olah [8], Martin Karplus [9], Arieh Warshel [10], and Richard Ernst [11]. In 2021 a new series of chemical autobiographies started: "Lives in Chemistry" (LiC), and nine books have appeared so far, six more are in the pipeline.

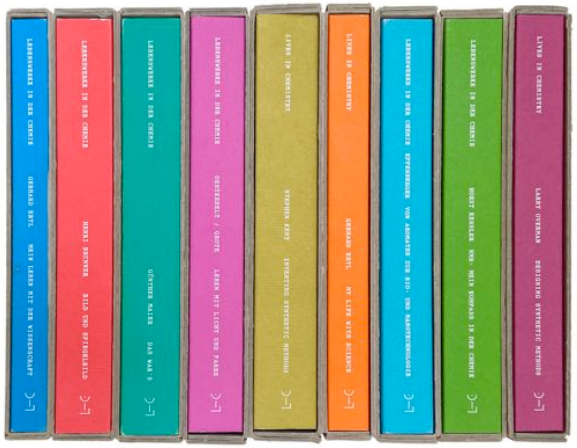
The Idea for "Lives in Chemistry"

In 2017 Günther Maier, emeritus professor of the University of Giessen in Germany, whose group first synthesized a tetrahedrane and mastered the characterization of numerous reactive intermediates and "impossible molecules" wrote an autobiography [12], and it was self-published by Reuter Chemische Apparatebau, a company that had been founded by Karl Reuter, one of Maier's PhD students. Self-published autobiographies of other organic chemists have appeared in 2007 by Horst Prinzbach [13] and in 2021 by K.C. Nicolaou [14]. Karl Reuter was fascinated by Günther Maier's scientific autobiography as it revealed for him the "creative process" that characterizes the work of trail-blazing chemists. Reuter felt that from such an autobiography early-career researchers could benefit enormously; in addition, science politicians and others interested in science and chemistry in particular could learn "how chemistry works", how new knowledge is acquired, how innovations come about. Reuter had the vision [15] that a library of chemical autobiographies would stimulate current and future generations of chemists and a wider readership. Together with his mentor Günther Maier he approached in 2018 the History of Chemistry division of the German Chemical Society (GDCh) with his plan for a series of chemical autobiographies.

How Did "Lives in Chemistry" Come About?

Christoph Meinel and Carsten Reinhardt, who led the discussions at the time for the GDCh History of Chemistry division, along with Karl Reuter and Günther Maier, were fascinated by the opportunity to publish accounts directly written by those "who had done it". Such autobiographies might become a valuable source of information for historians, in addition to the other possible benefits outlined by Karl Reuter. The Executive Committee of the History of Chemistry Division accepted the proposal and an Advisory Board for the series was formed. The Advisory Board meets three times a year and decides whom to invite, oversees the progress of the programme and the writings, and guides the publishers; individual members of the Board interact with the authors during the writing process. The series is published by GNT-Verlag which specializes in the history of science and technology.

Carsten Reinhardt wrote in a foreword to the series: "Major goals in chemical research often take a long time to achieve. In chemistry, the research process from the hypothesis to experiments and interpretation - often consists of many rapid steps that proceed more quickly than those in neighbouring disciplines. The works in the present series show how such a process can translate into major scientific achievements". To give the books of the LiC series an attractive branding and layout the highly acclaimed book designer Andreas Töpfer was tasked with the project. In 2021 the first three books appeared and received a year later a Gold Medal for the best designed books in the category "science and textbooks". All books in the series are available both in print (with a slipcase and one extra colour) and electronically (with full colour figures). Beyond the main text and the many figures, all books contain informative appendices: a CV; a chemistree (information about the school authors taken from the school they formed); excerpts from original notebooks and similar documents (as facsimiles); a list of the authors' publications; a list of useful links; and a name index.



What Has Been Published So Far?

Between September 2021 and April 2024 nine books from eight authors (one autobiography is available in both German and English) were published; six more manuscripts have been accepted and are planned to be published before the end of 2025. The following list is in chronological order and for the German titles a translation is given in parenthesis (all books are published by GNT-Verlag, Berlin):

Günther Maier, *Das war's—Erinnerungen eines Doktorvaters* (Done—Memories of a PhD Supervisor), 2021, 312 pp., 170 figs.

Gerhard Ertl, *Mein Leben mit der Wissenschaft*, (My Life with Science), 2021, 172 pp., 85 figs. international edition available (see below).

Henri Brunner, *Bild und Spiegelbild: Kleiner Unterschied—Große Auswirkungen* (Looking Glass Chemistry: Small Differences—Gigantic Effects), 2021, 296 pp., 261 figs.

Dieter Oesterhelt and Mathias Grote, *Leben mit Licht und Farbe: Ein Biochemisches Gespräch* (Life with Light and Colour—A Biochemical Conversation), 2022, 288 pp., 82 figs.

Stephen B. H. Kent, *Inventing Synthetic Methods to Discover how Enzymes Work*, 2022, 336 pp., 267 figs.

Franz Effenberger, *Von Aromaten und Heterocyclen zur Bio- und Nanotechnologie* (From Arenes and Heterocycles to Bio- and Nanotechnology), 2023, 268 pp., 231 figs.

Gerhard Ertl, *My Life with Science* (extended English Edition), 2023, 196 pp., 98 figs.

Horst Kessler, *NMR: Mein Kompass in der Organischen und Medizinischen Chemie* (NMR was my Compass in Organic and Medicinal Chemistry), 2023, 300 pp., 239 figs.

Larry E. Overman, *Designing Synthetic Methods and Natural Products Synthesis*, 2024, 252 pp. 213 figs.

Hubert Schmidbaur, *From Chemical Craftsmanship to the Art of Gilding Atoms*, ca. 280 pp., ca. 260 figs., to appear autumn 2024.

Sigrid Peyerimhoff, *Ab Initio—Ein Leben für die Quantenchemie*, planned to appear late in 2024.

Katharina Kohse-Höinghaus, *Burning for Science—A Woman in a Technical Fi*eld, planned to appear spring 2025.

Ryoji Noyori, *Research Should be Fresh, Simple, and Clear*, planned for 2025.

Albert Eschenmoser, *Awards are Nice but Discoveries are Better*, planned for 2025.

Klaus Müllen, *Die Chemie muss stimmen*, (The Chemistry Must be Right) planned for 2025.

As more and more LiC books appear in English and more come from authors outside of Germany, the international visibility of *Lives in Chemistry* is the next challenge. The autobiographies that have appeared received favourable reviews, see for example [16]. A significant number of LiC copies are presented to early-career researchers thanks to additional sponsorship from various donors and the GDCh uses the books as presents for special lecturers and other awardees. Through all this, combined with ordinary sales, the LiC books find their way to readers. The vision of the sponsor Karl Reuter has come true, and the mission of the GDCh is well served.

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Peter Gölitz

BOOK REVIEWS

Magdolna Hargittai. *Meeting the Challenge: Top Women in Science*. (Oxford University Press, 2023). ISBN 9780197574751. £22.99. Pp. 296.

In the preface to *Meeting the Challenge: Top Women in Science* it is stated that the "volume introduces successful women scientists from the past and the present, from different parts of the world and in different fields. … Taken together, they demonstrate that despite the obsolete attitude that 'science is not for women,' women can and do succeed in science, even if this success often requires courage and perseverance". The book features fascinating summaries of the lives and achievements of over 120 female scientists, some being personally known by the author or interviewed by her.

The book is broken down into sections devoted to specific scientific areas: astronomers; mathematicians; physicists; crystallographers; chemists and biochemists; biologists and biomedical scientists; physicians, surgeons and nurses; inventors and technologists; and ecologists. An introduction is provided at the start of each section to set the scene, followed by the biographies and accomplishments of specific scientists.

The coverage is global and well organised, with a helpful contents page listing the scientists in each section and a name index at the end of the book. References are included in a few cases (as footnotes on the pages where they are referenced), but this is one area which could have been improved, especially for the benefit of readers who may wish to dig deeper into the lives or work of individuals.

The paintings and photographs of the women featured are a valuable component of the book. Particularly telling are the photographs at the start of the Physics section of male-dominated conferences from the first half of the twentieth century, all but one of which include only one woman (the other includes two!).

This book is probably not one most people would read from end-to-end, but a valuable reference resource for anyone interested in the history of science and the overlooked role of women. As a personal example of its usefulness, for a talk I was working on for the RSC Historical group I was delighted to discover that within the Crystallography section there is a sub-category for "Pioneers of Data Banks", a topic of particular interest to me. This provided useful information about the two women in this section, one of whom I had not come across before – I included both in my talk. On the basis of this, I

believe the book will increase awareness of the women featured; it is an excellent repository for discovering and learning about inspirational female scientists, whose achievements might otherwise have remained buried in individual publications, if recognised at all.

The modest price of the book, at approximately £20 for the hardback edition (less for e-book versions), means that it will be readily accessible by many, thereby increasing exposure of the subject, which can only be for the greater good.

Helen Cooke

Science: Has its Present Past a Future? Selected Essays by Arnold Thackray. Edited by Jeffrey L. Sturchio and Bruce V. Lewenstein, (Ithaca: Seavoss Associates Publishing, 2022). ISBN-13: 979 8551167730, £19.99. Pp: 667.

This collection of Arnold Thackray's essays was published to celebrate his eightieth birthday and the fiftieth anniversary of the University of Pennsylvania's Department of History and Sociology of Science, of which Thackray was the founding chair. Thackray was a founder of the Chemical Heritage Foundation in Philadelphia (now known as the Science History Institute) and former editor of *Isis* (1978-1985) and *Osiris* (1985-1994), who played a central role in re-energizing and expanding the History of Science Society in the US. The editors, Jeffrey Sturchio and Bruce Lewenstein, doctoral students of Thackray, have brought together a volume which goes beyond the commemorative and evokes the atmosphere and ambience of a thriving department which created an enduring community of scholars. Under their direction, aided by fellow Thackray PhDs, and with contributions from Thackray on his career, the reader is taken on a journey through his publications starting with his outspoken essay review of Aaron Hyde's *The Development of Modern Chemistry* and J.R. Partington's *A History of Chemistry. Volume IV,* which was published in the journal, *History of Science*, in 1966.

The volume is divided into eight parts, the first five of which reproduce essays by Thackray, accompanied by his thoughts on their place in his career and wider context in the field. Part I covers Thackray as a young man. Having grown up in Manchester and with a chemistry degree, his attraction to John Dalton, the city's most famous chemist and icon of the Industrial Revolution, was the focus of many early papers. Part II includes the article "Science: Has its Present Past a Future?", which came from a conference on the relations between the history and philosophy of science held at the University of Minnesota in 1969 and posed a radical alternative to the views held by the other participants. Part III focusses on his writing on science in America and part IV on dissecting the discipline, exploring his contributions to the historiography of science, which, as Thackray comments, stemmed from a desire to "stir up trouble or perhaps encourage people to think". Part V is a collection of his editorials from *Isis* and *Osiris*, which provided a forum addressing the discipline worldwide. The next two sections focus on the community of scholars that Thackray created at Penn's novel Department of History and Sociology of Science. This includes biographies of a number of his PhDs, followed by reflections from his former students, including Robert Bud, David Philip Miller and Ruth Barton. The eighth part contains a biography of Thackray and a CV, which notes his link to the Royal Society of Chemistry as a Fellow and a Chartered Chemist, amongst many other memberships, appointments and accolades.

Such a volume of collected writings invites comparison with the *Variorum Collected Studies* series, which brings together a selection of articles by a leading authority on a particular subject. Whilst a number of key figures in the history of chemistry, including Bill Brock, David Knight and Trevor Levere, had titles published in this series, Thackray was not one. The editors are to be congratulated in creating a volume which not only brings together a scholar's key publications and provides a reflection on five decades of writing on the history of chemical sciences and technologies, but also provides an engaging and personal perspective of an exceptional man and his innovative and argumentative department which has contributed so much to the development of the history of science.

Anna Simmons, UCL

RSCHG MEETING REPORTS

The Development of the Chemist's Notebook

For many centuries chemists have used notebooks to record their experiments, results, literature research and thoughts. This meeting, which took place on Wednesday 13 March 2024 at Burlington House featured analysis of the notebook practices of some famous chemists starting from the time of Robert Boyle and considered their evolution until their most recent manifestation in electronic form.

The Workdiaries of Robert Boyle

Michael Hunter (Birkbeck, University of London)

This talk provided an account of Robert Boyle's workdiaries, a sequence of bundles of sheets of paper on which he recorded his experiments and observations, along with data given him by travellers and others, and extracts from books. These survive randomly distributed through the Boyle Papers, Boyle's vast archive at the Royal Society, but they have been arranged in chronological order and published online (www.livesandletters.ac.uk/wd). After an overview of the workdiaries as a whole, the talk focused on two components of the corpus, first Boyle's interviews with travellers to exotic regions and his rationale in these; and then his chemical notes and their relationship with his published writings.

What Was a Chemistry Notebook?: The Case of the Young Charles Darwin

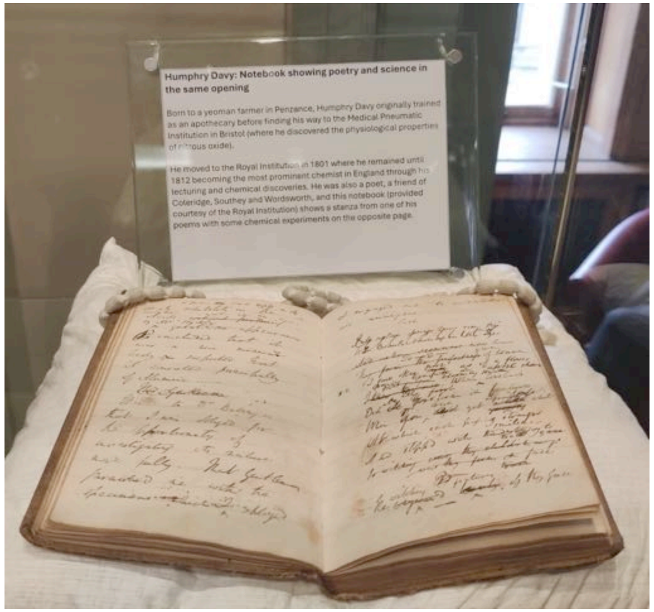
Matthew Daniel Eddy (Durham University)

Charles Darwin is not normally seen as being a figure relevant to the history of the experimental sciences. Using the notebooks he kept as a teenager, this paper revealed that he learned a surprising amount of chemistry in school and university that notably influenced his early knowledge of mineralogy and geology, two topics that underpinned his understanding of geochronology and its connections to evolution throughout the rest of his career. The paper explored his student notebooks with a view to determining how he used them to learn about chemistry and to keep track of chemical information more generally. In addition to exploring which chemical substances he and his teachers found noteworthy, the paper featured two recurring themes. First, Darwin used several different kinds of makeshift notebooks that, though overlooked by historians, offer insights into his early chemical interests. Second, the purpose of his notebooks as artifacts was not simply to record chemical information, but also to shape his memory, to generate ideas and to function as self-made reference devices when he reworked concepts in his later years.

Protean Poetics in Humphry Davy's Notebooks

Sharon Ruston (Lancaster University)

The transcription and publication of Sir Humphry Davy's notebooks reveals that he wrote huge amounts of poetry, throughout his life, sometimes even in his laboratory on pages torn and stained by his chemical experiments. This paper has been made possible because of the work of 'citizen



Humphry Davy's Notebook showing poetry and science.

scientists' who have transcribed the notebook pages which will soon be searchable online via Lancaster Digital Collections. Over the past four years, 11,417 pages of Davy's notebooks have been transcribed by nearly 3,500 volunteers from around the world. The notebooks reveal Davy's fascination with the idea of transformation, whether chemical, biological or geological. In her paper, Prof. Ruston showed that Davy's poetry and science exist side by side in the notebooks and in a symbiotic relationship. She argued that Davy used the figure of Proteus to illustrate his conception of a world in a state of perpetual change. The notebooks demonstrate the extent of Davy's poetic output and confirm his world view that matter is constantly being made, unmade, and made again in new forms. For Davy, atoms are drawn dynamically towards and away from each other, forging new entities through the power of heat, cold, and other chemical interventions. Prof. Ruston looked at specific instances where Davy's poetry and science are in close proximity to each other, on the same notebook page or in the same notebook, paying attention to Davy's interest in the so-called 'proteus fish', which was thought to be able to adapt to life on land or sea at

will. Davy saw the mythological figure Proteus as a symbol for chemical change and for the changes that all matter goes through. She also used this trope to discuss the development of Davy's ideas from notebook to lecture and published page.

How Michael Faraday's Laboratory Notebooks Developed into a Diary

Frank A.J.L. James (UCL)

The nineteenth-century English chemist and natural philosopher Michael Faraday (1791-1867) kept detailed notebooks of his experimentation and theorising between 1820 and 1862. In them he recorded, amongst many other things, his discoveries of electro-magnetic rotations and induction (the principles behind the electric motor, transformer and generator), the universal nature of magnetism and thereafter the formulation of field theory, one of the cornerstones of modern physics. They thus record some of the most important work undertaken in nineteenth-century physics and chemistry, with far-reaching engineering applications.

In most of the ten manuscript notebooks (held by the Royal Institution and now inscribed on the UNESCO Memory of the World Register) he used a sophisticated information retrieval system by numbering each paragraph (16,041 in total). Using these numbers he would index and cross reference them so that he could easily find details of work undertaken perhaps decades before. Faraday seems to have done this because he believed that he had a bad memory, though it would seem that his poor memory would be anyone else's good memory.

This talk considered, amongst other things, how Faraday developed his system of notetaking (which while not unique at the time, was certainly the most extensive), how he used his notebooks, the relationship between the notebooks and his printed papers. Finally, it discussed how and why they were published in the 1930s in seven large quarto volumes (reprinted 2008) as *Faraday's Diary*.

Their publication moved the manuscripts and the text they contain into several contexts far beyond their original creation. These included celebrating Faraday, especially the role of his image and work in promoting electrification in the inter-war period, the institutional value of possessing the manuscripts, and the commercial role of the publisher who in effect turned laboratory notebooks into a diary. Finally, the talk explored the value of the published text to inter-war science, as well as to contemporary history, philosophy and psychology of science, especially the work of David Gooding and Ryan Tweney.

Notebooks as Laboratories: The notebooks of Linus Pauling

Kostas Gavroglu (University of Athens)

From the end of the nineteenth century, chemistry and chemists were confronted with two mysteries and one lethal threat. The first mystery was argon. How could one conceptualise a chemical element which does not react with any other element? The inertness of argon called for a radical re-conceptualization of what a chemical element is, that is an element which was inert and could not react with any other element. That was the first mystery. The second mystery was the covalent bond, the fact that the hydrogen molecule was diatomic. How could electrically neutral atoms form a diatomic molecule? It was clear that the laws of electrodynamics were not valid in small distances or, something peculiar was happening to the electromagnetic forces at the atomic level.

By 1927, quantum mechanics resolved the two mysteries. It showed that the reactivity of chemical elements and their molecular structure depends on the electron configurations in the various orbitals and that such a schema, also, allowed for non-reactivity. Argon's inertness could now be understood, and the covalent bond could be explained.

In a couple of years an old ghost appeared in a new form and came to haunt the chemists. It was a threat that threatened the very existence of chemistry and chemists. Might it be the case, that chemistry was after all, a branch of physics? Such worries were not new and chemists had already been living in an uncertain state of self-identity, especially since the last decade of the nineteenth century. Was quantum mechanics an all embracing theory for both physical as well as chemical phenomena? Paul Dirac (1902-1984), one of the founders of quantum mechanics provided a damning answer. Yes, the "whole of chemistry", notwithstanding the calculational complications, could be dealt with quantum mechanics.

The talk discussed the Berkeley Lectures that Linus Pauling (1901-1994) delivered between 1929-1932. Pauling ignored Dirac's incapacitating pronouncement and presented the most eloquent and persuasive answer to these questions: yes, indeed, the chemists can have their own ways of dealing with quantum mechanics and, provide, solutions to "their own" problems. In his notebooks preparing for the lectures, Pauling developed a

new way for chemists to tackle the covalent bond, proposed a new mechanism, that of resonance, and, in effect, elaborated a theoretical justification for G.N. Lewis' (1875-1946) cubic atom. The notebooks from that period provide a rather intriguing medium for tracing Pauling's attempts to articulate a quantum mechanical treatment of chemical bonding which would be much more amenable to the chemists' culture, than the abstruse treatments by some physicists of that period who examined the problem of the covalent bond. In these notebooks one can trace the ways Pauling came to a decision about the central role of resonance for chemical bonding. Thus, the notebooks, can be perceived as a kind of quasi-laboratory, since they contain much of the uncertainty and the trial-and-error approach of an actual experimentalist.

Electronic Lab Notebooks and Beyond! The Evolution of Process Recording Tools for Scientific Research

Samantha Pearman-Kanza (University of Southampton)

The Electronic Lab Notebook (ELN) was originally created to serve as a direct replacement for the paper lab notebook, to ensure the digital capture and retention of the scientific record. What seemed like an obvious simple software-based solution has been anything but, and there are now over eighty active ELNs on the market and a wide range of different approaches have been taken to digitizing scientific research across academia and industry.

This talk delved into the history of ELNs, explaining the wide range of barriers and considerations that need to be taken into account when considering the implementation of one of these systems, and discussed the current landscape of software in the physical sciences, including the uptake of digital tools (ELNs, generic notebooking software, and other scientific software) in the academic sphere.

The discussion then shifted to why any of this matters in the first place. Ultimately, we are looking to digitally capture our scientific research such that we can produce Findable, Accessible, Interoperable and Re-useable (FAIR) data to go alongside our publications, such that others can actually make use of the research and data we have produced. This talk postulated how even though FAIR is a good starting point, we need to think beyond that. There is not only a high level of disparity between what is captured in the lab book and what is published alongside scientific papers, there is an arguably even greater issue that vital pieces of contextual information are not captured at all.

The talk concluded by discussing some successful implementations of digital notebooks, and outlining the range of research and service development that is being undertaken by the Physical Sciences Data Infrastructure (PSDI) to combat and aid with these issues.

A full copy of the slides can be found here: https://zenodo.org/doi/10.5281/zenodo.10818945

Michael Hunter, Sharon Ruston, Kostas Gavroglu, Matthew Eddy, Frank James and Samantha Pearman-Kanza

REPORTS OF RSCHG WEBINARS

Who Really Invented the Haber Process?

Alan Dronsfield (January 2024)

Far-sighted chemists and agriculturists realised in the late nineteenth century that the supply of foodstuffs would be insufficient to meet the projected population rise, already beginning in the burgeoning cities and towns. To avoid starvation, crops would have to be "nourished" by the liberal application of fertilizers. This was presently being achieved with animal dung and guano from South America, both rich in nitrogen, but these would be insufficient to meet the nations' needs as the twentieth century dawned.

Another possible source of "biochemical nitrogen" would be atmospheric nitrogen, if only an economically viable route could be found for "fixing" it – that is, converting it into a compound which would easily be assimilated by field crops. A long-standing goal was the manufacture of ammonia from its elements and then to convert it into ammonium or nitrate salts for agricultural use. Today we attach the name of Fritz Haber to his eponymous process ($3H_2 + N_2 \rightleftharpoons 2NH_3$), but in truth, another chemist arguably now lesser-known, achieved it first. It was Haber's collaboration with the industrial technologist Carl Bosch that resulted in a scaling up of his bench-top apparatus to produce ammonia by the tonne, and changed the world as the result.

Morton Sundour Fabrics: The Splendour of Unfadeable Dyes

Katie McClure (February 2024)

In 1901 in Germany, a new class of synthetic textile dyes was discovered by René Bohn (1862–1922), a chemist working for BASF. These 'anthraquinoid vat' dyes were unusual molecules with new chemical properties. Their discovery introduced novel colours to the twentieth-century textile design palette, and these colours had an unparalleled resistance to fading. James Morton (1867–1943) recognised the value of these dyes and built a pioneering British textile firm, Morton Sundour Fabrics, based on their properties. His successful marketing of the anthraquinoid vat dyes allowed him to build upon and diversify his father's lace-making business (Alexander Morton & Co.) into a sprawling network of influential UK companies which spanned dye manufacturing, dyeing, printing, and weaving. This talk presented the intertwining histories of the anthraquinoid vat dyes and Morton Sundour Fabrics, discussing the impact of this newly discovered chemical class on twentieth-century textile design.

Pharmacy in Britain: Division of Medicine or Branch of Chemistry?

Stuart Anderson (March 2024)

This talk explored the shifting relationships between pharmacy, medicine, and chemistry in Britain during the nineteenth century, and described the personal connections that linked the Pharmaceutical and Chemical Societies. Why can pharmacists call themselves chemists, but chemists cannot call themselves pharmacists? The answer lies in the way pharmacy was professionalized during the nineteenth century. Discoveries in chemistry in the late eighteenth century led farsighted chemists and druggists to realise the importance of chemical knowledge, and that education would provide the basis for professionalizing pharmacy. In France, the chemist Antoine François Fourcroy (1755-1809) suggested that pharmacists needed to recognise the position of pharmacy as subordinate to chemistry. This position was soon taken up by leading British doctors such as Anthony Todd Thomson (1778-1849), who in his *The London Dispensatory* of 1811 wrote that "pharmacy is that branch of the science of chemistry which relates to the combination and mixture of different substances for the purposes of medicine".

When the Pharmaceutical Society of Great Britain was founded in 1841 its leaders expected pharmacists to be recognised as members of a fourth branch of medicine, alongside the physicians, surgeons, and general medical practitioners (formerly apothecaries). The Society secured passage of a Pharmacy Act in 1852 which provided for a statutory register of pharmaceutical chemists. This meant that when the Medical Act was passed in 1858 it provided only for registration of the other groups. But the Pharmacy Act reserved the titles 'pharmaceutical chemist' and 'pharmaceutist' for Pharmaceutical Society members, and when a Pharmacy and Poisons Act followed in 1868 further titles, including 'chemist', were added to the restricted list.

The American Chemical Society and the Cult of Joseph Priestley

John Powers (April 2024)

In the Summer of 1874, a group of chemists descended upon the remote town of Northumberland, Pennsylvania, to commemorate Joseph Priestley's discovery of oxygen a century earlier. They met in the place where Priestley settled after his departure from England and, in the minds of the gathered chemists, brought modern chemistry to America. The success of this gathering led to the founding, two years later, of the American Chemical Society, the first national organization of chemists in the United States. This talk examined the origins and reasoning behind this commemoration of Priestley, specifically how Priestley was portrayed as a founder of American chemistry at a time when American chemists were constructing a professional identity for themselves both in relation to other scientific disciplines in the United States and in trying to compete with European chemical institutions. Powers compared this myth of Priestley as founder of American chemistry to Priestley's experiences in America as an immigrant (c. 1794–1804) as documented in the historical record. While Priestley

wished to continue his defence of the phlogiston theory (against Lavoisier's "antiphlogistic" chemistry built around oxygen), he found that by the 1790s even the provincial, American chemists had embraced the new chemistry and were eager to rebuff his claims and arguments. Thus, the Priestley commemoration in Northumberland in 1874 was an invention, created to suit the professional needs and disciplinary narratives of that time and place.

Making Molecular World: Building a Practice-Based Account of Modern Chemistry

Catherine Jackson (May 2024).

According to existing histories, theory drove chemistry's remarkable nineteenth-century development. This talk showed instead how novel experimental approaches combined with what Jackson has called "laboratory reasoning" enabled chemists to bridge wet chemistry and abstract concepts and, in so doing, create the molecular world. Based on a series of practice-based breakthroughs – including the "glassware revolution", the turn to synthesis, and the "chemical identity crisis" – this historical reassessment reveals organic synthesis as the ground chemists stood upon to forge a new relationship between experiment and theory—with far-reaching consequences for chemistry as a discipline.

Twelve Pioneering Women Chemists You Should Know About But Probably Don't

Geoff and Marelene Rayner-Canham (June 2024)

More and more of the 'forgotten' women chemists in HERstory have come to light in recent years. So many women chemists who should have received widespread recognition. There have been books on women chemists who should have won Nobel Prizes; who contributed to Periodic Table discoveries; and the Rayner-Canham's research and subsequent books on British women chemists. This presentation focussed on the diversity of contributions that women chemists have made. It selected twelve women and, in advance of the talk, provided clues to their identity (from earliest to latest). Try to identify them and if you missed the webinar listen to the recording on the RSC YouTube Channel (details later in the newsletter) for the answers. The clues (from earliest to latest):

1. Originator of quote: "… minds have no sex …" [French]

2. Authored scientific paper: "Circumstances affecting the heat of the Sun's rays". [American]

3. Undertook research with R. Bunsen, A.W. von Hoffman, V. Markovnikov [Russian]

4. Co-developed a famous biochemical equation [Canadian]

5. In her classic book, wrote: "…perhaps bacteria may tentatively be regarded as biochemical experimenters …" [British]

6. Encouraged Dorothy Hodgkin to pursue crystallography. [British]

7. Synthesized effective compound against Hansen's Disease [American]

8. Isolated first effective anti-fungal [American]

9. First X-ray photo of DNA. [British] (no, not RF)

10. Constructed gas chromatograph [German]

11. Isolated anti-malarial using ancient Chinese recipe [Chinese]

12. Later TV Math & Science "Quiz Mistress" for school children [Ghanaian]

The 250th Anniversary of Joseph Priestley's Discovery of Oxygen

Helen Cooke (July 2024)

This talk celebrated the 250th anniversary of Joseph Priestley's discovery of oxygen, which he called dephlogisticated air, on 1 August 1774. Some of the circumstances and events which led up to Priestley's most famous discovery, the people around him who helped to facilitate it, and the place where 'dephlogisticated air' was isolated are explored. Priestley was a prolific writer, producing many publications in which he recorded details of his experiments, the background to them and the narrative surrounding them; excerpts from his publications are featured throughout the talk. The apparatus Priestley used also forms part of the story, how he sourced it and how he tested the gases produced to establish their nature and properties. The talk concludes with some examples of how and where Priestley is commemorated in the UK and elsewhere.

RSC YouTube Channel

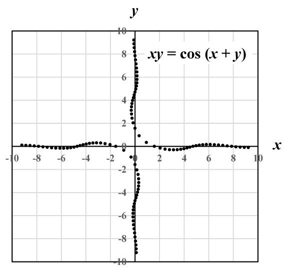
The recordings of a number of previous online lectures can be found at the Historical Group's playlist on the RSC YouTube Channel: https://www.youtube.com/playlist?list=PLLnAFJxOjzZu7N0f5-nVtHcLNxU2tKmpC

MEMBERS' PUBLICATIONS

If you would like to contribute anything to this section, please send details of your historical publications to the editor. Anything from the title details to a fuller summary is most welcome.

Michael Jewess, "$xy = \cos(x + y)$ and other implicit equations that are surprisingly easy to plot", *Mathematical Gazette*, 2024, 108 (1), 1-11.

Readers may remember Mike's illustrated account of the calculating methods widely used by physical chemists until about 1975 ("Calculating Chemistry: How it Used to be Done, a Witness Account", *Newsletter RSC Historical Group*, 2023 (winter), 83, 26-37). In those days, problems that were especially difficult, for instance requiring successive approximations, might be dealt with by using inconvenient, unreliable, and user-unfriendly university mainframe computers. But many quite elaborate calculations were performed, accurately, with hand-cranked or electromechanical desktop machines (capable only of the four mathematical functions), supplemented by printed mathematical tables, e.g. for trigonometrical functions. A 1960 mathematics text asserted that the implicit equation $xy = \cos(x + y)$ was insoluble "in any effective sense", suggesting that use of successive approximation by computer would be necessary to work with it. The article in *Mathematical Gazette* (in an issue whose cover picture is a photograph of a hand-cranked calculator) shows that in fact the equation is not so troublesome after all. By use of appropriate parametrisation, the old techniques would in an acceptable time have generated enough (x, y) pairs to make a decent plot, as illustrated. In fact, there is an entire class of such "easy" implicit equations.



However, some other implicit equations that, at first sight, might look less troublesome are resistant to such an approach (an example is $2y^5 + 3y^4x + y^3x^2 + 5y^2x^3 + yx^4 + x^5 - 5 = 0$). So, today's physical chemist should be glad that he or she can, for instance, simply type either of the above equations into the "fimplicit" module of MATLAB on his or her PC and thereby generate a plot with little further ado.

Michael Jewess, "An Equation for the 'Weather Glass'", *Physics Education*, 2024, **59**, 035006.

The accompanying figure shows a "weather glass" sold today as a decorative scientific ornament. Indoors at fairly constant temperature, it functions well as a barometer, the water in the neck of the swan rising if atmospheric pressure falls, as air in the headspace of the body of the swan expands – and conversely, if atmospheric pressure rises. (Note that the beak of the swan has an opening.) But from the early seventeenth century to the second half of the nineteenth century, such devices, in plainer forms, were important portable practical weather-forecasting devices, latterly including temperature compensation. The mercury-containing Torricellian barometer of 1644 was minimally temperature-sensitive, but was a metre tall, heavy, and difficult to move around. The *Physics Education* article shows how a physics or chemistry student can model a weather glass using only an A-Level knowledge of the ideal gas laws, of saturated vapour pressure, and of hydrostatics.

From about 1860, for practical purposes, the weather glass was out-competed by the aneroid barometer, which was comparably compact and, like the Torricellian barometer, minimally temperature-sensitive.

P.E. Childs, "The Seaweed/Vraic Industry in Guernsey and Jersey and the Extraction of Iodine", Part 1, *The Review*, The Guernsey Society, Winter 2023, 84-95.

The gathering of vraic was an ancient tradition in the Channel Islands. When it was discovered that vraic was an excellent source of iodine, two men in Guernsey established factories to extract iodine from seaweed. Part 1 of this series, gives a general introduction and overview of the iodine from seaweed industry in the British Isles. Later parts will look at the first iodine

manufacturer on Guernsey, Adolphus Arnold, a chemist and druggist in St Peter Port and a member of the Chemical Society and Albert Best, who was operating an iodine works from the late nineteenth into the mid-twentieth century.

Other recent papers by Peter E. Childs

P.E. Childs, "Donegal's Other Kelp and Iodine Works", *Donegal Annual*, **75**, (2023) 74-79.

P.E. Childs, "Peter Woulfe (1727-1803): The Last of the Alchemists", *Bulletin for the History of Chemistry*, **48(2),** (2023) 136-154.

P.E. Childs, "Edward Charles Cortis Stanford: Seaweed Entrepreneur (1837-1899)", *Bulletin for the History of Chemistry*, **49(1)**, (2024), 21-47.

PUBLICATIONS OF INTEREST

The following journal issues have been published since the winter 2024 *Newsletter* was completed.

***Ambix*, The Journal of the Society for the History of Alchemy and Chemistry, vol. 71, issue 1, February 2024**

Special Issue - Changing Colour: Yellow Dyes from Antiquity to Early Modernity, guest edited by Marjoljin Bol, Matteo Martelli, Lucia Raggetti and Jennifer M. Rampling.

Caterina Manco and Matteo Martelli, "Is Gold Yellow? Plant Dyes and Gold-Making in the Ancient Chemical Arts".

Lucia Raggetti, "Stolen Horses and Scented Garments: Vegetal and Mineral Yellow in Arabic Technical Literature".

Jennifer M. Rampling, "Citrination and its Discontents: Yellow as a Sign of Alchemical Change".

Marjoljin Bol and Giacomo Montanari, "Making Yellows Last with Nitric Acid: Exploring Colour Permanence in Art and Knowledge, 1600–1850".

***Ambix*, The Journal of the Society for the History of Alchemy and Chemistry, vol. 71, issue 2, May 2024**

Gabriele Ferrario, "Fragments of Alchemy from a Cairene Synagogue: Context, Codicology, and Contents of the Alchemical Corpus of the Cairo Genizah".

Stefano Mulas, "Translating Forbidden Authors: New Evidence on the Alchemical Library of Don Antonio de' Medici".

Maria Fiammetta Iovine, "A Very 'Distilled' Emblem in Baroque Rome: Natural Philosophy, Alchemy, and Atomism in the Academy of the Umoristi".

Marco Berretta, "Lavoisier and the History of Chemistry".

***Bulletin for the History of Chemistry*, vol. 49, number 1, 2024**

William B. Jensen, "Ask the Historian".

Marlene Rayner-Canham and Geoff Rayner-Canham, "The Matilda Effect: Some British Chemistry Case Studies".

Nenad Raos, "The Formose Reaction: A Never-ending Story".

Peter E. Childs, "Edward Charles Cortis Stanford: Seaweed Entrepreneur (1837-1899)".

Ian D. Rae, "Analytical Chemistry and the Stability of Nitrocellulose".

Gregory S. Girolami, "Origin and likely Etymology of the Word 'Trypsin'".

Helge Kragh, "Chain Reaction: a Chemical Word and its History".

Sibrina N. Collins, "Michelle Nelson and Tiffany Steele, Langston Fairchild Bate (1899-1977): the Third African American Chemistry Doctorate Recipient".

Gerard Shanley, "A Methylic Mystery: Early Production of Methyl Bromide was Overlooked".

Book Review: Philip Ball, *Beautiful Experiments: an Illustrated History of Experimental Science,* reviewed by Carmen J. Guinta.

The Back Story: Jeffrey I Seeman, "Luitzen Oosterhoff and the Sleeping Beauties".

Mitteilungen der Fachgruppe Geschichte der Chemie, Nr 27 (2023)

The latest volume of articles published by the German Chemical Society's History of Chemistry Group includes articles on Dorothea Juliana Wallich (1657-1725) a female alchemist from Thuringia; Lothar Meyer (1830-1895), the German chemist and one of the pioneers of developing the earliest versions of the Periodic Table; German and Austrian chemists, including Werner Mecklenburg, who worked as consultants in Soviet Russia between 1924 and 1938; and a biographical sketch of the chemist Lili Wachenheim (1893-1989). Articles are in German with abstracts in English.

***Ambix* Edited Collection: Knowledge in the Making**

This collection of papers from *Ambix* explores the use of laboratory and lecture notebooks as historical sources across several centuries of alchemy

and chemistry. Unlike the considered content of printed scientific texts or formalized manuscripts, notebooks capture information and knowledge in the process of its generation, often providing a rich source of insight into the author's methods and processes of thought. However, the entries in a notebook as recorded may be intended for sharing with a small audience familiar with their idiom and notations – or possibly for the reference of the author alone – leaving the historian with the task of deciphering, figuratively or even literally, the information they contain and its import within the larger context of contemporary sciences. The articles in this collection make central use of notebooks as historical sources to illuminate the development of chemical ideas and their communication within limited and well-versed circles. This collection of essays from *Ambix*, which include contributions from Frank James on Humphry Davy (1778-1829) and Agricultural Chemistry and from Anna Simmons on Robert Warington (1807-1867) and Chemical Consulting, has been edited by Charlotte A. Abney Salomon, and is available open access for a limited period:

https://www.tandfonline.com/journals/yamb20/collections/knowledge-in-the-making

Dyes in History and Archaeology – Conference Proceedings

DHA41, 11–13 October 2022, Visby (Gotland), Sweden

This special issue of the journal *Heritage* features seventeen papers from the conference:
https://www.mdpi.com/journal/heritage/special_issues/dyes_in_history_and_archaeology

A book of abstracts from the conference can be found at: https://www.dyesinhistoryandarchaeology.com/resources/Past_Meetings/DHA41_Abstracts.pdf

DHA42, 31 October - 3 November 2023, Copenhagen, Denmark

A book of abstracts from the conference can be found at: https://www.dyesinhistoryandarchaeology.com/resources/Past_Meetings/DHA%2042%20Copenhagen%202023_Abstracts.pdf

SOCIETY NEWS

Society for the History of Alchemy and Chemistry

Morris Award 2024

The Society for the History of Chemistry wishes to announce that the Morris Award for 2024 has been given to Carsten Reinhardt for his outstanding work on the recent history of chemistry and the history of the chemical industry. He has been an innovator and a leader in the history of modern chemistry and chemical industry from the beginning of his career, exploring the instrumental, theoretical, commercial, industrial, and regulatory dimensions of the field that we call chemistry, while emphasizing the frequent "disappearance" of "chemistry" into other fields, such as molecular biology, materials science, nanotechnology, or environmental science. He has a gift for collaboration and cooperation that has greatly benefitted studies in the history of chemistry and chemical technology.

Carsten Reinhardt took his PhD on chemical research at BASF and Hoechst between 1863 and 1914 at the Technical University of Berlin in 1996. He became Professor for Historical Studies of Science, University of Bielefeld in 2007 and between 2013 and 2016, Reinhardt was President and CEO, Chemical Heritage Foundation, Philadelphia, USA (now the Science History Institute). From 2017 until 2021, he was the President of the Gesellschaft für Geschichte der Wissenschaften, der Medizin und der Technik (GWMT) and is a co-editor of the *Mitteilungen der Fachgruppe Geschichte der Chemie*.

The Morris Award honours the memory of John and Martha Morris, the late parents of Peter Morris, the former editor of *Ambix* and recognises scholarly achievement in the History of Modern Chemistry (post-1945) or the History of the Chemical Industry. The recipient of the award gives the Morris Award Lecture at an appropriate meeting and this is usually published in *Ambix*. Previous holders of the award are Ray Stokes (2009), Mary Jo Nye (2012), Anthony Travis (2015), Yasu Furukawa (2018) and Ernst Homburg (2021). The next award will take place in 2027 and nominations from all with a track record of publishing on the history of modern chemistry and/or the history of the chemical industry are warmly welcomed. A call for nominations will be circulated in 2026.

2024 HIST Award

The recipients of the 2024 Joseph B. Lambert HIST Award of the Division of the History of Chemistry (HIST) of the American Chemical Society are James L. and Virginia R. Marshall. James Marshall is an Emeritus Professor of Chemistry at the University of North Texas, Denton, TX. Virginia Marshall, although not a chemist by training, was Jim's partner in their work on the history of the chemical elements. The HIST Award is for outstanding

achievement in the history of chemistry and is international in scope. This award is the successor to the Dexter Award (1956-2001) and the Sydney M. Edelstein Award (2002-2009), also administered by HIST.

FUTURE CONFERENCES

International Conference on the History of Chemistry – Valenica 11-14 June 2025

The 14th International Conference on History of Chemistry **(14ICHC)** organized by the EuChemS Working Party on the History of Chemistry (WPHC) will be held in Valenica, Spain on 11-14 June 2025. The general aim of the conferences organised by the WP is to facilitate communication between historically interested chemists, museum curators, science educators and historians of chemistry, and to gather the community together on a regular basis. 14ICHC will be hosted by the Lopez Piñero Inter-University Institute - University of Valencia, an academic institution which supports research projects and outreach activities on historical and social studies on medicine, technology, science and the environment. It is located in a restored eighteenth-century palace in the centre of Valencia. The conference programme includes scientific sessions, key-note lectures, the Working Party business meeting, excursions, a reception, and a conference dinner. The general conference theme is **Chemistry and Capitalism** with the aim to foster debates about the relationship between chemistry broadly constructed, industry, environment, and regulations through a historical perspective. Sessions and papers on all aspects of the historical development of material and life sciences are also welcomed.

Important Dates:

Deadline for submitting proposals: 1 December 2024

Notification of acceptance: January 2025

Provisional programme: February 2025

Early bird registration: before 15 April 2025

Normal fee registration (deadline to appear on the program): 15 May 2025

Final programme: May 2025

Conference dates: 11-14 June 2025 (Saturday excursion included)

Proposal Guidelines:

The programme committee especially encourages the submission of panel/session proposals, but also welcomes the submission of stand-alone papers. Collaborations and co-authorships are accepted. All proposals must be in English, the language of the conference. Submitted abstracts and session proposals (max. 250 words) will be subject to review by an International Advisory Committee, that assists the Steering Organising Committee in ensuring the quality of the conference program. Sessions should include about three to five papers, and no more than one session can be proposed by the same organizer. There is a limit of one paper per presenter (including the papers listed inside a panel or a session). All paper proposals must use the templates for panels and papers provided on the conference website, and be submitted by email (by 1 December 2024) to: 14ichcvalencia@gmail.om

For all matters relating to the conference including templates for panels and papers and details of fees when they are available please visit:

https://esdeveniments.uv.es/116631/detail/14th-international-conference-on-the-history-of-chemistry-14ichc.html

Dyes in History and Archaeology

The 43rd annual meeting of Dyes in History and Archaeology (DHA) will be held from 23 to 25 October 2024 at Cloth Hall Court, Quebec Street, Leeds LS1 2HA and will be hosted by the Society of Dyers and Colourists, which is marking its 140th year of existence as well as the centenary of the Colour Index™. The programme will include twenty-four posters and twenty-two oral presentations. The conference dinner will be held on Thursday 24 October at the Malmaison Leeds. LS1 4AG. For more information visit: http://www.dha43.org