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RSC INTEREST GROUP
HISTORICAL

Historical Group

NEWSLETTER and SUMMARY OF PAPERS

Editor: Dr Anna Simmons

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RSC Historical Group Newsletter No. 85 Winter 2024

Contents

From the Editor

Welcome to the winter 2024 RSC Historical Group Newsletter. I hope readers will enjoy a new section: "Two books that markedly influenced my chemical career". In this issue Henry Rzepa takes us back to a childhood of chemistry experiments as he writes about A.J. Mee's *Practical Organic Chemistry* and J.W. Mellor's *Modern Inorganic Chemistry*. Following his talk at the Group's "Pot Pourri" meeting in March 2023, John Nicholson discusses "The Lives and Careers of the Sons of W.H. Perkin". Alan Dronsfield, Trevor Brown and Pete Ellis' article looks at "Conquering the Captain of Death - Chemical Interventions against Tuberculosis". Readers will also find a report of the group's meeting on British X-ray Crystallographers held at Burlington House in October 2023 and a new section on Events, Exhibitions and Outreach. There are summaries of the group's popular monthly online seminars, plus a list of the webinar recordings available to view on YouTube, a review of Catherine M. Jackson's *Molecular World: Making Modern Chemistry*, and information on publications of interest and forthcoming events.

The group's first meeting of 2024 will take place on Wednesday 13 March at Burlington House on the topic "The Development of the Chemist's Notebook". The meeting will feature analysis of the notebook practices of some famous chemists starting from the time of Robert Boyle and consider their evolution until their most recent manifestation in electronic form. A programme and booking details can be found later in the newsletter.

As ever, I am indebted to the newsletter production team of Gerry Moss and Bill Griffith for their assistance in bringing the final version together. Bill is stepping down as Membership Secretary and this is the last issue he will be involved with. He has been an excellent support and contributor whilst I have been Editor, so particular thanks to Bill for this and the many other issues we have worked together on.

If you would like to contribute items such as short articles, book reviews, news items and reports to subsequent issues please contact me. A new section on Events, Exhibitions and Outreach aims to showcase how the history of chemistry can be used to inspire interest in science. Readers are also invited to contribute to the new section "Two books that markedly influenced my chemical career". The deadline for the summer 2024 issue will be **Friday 7 June 2024**. Please send your contributions to a.simmons@ucl.ac.uk as an attachment in Word.

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 (apologies that this issue is slightly late). 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.

Anna Simmons, UCL

ROYAL SOCIETY OF CHEMISTRY HISTORICAL GROUP NEWS

Letter from the Chair

It is good to be able to write these few words in the light of another successful year for the Group, one in which, among other things, we had an encouraging influx of new committee members. Their details appear elsewhere in this Newsletter, and I would like to take this opportunity to thank them for volunteering, and to say how much I am looking forward to working with them. At the same time, we lost the services of Chris Cooksey, who stood down from the committee after many years of membership. We are grateful to him for all he has given to the Group. We are also due to lose a couple more committee members during next year, but I will wait until they have gone before thanking them formally for their service.

In the year just completed, we held two full-day meetings, the latter, on British X-ray Crystallographers, being exceptionally well-attended. We also continued our on-line webinar series, for which Peter Morris is to be thanked. He has secured the services of a wide range of well-informed speakers, and kept the interest of the membership high with the programme he has offered. These webinars, which were started in response to the Covid lockdown, are now a major activity of the Group, and we appreciate all Peter's efforts in keeping them going to such a high standard. We also thank the speakers for their contributions, including the ease with which they all appear to deal with the challenges of lecturing on-line. The webinar series is planned to continue during 2024, and we also have two in-person meetings planned at Burlington House. Again, this issue contains full details.

Which brings me to the subject of the Newsletter. This is such an interesting document, and we cannot thank our editor, Anna Simmons, enough for

maintaining the high standards of its content. I really don't think the term "Newsletter" does justice to its quality, so thank you, Anna, and please keep up the good work.

I hope you will find something to attract your interest among all our activities. As ever, there is the opportunity to contribute an article to the Newsletter if you feel that there is something in the history of chemistry that we are neglecting. And we hope to see you, either at one of our in-person events, or on-line at a webinar.

To end, I wish you and your loved ones all the best for 2024.

John Nicholson

Secretary's Report for 2023

The Group held two one-day scientific meetings at Burlington House, London, in 2023, open to members and non-members. Both of these were in-person, though the second of them, on British X-ray Crystallographers held in October, was a hybrid meeting with financial support from the British Crystallographic Association (BCA). This was a particularly well attended meeting, with many X-ray crystallographers present, thanks to the publicity put out by Jon Cooper of the BCA. The March meeting was an open (or "pot-pourri") meeting, the first we have held for several years. There were six talks and our first demonstration which was a distillation.

Full reports of our meetings have been published in the RSCHG Newsletter, two issues of which appeared in 2023. This publication continues to be edited by Anna Simmons, and is something we are particularly proud of. Anna maintains a consistently high standard, and succeeds in attracting a wide range of articles, meeting reports and other news items. She deserves all our thanks.

In addition to our one-day meetings, we continued our highly successful online lecture series on the third Tuesday of the month (August excepted), and these covered a wide range of topics on the history of chemistry. Although the lockdowns which spurred the creation of these lectures are long past, they continue to be well attended, audiences typically being up to around sixty participants, with people taking part from all over the UK and beyond. Lastly, we held two committee meetings during the year, both of which were virtual and this is likely to be our pattern for the foreseeable future.

We welcomed five new members to the committee, elected in our first group-wide ballot, and they are already making an important contribution to our activities. Our long-standing committee member, Chris Cooksey decided to retire at the end of October and we are very grateful for his service to the committee.

Peter Morris

ROYAL SOCIETY OF CHEMISTRY HISTORICAL GROUP MEETINGS AND ONLINE LECTURES

The Development of the Chemist's Notebook

This one-day in-person meeting organised by the Historical Group will take place on Wednesday 13 March 2024, 10.30-17.00, at Burlington House, Piccadilly, London W1J 0BA.

For many centuries chemists have used notebooks to record their experiments, results, literature research and thoughts. This meeting will feature analysis of the notebook practices of some famous chemists starting from the time of Robert Boyle and consider their evolution until their most recent manifestation in electronic form. For more information and to book please go to:

https://www.rsc.org/events/detail/77987/the-development-of-the-chemist-s-notebook or 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

10.30: Coffee

10.50: Welcome

11.00: The Work diaries of Robert Boyle

Michael Hunter (Birkbeck, University of London)

11.40: What was a Scientific Notebook? Amelie Kier, Chemistry and the Power of Annotation during the 1790s

Matthew Eddy (University of Durham)

12.20 Lunch (not supplied)

Afternoon Session

13.40: Protean Poetics in Humphry Davy's Notebooks

Sharon Ruston (Lancaster University)

14.20: How Michael Faraday's Laboratory Notebooks Developed into a Diary

Frank James (University College London)

15.00: Tea

15.30: Notebooks as Laboratories: The case of Linus Pauling

Kostas Gavroglu (University of Athens)

16.10: Electronic Lab Notebooks and Beyond

Samantha Pearman-Kanza (University of Southampton)

16.50: Closing remarks

17.00: Meeting ends

Chemistry, History and Medicine - Wednesday 16 October 2024, Burlington House

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 to 11 am, will consider how the development of chemistry in the nineteenth and twentieth centuries contributed to the amelioration of disease, and the prolonging of life.

Among the topics to be included in the meeting to be held at Burlington House will be

- the discovery of insulin and the methods used over the last century to monitor its effectiveness in the treatment of diabetes, via glucose estimations in blood and urine
- the discovery of the drugs used to attack, cure and control the scourge of tuberculosis

some aspects of the history of anaesthesia, with special reference to the early use of chloroform.

Online Lectures

These are continuing on the third Tuesday of each month at 2 pm. In January 2024 Paul Craddock will speak on the *Early History of Zinc and Brass* and in February, Katie McClure will speak on *Morton Sundour Dyes*. 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.

INTRODUCING OUR NEW HISTORICAL GROUP COMMITTEE MEMBERS

Anna Coyle

Anna Coyle worked briefly in the coatings industry in the 1980s before moving into her first publishing job at the Royal Society of Chemistry on Chemical Communications. When the RSC left for Cambridge she moved to British Gas Research and Technology and had various roles in R&D project management, public relations and was responsible for in-house R&D publications. Anna has worked as a freelance writer and was a member of the RSC's Women Chemists' Committee in the 1990s. From 2003 until retirement in 2016 she worked for Wolters Kluwer UK, where she was a Commissioning Editor for a portfolio of paper and online compliance publications in health and safety, environment and facilities management. Since retirement she writes about local history, mainly for the local history society's journal.

Vincent Daniels

Vincent Daniels studied chemistry at University College Cardiff and then started work at the British Museum on the science of the conservation of library materials. However he later worked on the deterioration and preservation chemistry of a large variety of materials from prehistory to the

present, including bog bodies, metals, paper, pigments, plastics and dyes. The huge variety of objects studied instilled in him a lasting curiosity about the science of all manner of man-made and natural materials. He left the Museum after twenty-nine years and worked at the Royal College of Art, teaching on the Conservation course for five years, while also performing research at the Victoria and Albert Museum on the fading of indigo and shellfish purple-dyed textiles. He has been a popular lecturer with conservation students, also representing the RSC at many university chemistry department talks. He was awarded the Anna Plowden Medal for Conservation by the Royal Warrant Holders Association for his inspirational lectures and the excellence of his research. He is currently an Emeritus Researcher at the British Museum where he is researching the history of the Museum's Research Laboratory which has been in existence for 102 years. He has been a member of the Dyes in History and Archaeology Group for over forty years and is also a Fellow of the International Institute of Conservation.

Andrea Gallio

Andrea Gallio is originally from Vicenza (Italy) and studied chemistry at the University of Padova which, founded in 1222, was home to Galileo and key in the unravelling of the scientific revolution. Andrea was subsequently awarded a PhD from the University of Bristol (UK) and is now working as a research associate at the same institution. His scientific expertise lies in the overlap between inorganic chemistry and biology, focusing on the mechanisms underlying the cellular trafficking of metal ions and cofactors. In his university years, Andrea took much inspiration from the biographies of notable scientists, which sparked a fascination for the history of chemistry. In particular, his main historical interests revolve around the pioneers of coordination and bioinorganic chemistry but also include the relationships between science and religion.

Alice Halman

Alice Halman recently joined the historical group committee after being a member of the group since 2019. Currently working at Sellafield Ltd., she holds a First-Class Honours Undergraduate Masters in Chemistry from Kingston University and 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.

Mike Leggett

Following a BSc Joint Honours Degree in Chemistry and Pharmacology (University of Nottingham, 1981) and a PhD in Chemistry (The Synthesis and Study of Derivatives of Polyaza-annulenes and Biguanides; Bristol Polytechnic, 1986), Mike was employed for five years as a Development Chemist working on office products. He retrained as a Technical Author and joined the British Standards Institution in 1993 as a Technical Editor. From 1995 he managed development projects for British, European and International Standards for multiple industries and technologies until his retirement in 2021. Previous roles on RSC Committees include as organizer of the Distinguished Guest Lecture and Symposium (2004-06) for the Environmental Chemistry Group Committee. He was Secretary (1995-96) of the Eastern England Region of the Industrial Division Committee. Historical interests include astrochemistry, medicinal chemistry, macrocyclic chemistry and colour chemistry. He is a founder member of the Society for the History of Astronomy, and also their General Secretary (since 2020).

NEWS FROM THE RSC LIBRARY

As we reported last year, the Royal Society Of Chemistry Library has recently received a donation of over 350 titles from Professor William H. Brock's comprehensive book collection on the history of chemistry. Professor Brock's donations are now on the shelves and the librarian, David Allen, is in the process of cataloguing them. The uncatalogued items can be browsed and read on site, but they cannot be taken out on loan until catalogued. Peter Morris has also donated a number of books and it is hoped these will be shelved next to the Brock Collection in the East Gallery of the Library.

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. Amongst 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*. If you would like to contribute, please get in touch via a.simmons@ucl.ac.uk

A.J. Mee*, Practical Organic Chemistry* (London: J.M. Dent and Sons, 1959) – "Mee"

G.D. Parks and J.W. Mellor, *Modern Inorganic Chemistry* (London: Longmans, 1946) – "Mellor"

My connection with both these books goes back to around 1962 and is set in a particular context. Being an only child, I played extensively with my two cousins who lived nearby. Their mother had a science degree and was in fact the owner of the inorganic text. When my aunt decided to emigrate to Canada in that year along with my cousins, she left her textbooks with my parents, perhaps in the very prescient anticipation that I would discover and read them. They were stored deep inside in the cupboard under the stairs. I was forever crawling into small spaces - a habit that had often caused consternation to my parents even at the age of three – and it was there I discovered the Mellor one day. It is not the kind of book that a twelve-year-old would normally start reading, but my parents had noted that I was missing my cousins and had decided to purchase a chemistry set for me as some form of distraction. There was something of a disconnect of course between all the fascinating compounds described in the Mellor text, and the relatively small range of chemicals in the box-set. The disconnect was made worse since I was particularly fascinated by the explosive and dangerous compounds described in the Mellor. Chlorine heptoxide (p. 507) is just one example that attracted me particularly, including its explosive nature. Nitrogen tri-iodide (p. 401) is of course far more famous and therein lie several more stories [1]. Mellor is scattered with diagrams of the apparatus used to prepare the compounds described, but I have no idea why as a twelve-year-old I found all this so fascinating! Indeed I read about almost any oxide avidly- especially if it was coloured. So, after a few days, and with all the chemicals in the set exhausted, I needed to find replacements.

I have no recollection about how I located A.N. Beck and Sons in Stoke Newington (no Google in those days of course), but they were a regular high street pharmacist who happened to have a basement where they would sell often exotic chemicals to twelve-year-old boys and girls. None of this bears thinking about nowadays of course! Stoke Newington was a lengthy bus ride away from where we lived in southeast London, but I happily ventured on my own on the 72 bus and started returning not only with a new batch of chemicals (figure 1) but also the glassware needed to perform "proper" experiments. Imagine my delight when I got a water pump and was able to do reduced pressure distillations. All this in a small (unventilated) annex to the kitchen in the house, the use of which my parents just about tolerated. At least until the day that I mixed ethanol with a mixture of sulfuric and nitric acids and sprayed a rather nice Jackson Pollock brown pattern onto the kitchen ceiling. My punishment for doing this was learning how to repaint the ceiling - I have been none too fond of painting ceilings ever since. I was now able to explore a few more of the compounds mentioned in the Mellor text, which I continued to absorb avidly. But soon I realised that there was much more to chemistry than described in Mellor.

Figure 1: A Typical Shopping List for A.N. Beck.

A.N. Beck and Sons not only sold chemicals but also had a few books for purchase and that is how one day I went home clutching A.J. Mee's text on practical organic chemistry (figure 2). That contained 297 experiments, many of which could be conducted in my new home laboratory. I started that book with dyes, which magically transform entirely colourless compounds into startingly bright reds and yellows and less often blues and greens. Indeed, at age seventeen when I was starting my university course

applications, I even applied to the colour chemistry course at Leeds. It is my regret that during this period, I never attempted the synthesis of mauveine, a compound that has a very local flavour since the site of the factory that its discoverer Perkin built to manufacture it is just down the road from where we now live [2]. After several years, I had ticked around half of the experiments in Mee and saved not a few of the final products in sealed glass specimen tubes. Dinitrogen tetroxide is a memorable sample from that period, since it is not easy to seal a compound that boils at 22 ˚C.

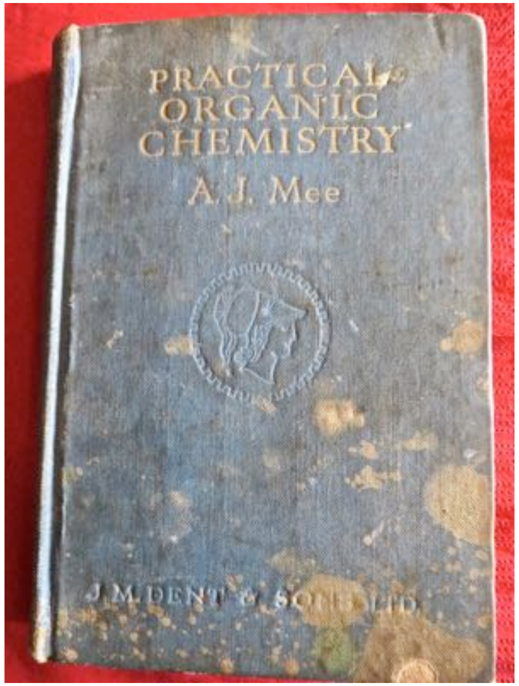


Figure 2: A.J. Mee's text, complete with chemical stains!

I should mention one interesting characteristic of the experiments described in Mee - the propensity to use large quantities of compounds. A typical experiment could use up to 10-50 g of material. As someone with a limited budget (approximately half of which was now being spent on attending football matches), I soon realised that a ten-fold reduction in quantities did not lessen the enjoyment of the preparation. Nowadays in some taught laboratories, the quantities are often measured in mg! The preparation of benzidine was an exception, involving 2g of this highly carcinogenic species and which I followed Mee to the letter. I still have nightmares about my experiments with this species and the quantity of it I produced – the Mee text does not mention the toxicity.

Just to balance things out, I should mention that I also (tried to) read a theoretical chemistry text by J.W. Linnett [3] which contained no home experiments to perform but probably sowed the seeds for my subsequent career years later.

By the time I started my university course in 1968, I was able to shut down my home laboratory (much to the relief of both parents) and continued in a somewhat safer university laboratory. Perhaps unsurprisingly, given the six years or so of practical experience I already had, I was delighted to win a prize for practical chemistry in my final year. By this stage of course, the standard inorganic texts were books by Cotton and Wilkinson and Vogel's practical organic chemistry – both in a very different style from my two selections above. I continued making molecules for my three years of PhD during the period 1971-74 - mainly sterically hindered indoles and indolinones - and it was these final syntheses that set me on my subsequent career of modelling reactions using quantum mechanics - a story told elsewhere [4]. But without doubt, both the Mellor and the Mee books played a crucial role in directing me along this long and winding path.

In 2014, some fifty years after reading my two highlighted books, I decided to find out if anyone else had similar experiences and I posted about them on my blog (Figures 1 and 2) [5]. To my delight fifty-two responses have been received to date and perhaps this newsletter article might encourage a few more? It turns out I was not alone. I even got one response from Hillary Beck Grant, whose father Kingsley Beck was the son of Albert Neve Beck. She vividly remembers the smell in the basement where two women did all the bottling, packing and dispatching. Sounds very similar to my own kitchen annex!

References

1. H.S. Rzepa, "Chemistry with a Twist", DOI: 10.59350/d4xrw-f1j66

2. H.S. Rzepa, "Chemistry with a Twist", DOI: 10.59350/j80na-mgz43

3. J.W. Linnett, *The Electronic Structure of Molecules: A New Approach* (London: Methuen, 1964).

4. H.S. Rzepa, "The long and winding road towards FAIR data as an integral component of the computational modelling and dissemination of Chemistry", *Israel J. Chem.*, **2021**, 62, e20210003. DOI: 10.1002/ijch.202100034.

5. H.S. Rzepa, "Chemistry with a twist", DOI: 10.59350/hjf0v-c0z37

Henry Rzepa

The Lives and Careers of the Sons of W. H. Perkin

Introduction

The story of W. H. Perkin and his discovery of the first synthetic dyestuff, mauveine, is well known [1, 2]. He was born in 1838 into a well-to-do family living near Cable Street in London's East End. He was educated at the City of London School then, from the age of fifteen, at the Royal College of Chemistry in Oxford Street.

The professor there was A. W. Hofmann, whose research was based on the chemicals derived from coal-tar, a waste product from gas works. Coal-tar was a rich source of organic chemicals, one of which, allyl toluidine, seemed promising for oxidation to prepare quinine. Quinine is an alkaloid which reduces fever in patients with malaria. Unfortunately, the proposed reaction is not possible because the structures of allyl toluidine and quinine are so different. However, this was beyond the state of knowledge at the time.

Perkin had a very basic laboratory at his home, and in the Easter vacation of 1856, using chemicals brought from college, he attempted the reaction of allyl toluidine with potassium dichromate as oxidising agent. He simply obtained an unpromising brown precipitate [2]. He therefore tried another substance derived from coal-tar, namely aniline (phenylamine in modern nomenclature). This also failed to give quinine, but instead gave a black slurry which left purple stains on the cloth used for wiping the laboratory bench. This was the clue that the product might be useful as a dyestuff.

So it proved. Preliminary studies at Pullars, a textile company in Perth in Scotland confirmed the potential of the substance as a dye for silk.

Encouraged by his father, Perkin left college and set up a factory at Greenford in Middlesex to make the dye. There he overcame many problems, both financial and technical, and set up facilities for the production of mauveine. He went on to make his fortune and the accidental discovery of mauveine can be seen as the birth of the organic fine chemicals industry [1].

Perkin retired from his company at the age of thirty-six, and then spent much of his time on fundamental research in organic chemistry. He maintained a private laboratory in the substantial home he occupied with his family at Sudbury, near Harrow. His research was very productive, and resulted in some ninety papers, all published in *Journal of the Chemical Society Transactions*. Perkin's work received widespread recognition: he was elected FRS in 1866, was awarded the Royal Medal in 1879 and the Davy Medal in 1889. He served as President of the Chemical Society (1883-85) and of the Society of Chemical Industry (1884-85), was knighted in 1906 and died a year later, aged sixty-nine.

Family and Personal Life

Perkin was married twice. First, at the age of twenty-one, in 1859, he married his cousin Jemima Harriet (née Lisset). She gave birth to two children, both boys, namely William Henry junior, born in 1860, and Arthur George, born in 1861. Sadly, shortly after the birth of Arthur, she died of tuberculosis.

Perkin married for the second time in 1866, his next wife being Alexandrine Caroline (née Mollwo). Through her, Perkin had a further five children, four daughters and a son. There is considerable confusion about the names of the daughters, and they are incorrectly stated in several references [e.g. both 1 and 2]. Searching census returns on-line for the relevant years (1881 and 1891) shows the children of Perkin's second marriage to be, in order:

Sascha Emilie (born 1868)
Frederick Mollwo (born 1869)
Lucy Jane (born 1872)
Annie Florence (born 1876)
Helen Mary (born 1879)

Of these children, Sascha never married and is buried with her parents in the family grave at Christchurch, Harrow. So, too, is Frederick, although he did

marry. Perkin was survived by Alexandrine, who later moved to Kensington, and died there at the age of eight-nine in 1929.

The Perkin family was very musical [3]. Perkin himself was a good violinist, his oldest son was an accomplished pianist and his second son played the flute and bassoon. Both older brothers played throughout their lives, and music was important to them. There is no record of the musical prowess of Frederick, but it seems likely that he would have been involved in the family music making as well.

In terms of careers, all three sons worked in chemistry. Like their father, they started at the Royal College of Chemistry, though it had evolved to become the Royal College of Science by the time Frederick became a student there. All were initially organic chemists, and William junior and Arthur remained so for their whole careers. Frederick moved into physical chemistry in the middle of his career and later into technical chemistry as a consultant to Government and industry. In the remaining part of this article, the individual lives and careers of the three brothers will be described.

W. H. Perkin Jr

Of the Perkin brothers, William junior could be argued to be the most successful. He had a stellar academic career that culminated in his holding the Waynflete Chair in Chemistry at Oxford University, a position he occupied from 1913 until his death in 1929 [4].

William's education began at the City of London School, where he went at the age of ten in 1870. During his schooldays, he had the use of a small laboratory in a hut in the garden of his home, which he shared with Arthur. They are reported to have worked at opposite ends of this hut on tasks given by their father, such as crystallisations and other simple chemical manipulations [3]. The two boys were close, as they continued to be throughout their lives, and both delighted in this early exposure to experimental chemistry. Both felt that "the great object of their lives must be chemical research" [3].

In 1877 William junior went to study at the Royal College of Chemistry, by this time transferred to South Kensington. The professor at the time was Edward Frankland, and the laboratories were directed by Dr W.R.E. Hodgkinson [5]. William made an immediate impression because of his highly skilful practical work. Much of the latter part of the course was devoted to research, and William was supervised in this by Dr Hodgkinson.

After completing his college diploma, William stayed for another academic year as assistant (unpaid) in the advanced laboratory.

The results of his earliest research were published in two papers that appeared in 1880, both in *Journal of the Chemical Society Transactions* [6, 7]. Both involved studies of reactions of what was then called phenylic acetate (phenyl ethanoate in modern nomenclature). In the first case, the reaction with sodium was studied [6]; in the second, reaction with benzylic chloride *i.e.* (chloromethyl-benzene) was studied. Experiments involved high temperatures, and had lively results: there were explosions due to the evolution of large volumes of hydrogen chloride gas [6]. To overcome these problems, reactions were carried out in sealed copper containers. The work involved large quantities of reagents, with some 3 kg of starting material being used [7]. Even their small scale looks large to modern eyes, with 100 g of phenyl ethanoate being used in experiments reported in the first paper. Not surprisingly, given the extreme conditions of temperature and pressure involved, reaction products proved to be complex mixtures, and some components defied identification. No doubt William learnt a lot from the experience, but nothing of lasting value emerged from these studies.

In October 1880, William went to the University of Würzburg to study for a PhD under the supervision of Johannes Wislicenus [8], a move that was probably influenced by his supervisor at South Kensington, Dr Hodgkinson. In Würzburg, William studied physics and mineralogy in addition to undertaking chemical research. The initial project suggested by Wislicenus went badly and was abandoned, but the next project went much better. It concerned reactions of ethyl aceto-acetate and diethyl malonate and several papers resulted which allowed William to completed his PhD in 1882 at the young age of twenty-two.

In the autumn of that year he moved to the University of Munich to work in the laboratories of Adolf Baeyer [9]. William stayed there for four years and, as well as research, he became actively involved in teaching [3]. He also supervised quite large laboratory classes.

Baeyer's group at Munich was large and productive, and in the years that Baeyer ran it (1875-1915), about 1200 papers on organic chemistry were published and some 395 PhD degrees obtained [4]. The scale of the operation and the steps that Baeyer took to accommodate it with building programmes and modern laboratories had a strong influence on the young

William. So did Baeyer's disdain for physical chemistry and his indifference to theory in general.

However, Baeyer had made one contribution to theory. He proposed that in organic compounds, where the bonds in a carbon atom are forced to deviate from the ideal tetrahedral angle (109.5°) there is a strain which causes the compound to be reactive [10]. This is usually presented in terms of cyclic compounds, but Baeyer actually used the concept to account for the reactivity of unsaturated compounds, notably alkynes. He considered that these molecules contain two-membered rings [11]. The idea of strain did not survive for very long in this form.

William decided to investigate whether this theory applied to compounds containing small rings of carbon atoms, and set out to prepare such compounds, in most cases for the very first time. Perkin's experimental work on this topic was a *tour de force*, and was widely appreciated at the time. Beginning in 1883, over the next eleven years, he published a series of papers reporting the synthesis of compounds containing rings of three, four and five carbon atoms. For example, in 1883 he reported the synthesis of the first cyclobutane derivative [12] and two years later the first cyclopropane derivative [13]. In studying such compounds, William was able to confirm the basic truth of Baeyer's ring strain theory.

As a result of these studies, by 1886, William's reputation was very high and he was seen as one of the most promising chemists of his generation [3]. In this year, he returned to England and was offered laboratory space at Owen's College, Manchester, by the professor, Harold Dixon. He took up this offer, and worked there for the academic year 1886-87.

He then moved to Edinburgh to take up the post of Professor of Chemistry at Heriot-Watt College. This institution had been established in 1821, and was small, with a high teaching load for the professor. The days were full of lecturing duties, and research was only possible in the evenings. Nonetheless, despite this, William used the opportunity to enhance his reputation as a researcher in organic chemistry. A series of fourteen papers entitled "Contributions from Heriot-Watt College, Edinburgh" appeared in *Journal of the Chemical Society Transactions* in William's time there. Two of these were by his brother Arthur and one by Frederick, though neither held a formal position at the college. Another significant chemist involved in this work was F.S. Kipping, who William first met in Manchester and who joined him as demonstrator at Heriot-Watt. Through Kipping, William met his future wife Mina and eventually Kipping and William became related by marriage, as they each married one of the Holland sisters [3]. William's financial position improved sufficiently on his appointment to the chair at Heriot-Watt to put him in the position to marry Mina, which he did on 31 December 1887.

During William's time in Edinburgh he was elected FRS (1890). Then, in 1892, he was appointed to the Chair in Chemistry at Owen's College, Manchester. Shortly after his arrival, this institution became a fully-fledged university, with the formation of the Victoria University. Originally conceived as a multi-collegiate university, with Owen's as one of its constituent colleges, the Victoria University soon split and the other colleges, at Liverpool and Leeds, received their charters as full universities. This appointment of William to the position in Manchester was significant because it allowed him to build the first proper university research school in the UK, and the only one that could compare with those in Germany [4].

When William went to Manchester, space available for students was limited. However, the Chair had become vacant because its original occupant, Carl Schorlemmer, had died and it was decided to erect a new chemistry building as a memorial to him. Funds were duly raised, and William took an active role in planning the new laboratories. This became a recurring them in William's career, raising funds, supervising building projects and expanding space available for organic chemical research.

The Schorlemmer Memorial Laboratory was opened in 1895. It was not long before it needed to be extended, and William led the way with fund-raising, so that soon an extension was added containing the Schunck, Dalton and Perkin laboratories. The last one was named for William's father, who formally opened all three in 1904. Yet more money was raised in the form of a donation from Andrew Carnegie, and this funded the John Morley Laboratories, named after the University's Chancellor, which were opened in 1909.

Despite the workload of all these building projects, William maintained his commitment to his personal research. He typically lectured at 9.30 a.m. on four mornings a week, then went to the laboratory, first to check on progress with his students, then to carry out his own experimental work [3]. He typically worked with a short break for lunch until about 4.00 in the afternoon. He used only the simplest of techniques (distillation, crystallisation and combustion analysis) and of apparatus (beakers, test

tubes, watch glasses and funnels), beginning each day with a stock of newly cleaned glassware and working along the bench until everything was dirty, at which point he left. The university employed a "washing boy" to clear up after him and to replenish the stock of clean equipment for the next day. In this way, William carried out a large volume of work that enriched the literature of his time. He also co-authored three text books, one of which, with Frederick Kipping, became a standard university textbook for almost fifty years.

Figure 1: William Henry Perkin Jr (1860-1929) in the Laboratory at Oxford
Source: Science Museum Group Collection Online. Object Number: 1974-644/
Accessed 6 December 2023.
https://collection.sciencemuseumgroup.org.uk/objects/co8022307/william-henry-perkin-photograph-portrait

Then, in December 1912, William was appointed to the Waynflete Chair of Chemistry at Oxford University. He was preceded in this position by William Odling (1829-1921), who had not done research since 1876 and whose attitude can be summed up as "Odling was not a slave to his laboratory, which he thought it a breach of etiquette for the professor to enter" [4]. William was determined to change things.

Once again, this entailed a building project. William's plan was to have a university facility, and not rely on college laboratories, of which there were five when he arrived in Oxford. By 1915 he had secured the necessary funding, including a significant donation from the philanthropist and owner of the company that made Worcestershire Sauce, C.W. Dyson Perrins. The resulting laboratory was named in the latter's honour and the first part, comprising the central block and western wing, were completed in 1916. Later, in 1922, a second stage was completed.

William filled the new building with research students. He was also instrumental in introducing the DPhil degree (in 1917) and, around the same time, of adding the research fourth year to the BA degree in chemistry [3]. This was a significant development, not only in Oxford, but well beyond. Although no other university followed Oxford in having a full extra year, they all gradually introduced a research component to the final year of their degree courses, and now a chemistry (or any other science) degree without a final year research project is unthinkable.

William continued his personal experimental work, as well as his research degree supervision, more or less up to the end of his life. In 1929, he became quite ill, and a holiday in Switzerland with his wife made no difference. They returned to Oxford, where he died on 17 September. William and Mina were childless. Both were enthusiastic about music, often hosting musical evenings at their home and William played the piano for some time most days of his life. The Perkins were also keen gardeners.

In William's life, he received many honours in recognition of his work, including the Davy Medal and Royal Medal of the Royal Society. He was President of the Chemical Society from 1913 to 1915.

A.G. Perkin

Arthur Perkin was also a successful academic organic chemist, though not quite so high a flyer as his older brother. He was born on 13 December

1861, and was a delicate child [14]. He was not expected to live but in the end was the longest lived of all the Perkin brothers.

Like his father and older brother, Arthur was educated at the City of London School then, from October 1877, the Royal College of Chemistry. His first paper, which concerned the action of nitric acid on di-*para*-toylyguanidine, was published in *Journal of the Chemical Society Transactions* [15]. This paper has a number of interesting feature, including the fact that Arthur used the first person singular rather than the passive voice in describing how his experiments were performed. Arthur also reported problems with the reaction, because simply adding the two reagents led to an energetic reaction in which copious amounts of red fumes were generated. He was able to modify this by adding the base in small quantities to the nitric acid. In this way, he could prepare the di-nitro derivative of the base in satisfactory amounts. He found that carrying out the reaction in alcohol altered the product and allowed him to obtain di-nitro-*para*-toylyurea. He went on to reduce this compound with tin and "sulphurettd hydrogen" (i.e. hydrogen sulphide) to make a new base, di-amido-*para*-tolylurea, which he precipitated as the hydro-chloride salt.

On completion of his college diploma in 1880, Arthur went to Glasgow to study under Professor E.J. Mills [16]. A year later, he moved to the Dyeing Department at Yorkshire College (now the University of Leeds). He had a scholarship awarded by the Worshipful Company of Clothworkers and worked under Professor J.J. Hummel [17], the Head of Department, the topic being the constitution of natural colouring matters.

When the scholarship ended, Arthur took up a position in industry as a chemist at the alizarin factory of Hardman and Holden in Manchester [14]. He stayed there for ten years, being promoted to manager after a few years. In 1887, he married Annie (née Bedford), whose brother Charles had been a fellow student at Yorkshire College. While in industry, Arthur published a few papers, including with his brother William as part of the series from Heriot-Watt College.

In 1892, Arthur was appointed lecturer and research chemist back at Yorkshire College. Here, teaching duties were light, comprising one lecture a week in the first and second terms of each academic session. He also had some senior students to supervise in the laboratory. For the rest of his time, Arthur was free to concentrate on his research. He also worked in the evenings, returning to his laboratory with his wife, Annie, who acted as his assistant in experimental work [14]. Sadly, she was never mentioned as a co-author on the resulting research papers.

Arthur's work had strong similarities to William's. It used the simplest apparatus and careful manipulations, though it was more narrowly focused, being entirely concerned with the composition and structure of dyestuff molecules. Arthur concentrated on the isolation of colouring matters and the determination of their constitutions using degradation analysis. He did not attempt synthesis, but left it to others to confirm his deductions with synthetic studies.

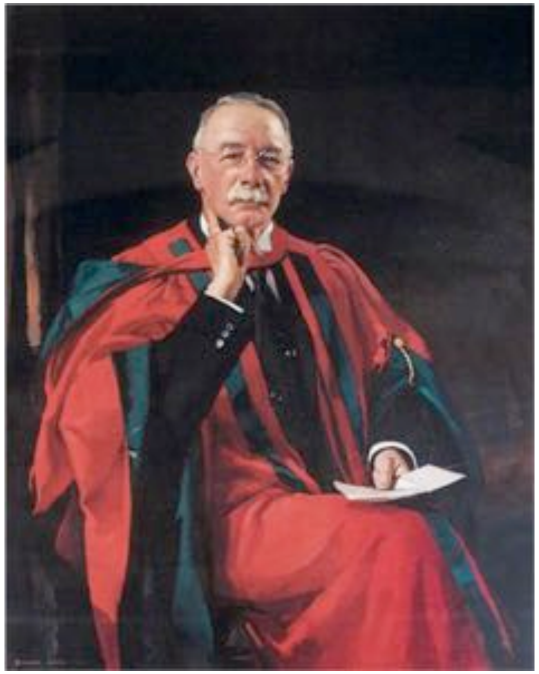


Figure 2: Arthur George Perkin (1861-1937). Portrait in his Honorary DSc robes, Leeds University, 1927.
Source: The Stanley & Audrey Burton Gallery, University of Leeds. Accessed online: 6 December 2023, https://artuk.org/discover/artworks/arthur-george-perkin-18611937-dsc-frs-professor-of-colour-chemistry-at-the-university-of-leeds-18921926-39115

During the 1914-18 War, Arthur carried out work for the Ministry of Munitions. In 1916, he was promoted to the Chair of Colour Chemistry and Dyeing at what had by then become the University of Leeds. Other honours that came his way were election as FRS (1903) and the award of the Society's Davy Medal in 1924.

Arthur retired in 1926 and was given the title Emeritus Professor. The next year, the university conferred an honorary DSc degree on him. In retirement, he continued his researches in the Department of Colour Chemistry and Dyeing, maintaining a steady stream of publications. Then, from about February 1937, he gradually started to become frail and he died at home on 30 May.

Outside his scientific work, Arthur found relaxation in music. He was an accomplished player of both the flute and the bassoon, and he played one or other of these instruments each day until close to the end of his life. He was a member of a several amateur orchestras in the Leeds area over the years.

Arthur and Annie had a holiday home on the Isle of Man, where they spent most of their vacations for around forty years [14]. Like William and Mina, Arthur and Annie were childless. They kept a variety of animals, notably dogs and ponies, and also a tortoise. Arthur remained on good terms with both of his brothers until their respective deaths, and published papers with each of them.

F.M. Perkin

Frederick, the last of Sir William Perkin's sons, was born on 8 November 1869 [18]. His education was first at Amersham Hall School, Reading, and afterwards at the Royal College of Science, South Kensington (1888-90). He then moved to Edinburgh, apparently as a student at the university, though there is no report of him graduating. During his time in Edinburgh, his brother William was still professor at Heriot-Watt College, and Frederick published one of the papers in the series "Contributions from Heriot-Watt College, Edinburgh" on "Some derivatives of piperonyl" [19].

In 1893, Frederick went to Germany to study for a PhD at the University of Würzburg. In the thirteen years since William had been there, Professor Wislicenus had moved on and been replaced by Arthur Hantzsch [20], and it was he who supervised Frederick's PhD work. The project was concerned with electrolytic methods of preparing organic compounds, and introduced

Frederick to physical chemistry, which he, alone of the Perkin brothers, was to pursue later in his career.

In 1897, Frederick was appointed Head of the Chemical Department at the Borough Polytechnic Institute in South London (now London South Bank University). Perkin established what he called the "Electrochemical Laboratory", from which he published a number of papers, mainly in *Transactions of the Faraday Society*. Interestingly, in these papers he styled himself F. Mollwo Perkin. One of his papers, entitled "A simple form of rotating electrode for electrochemical analysis" described a technique not unlike polarography [21].

In 1903, Frederick became the first treasurer of the Faraday Society, and stayed in that position until 1917, long after he had left the academic world. During his time at the Borough Polytechnic Institute, he also wrote a book "Practical Methods of Electrochemistry".

Frederick set himself up as a consultant in 1909, working first in his late father's old laboratory at Sudbury, and later in his own laboratory at his family home in Lewisham. In this role, he undertook various studies in technical chemistry, mainly in the use of oils, including the drying oils used in the paint industry. This led to him being invited to become the first President of the Oil and Colour Chemists' Association in 1918 (until 1920) [22]. His work as a consultant included undertaking work for the war effort from around 1916, for which he was awarded the OBE in 1920.

During Frederick's time as a consultant, he also wrote books on "Practical Methods in Inorganic Analysis", "Electrochemical Methods" and "Smokeless Fuels". He was married to Elizabeth (née Mackay), with whom he had a son and two daughters. In his later life, Frederick suffered ill health, and he died at the relatively young age of fifty-eight on 24 May 1928.

References

1. A.S. Travis, "Perkin, Sir William Henry (1838–1907)", in the *Oxford Dictionary of National Biography,* H.C.G. Matthew and B. Harrison (eds), Oxford University Press, 2004.

2. M. Sutton, *Chemistry World*, March 2010, 54-57.

3. S.G.P. Plant, William Henry Perkin, Jr., in *British Chemists*, A. Findlay and W.H. Mills (eds), London: Chemical Society, 1947, 176-218.

4. J. Morrell, *Osiris*, 1993, 8, 104-126.

5. W.R.E. Hodgkinson (1851-1935). Born in Sheffield, 1851, studied at the Royal College of Chemistry, then PhD at the University of Würzburg under Professor Wislicenus. Returned to England and joined the staff of the Royal College of Chemistry. Director of the Laboratories, where he supervised WHP Jr. In 1890, moved to the Ordnance College, later the Military College of Science, Woolwich, where he spent thirty-one years teaching chemistry and metallurgy, rising to become professor. Changed his field of research and became an expert in explosives. Awarded the CBE for his contribution to the war effort in 1914-18. Died at Blackheath in April 1935. Details from R. Robinson, *Nature*, 1935, 135, 945.

6. W.H. Perkin Jr. and W.R. Hodgkinson, *J. Chem. Soc. Trans.,* 1880, 37, 487.

7. W.H. Perkin Jr. and W.R. Hodgkinson, *J. Chem. Soc. Trans.,* 1880, 37, 701.

8. Johannes Wislicenus (1835-1902). Born in Saxony, 1835. Studied first at the University of Halle (1853) but had to flee Europe because of his father's political views. Went to the United States and became an assistant at Harvard University, also becoming proficient in English. Returned to Europe in 1856 and entered the University of Zurich, graduating in 1860. Moved initially to a position at the polytechnic in Zurich then, in 1864, to a chair at the university. Established himself as a leading organic chemist and supervisor of PhD students, carrying out research into the chemistry of a wide range of organic compounds and reagents. His most important work was in explaining geometric isomerism in organic compounds. From 1872, he occupied the chair of chemistry at the University of Würzburg, then in 1885, he moved to the University of Leipzig in succession to Kolbe. He was awarded the Davy Medal by the Royal Society in 1898, and died in late 1902. Details from obituary notice, *Nature*, 1903, 67, 228-9.

9. Adolf von Baeyer (1835-1917). Studied physics and mathematics at the University of Berlin between 1853 and 1855, then moved to Heidelberg to study chemistry with R.W. Bunsen. After that he worked in Kekulé's private laboratory, and was able to submit the work he did for the degree of PhD at the University of Berlin 1858. He then spent a number of years making several moves in quick succession before becoming Professor at the newly-established University of Strasbourg in 1871. Two years later, he was

appointed to the chair at the University of Munich. There, he built up a substantial team of researchers occupying modern, well-equipped laboratories for which he raised significant amounts of money. He became the leading organic chemist of his age, winning the Nobel Prize for chemistry in 1905. He was also awarded the Davy Medal in 1881, and was elected a Foreign Member of the Royal Society in 1885. Details from: https://www.nobelprize.org/prizes/chemistry/1905/baeyer/biographical/. Accessed 15.11.2023

10. G. Nagendrappa, *Resonance*, 2014, 19, 489.

11. C.A. Russell, *The History of Valency* (Leicester: The University Press, 1971).

12. W.H. Perkin Jr., *Berichte*, 1883, 16, 1787.

13. W.H. Perkin Jr., *J. Chem. Soc. Trans.,* 1885, 47, 829.

14. F.M. Rowe and R. Robinson, Arthur George Perkin, in *British Chemists*, A. Findlay and W.H. Mills (eds), Chemical Society, London, 1947, 219-246.

15. A.G. Perkin, *J. Chem. Soc. Trans.,* 1880, 37, 696.

16. Edmund James Mills (1840-1921). Studied at the Royal School of Mines, which included instruction in chemistry at the Royal College of Chemistry, Oxford Street, London. Obtained BSc (1863) and DSc (1865) degrees of the University of London. In 1862, took up the appointment as demonstrator under Professor Thomas Anderson in Glasgow. Returned to London in 1865, and it is not clear what he then did, until 1871, when he was appointed Professor of Technical Chemistry at the Glasgow and West of Scotland Technical College (one of the predecessors of the University of Strathclyde). Retired in 1891. Vice President of the Chemical Society, 1912-15, FRS (1874) and awarded an honorary LLD (University of Glasgow). Details from obituary notice, *Nature*, 1921, 107, 432-433.

17. John James Hummel (1850-1902). Born in Clitheroe, Lancashire to an English mother and Swiss father. Studied chemistry at Zurich Polytechnic, graduating in 1870, then worked in industry for companies manufacturing printing inks and dyestuffs. Appointed Instructor in the Dyeing Department, Yorkshire College, Leeds Details in 1879, promoted to Professor in 1880. Died in post, aged fifty-two. Details from obituary notice, *Nature*, 1902, 66, 520.

18. Obituary notice, Frederick Mollwo Perkin, *J. Chem Soc. (Resumed),* 1928, 3299.

19. F.M. Perkin, *J. Chem. Soc. Trans.,* 1891, 58, 150.

20. Arthur Rudolf Hatzsch (1857-1935). Born in Dresden and educated first at Dresden Polytechnic, then at University of Würzburg, taking his PhD under the supervision of Johannes Wislicenus in 1880. Appointed professor at the University of Zurich in 1882, moving to Würzburg in 1893 and Leipzig in 1903. Worked mainly on heterocyclic chemistry. Retired in 1927 and died in 1935. Details from T.S. Moore, Hantzsch Memorial Lecture, *J. Chem. Soc. (Resumed)*, 1937, 1051.

21. F.M. Perkin, *Trans. Faraday Soc.*, 1906, 2, 91-93.

22. G. Copping, *A Fascinating Story: The History of OCCA 1918-1968* (London: Oil & Colour Chemists' Association, 1968).

John Nicholson

Conquering the Captain of Death - Chemical Interventions Against Tuberculosis

1952-53 saw a revolution in the treatment of tuberculosis. Hitherto, it was a widespread disease which in most cases led its sufferers to a long, lingering death. Its control was realised half a century ago by teams of research chemists working independently in America and Germany. However, like so many successful chemical interventions against disease, it is "the doctors" who get all the credit.

Tuberculosis killed about 50,000 people in England and Wales per year in the 1930s. The disease was aptly named "the captain of death". Once diagnosed, half the sufferers would be dead within five years. The disease is caused by the bacillus *Mycobacterium tuberculosis*. The lungs were infected in nearly every patient, but it could also affect a range of other organs, including glands of the neck and abdomen, bones, joints, and skin. Infection of the skin was called *lupus vulgaris*, or the common wolf, because of the imagined resemblance to a wolf bite. Infection of the adrenal glands was one cause of Addison's disease. It was this complication that probably led to the death of novelist Jane Austen in 1817. TB was responsible for the deaths of several of the Bronte family, including Emily, Charlotte and Anne.

Tuberculosis of the lungs is an ancient disease. It is evident in skeletons from the Early Bronze age and pre-Columbian Peru and may have originated some 15,000 years ago. It was well known to the Greeks and the early physicians Hippocrates and Galen recognised it as infectious. This remained the conventional wisdom until the seventeenth century when the French physician Gaspart Laenec (who was later to die of TB) argued that it was caused by a particular vulnerability of weakened patients, rather than an infection. This view persisted until 1868 when Jean-Antoine Villemin experimentally reproduced tuberculosis in animals and 1882, when Robert Koch announced the discovery of *B. Tuberculosis* and Ehrlich reported the acid fast method of staining which, with slight modification (the Ziehl-Neelsen method) is still used today [1]. These findings restored the concept of TB as an infectious disease.

A wide range of "cures", many heroic, have been employed since antiquity. In the century from 1850 these included a range of generally toxic chemicals (including mercury, iodine, creosote, guaiacol, hypophosphites, arsenic, "nascent" iodine, emetine, double thiosulphate of gold and iron), fresh air (variously at the seaside, on sea voyages or at altitude), graduated exercise, vegetarian diet and various tonics, with the only constant treatment over this period being cod liver oil! Towards the end of this period surgical treatments to collapse one lung or restrict its movement became common [2]. For all this, there was a healthy scepticism about these treatments, as indicated by this observation from 1851:

> The fact is, that everything that has ever been recommended, however trivial, has seemed to cure phthisis [tuberculosis of the lungs] simply because patients labouring under phthisis do continually recover from existing attacks, and in rare instances regain perfect health, though pent up in towns, breathing the foul air of crowded workshops, living in unhealthy habitations, and surrounded by every unwholesome influence……

This tendency of the illness to go into spontaneous remission or even, exceptionally, to be cured, made it difficult to decide whether a new treatment was in fact effective or not. As a result there were several "false dawns", each heralding a breakthrough in treatment.

Despite these repeated setbacks, by the mid 1930s there was some optimism that chemists and biochemists might have roles to play in curing TB. Other infections had succumbed to newer drugs, starting with the first effective

treatment of syphilis by Salvarsan and other arsenicals in 1909 (developed by Paul Ehrlich) and particularly the effectiveness of Prontosil and other sulphonamides against a range of bacteria from 1935 (from work by Gerhard Domagk) [4]. (Although penicillin had been discovered by Alexander Fleming in 1928, it was not used to treat patients, other than on an experimental basis, until about 1944 after further development work by Howard Florey, Ernst Chain and co-workers.) These developments, of naturally occurring antibiotics and of synthesised chemicals with action against infectious agents, led to two separate strands of research:

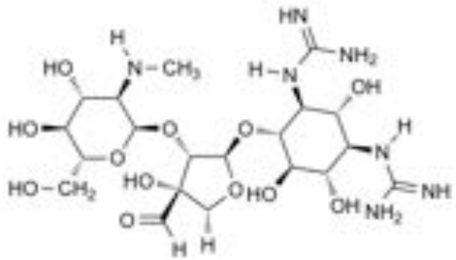
- the isolation from nature of an organism which would produce a substance (an antibiotic) that would attack the bacillus without harming the host.
- the search for synthetic chemicals active against TB in much the same way as Prontosil defeated pneumonia and streptococcal infections.

The Search for an Antibiotic in Nature

René Dubos was a microbiologist who started his graduate work with Selman Waksman at Rutger's University in New Jersey. Waksman had developed a reputation for his work in isolating and classifying the various moulds which infected fruit, particularly the actinomycetes. Dubos went on to work at the Rockefeller Institute for Medical Research, New York where he noticed that certain soil-living organisms had the ability to "dissolve" cellulose. At that time (around 1930) it was believed that the cellulose-like sheath which surrounded the microbe causing pneumonia protected it from attack by the white cells, the body's defences against infection. Dubos asked Waksman for some soil samples and from these he isolated a bacillus which destroyed the protective sheath. Within weeks he had tested an extract from the bacillus on pneumonia-infected mice and found that it protected them from the otherwise lethal infection as a result of the cellulose sheath having been destroyed. Although these findings were published in 1930, little developed from this breakthrough. In particular, the work was not extended to the tubercle bacillus, even though it was thought to possess a similar protective sheath. At the time of his discovery pneumonia was a serious and often lethal disease, but Dubos' enzymatic extracts appear not to have been tested on animals larger than mice. One reason put forward for the apparent inertia is Domagk's announcement in 1935 of the use of Prontosil to tackle a whole range of infections, including pneumonia. This may have indicated to Dubos that this would henceforth be the most productive way of counteracting disease.

However Dubos' success caused Waksman to investigate his soil samples in case they contained potentially useful, similar, agents. This work was particularly far-sighted as it was started before Florey and Chain's landmark paper on penicillin as a curative agent, which established such organisms as the principal source of antibiotics. The first product that Waksman isolated, actinomycin (1940), showed much promise *in vitro*, but was too toxic to be used on humans. In 1944 though, working with Albert Schatz, he isolated streptomycin, which also showed *in vitro* promise, particularly against the bacillus causing TB. Animal tests were performed later that year and in 1945 the results of the first clinical studies were reported. Streptomycin was the first demonstrably effective treatment against tuberculosis [5].

Structure of Streptomycin



It had, however, two drawbacks:

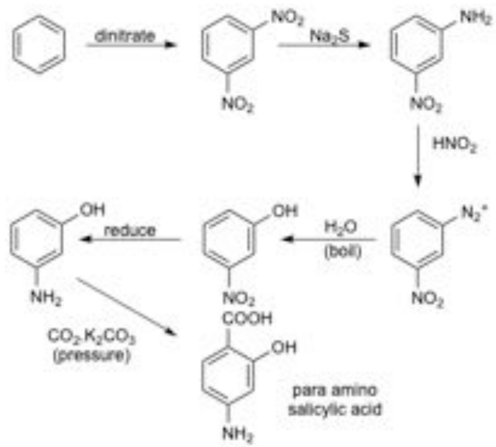
- Its dose had to be carefully controlled – too little and it was not effective, and yet too much could cause damage to the eighth cranial nerve and result in irreversible deafness.
- It was particularly effective against most forms of tuberculosis but against the disease in the lung, which required prolonged therapy, the patient appeared to recover for a while, and then succumb as the disease fought back, this time in a form that was streptomycin resistant. And the patients died.

Para amino salicylic acid

In the late 1930s Frederick Bernheim, a biochemist was working at Duke University, North Carolina, on the metabolic requirements of disease causing organisms. It had been known that oxygen was necessary for the multiplication of the bacilli since 1925 and that the disease was apt to localise in areas of the body (such as the apex of the lung) where oxygen

concentration is highest. Bernheim's technique was to measure the *in vitro* consumption of oxygen and consequent production of CO_2 as the organism was exposed to a range of possible nutrients. Focussing on the TB bacillus, he noted that its respiration was enhanced in the presence of sodium salicylate. This prompted him to study a raft of compounds containing the –CHO and –COOH functions. Of those he studied, benzaldehyde, benzoic acid and salicylic acid each caused a marked uptake of oxygen, suggesting some direct interaction with the metabolism of the bacillus. Aware of these results, a Danish doctor, Jorgen Lehman, contacted the Swedish drug company Ferrosan and suggested that "compounds closely related to salicylic acid (should) have bacteriostatic properties. Therefore it should be of interest, at first, to study the effects of 4-aminosalicylic acid" [6]. This was based on the presumption that if salicylic acid promoted metabolism, a somewhat different but related compound might block it. The synthesis of 4-aminosalicylic acid (para-aminosalicylic acid, PAS) was difficult (Scheme 1), but by the 30^{th} December, 1943, Lehmann was able to show that "PAS inhibited the growth of the tubercle bacillus in a concentration lower than that reported for any previously tested compound" [6].

Scheme 1 Synthesis of para aminosalicylic acid



A week later animal tests commenced on guinea pigs and rabbits. The compound was well tolerated and trials on humans followed in March 1944. By 1946-47 there were several reports showing how effective this simple treatment was against tubercular infections in a variety of organs. Tubercular meningitis was invariably fatal, but in 1950 a combination of streptomycin and PAS was found to be a particularly effective treatment. This started the era of "combination therapy", which persists today. The patient is treated with two or more anti-tuberculosis drugs. Each seems to reinforce the action of the other, but additionally, delays the appearance of drug-resistant forms of the bacillus so that the cure can become complete. A typical regime in 1950 was to give streptomycin in 1g doses twice a week by intramuscular injection and 12 g of PAS per day for 6 months. The large amount of PAS presented problems in administration. It was dispensed in cachets, flying saucer shaped containers made from rice paper, intended to be moistened in water and swallowed in a single gulp. Unfortunately they were apt to stick in the throat and were disliked by patients.

Isoniazid

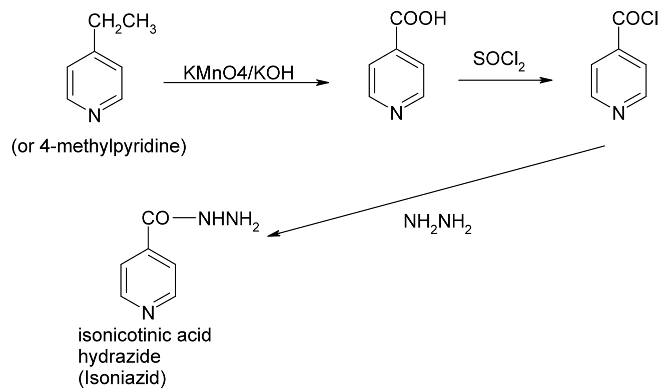
This, the third of our anti-tuberculosis drugs, has been described as "the most potent drug yet discovered for the treatment of TB" [7]. Its history goes back to 1935 when Domagk announced his discovery of Prontosil to the world. This was the first effective chemotherapeutic agent against pneumonia and a host of other infections, especially those caused by streptococci organisms. It was natural that it should be investigated for anti-tubercular potential. Most work focussed on sulphanilamide (See Structure (1) in the box "*Key drugs which influenced the fight against tuberculosis*"), the breakdown product of Prontosil and the agent responsible for its curative action. The results were not outstanding: some workers reported that it was marginally effective at large doses, while others failed to detect any influence on the disease. The consensus was that the results were not sufficiently definitive to warrant clinical trials. An analogue, sulphapyridine (2), was found to be more effective than sulphanilamide, but the dosage necessary for it to show action caused serious damage to the alimentary tract. Sulphathiazol (3) was reported by Domagk to be the most promising compound of this class and his in vitro tests prompted him to undertake animal trials. Although the results were unspectacular, this drug played an important part in the development of Isoniazid.

Despite the marginal success of sulphanilamide against TB, its potency against a wide range of death-dealing diseases encouraged speculation that

tuberculosis might be susceptible to a similar small molecular mass compound. The problem was finding it.

Sulphones are structurally related to the sulphonamides. In 1940 it was found that 4,4′-diaminodiphenylsulphone (4) in small doses had a similar effect to sulphanilamide given in large doses. It was relatively non-toxic and the results of animal studies were promising. An analogue of diaminodiphenylsulphone was Promizole, 4,2'-diaminophenyl-5-thiazolylsulphone (5). This compound, first reported in 1944, combines the sulphone moiety with the thiazole unit encountered in sulphathiazol. Clinical trials showed that it could retard the progress of two of the most lethal forms of the disease, miliary tuberculosis and tubercular meningitis. "Cure" was too dramatic a word, but survival times were greatly extended. Promizole appeared on the medical scene in 1950 and suffered from comparison with the recently discovered streptomycin. Consequently its full therapeutic potential may not have been completely explored.

Scheme 2 Synthesis of Isoniazid



The partial promise of the thiazole drugs against TB prompted Domagk to speculate; firstly that their therapeutic action lay in the ring containing the nitrogen, sulphur and carbon atoms; and secondly that an open chain sequence of these atoms might have anti-tubercular potential. A host of synthetic units which showed some (open chain) structural similarity to Promizole were prepared. Generally a benzene ring was incorporated in the molecule, as aromatic substitution could extend the range of molecules available for testing. Success came in 1946 with Tibione (4-acetylaminobenzaldehyde-thiosemicarbazone) (6). Though not dramatically effective against pulmonary tuberculosis, it was useful (around 1950) for treatment of the disease in the skin (lupus) and when TB infected the mucus membranes.

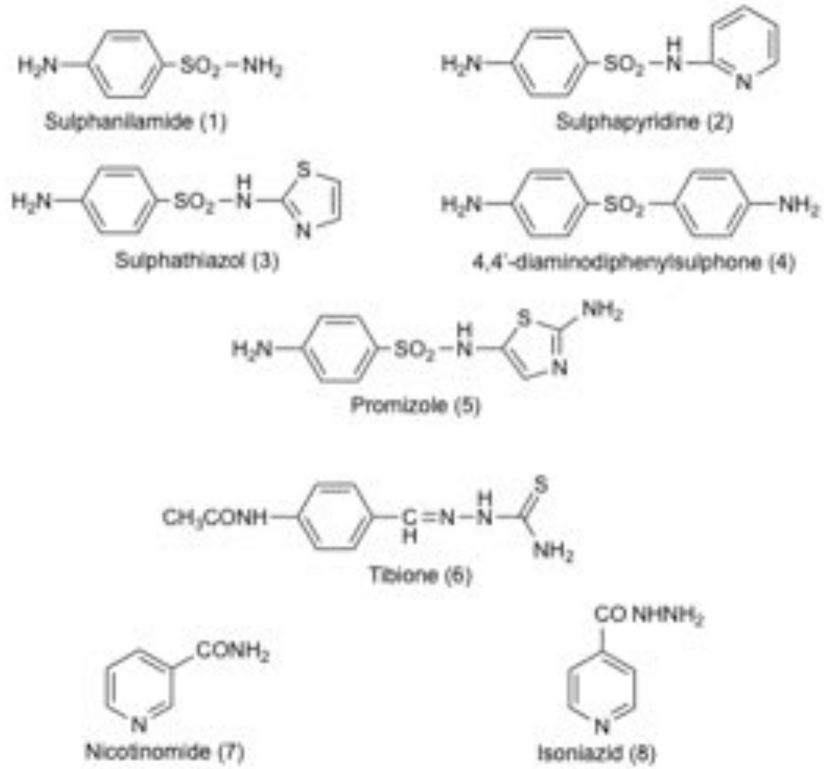
Tibione contains the modified hydrazine grouping =N-NH- and a variety of phenyl hydrazine derivatives were tested for anti-tubercular activity. Any potential, however, was off-set by the toxic nature of these compounds. But success, dramatic success, came when the pyridine ring of another compound, nicotinamide (7), which had been shown in 1946 to have a repressive influence on the TB organism both in *in vitro* studies and in guinea pig trials, was elaborated into a hydrazide (Scheme 2).

The product, isonicotinic acid hydrazide (Isoniazid) (8), was to revolutionise the treatment of tuberculosis. Its enthusiastic reception by the medical fraternity from its introduction in 1952 is captured in the following account: "fever declined and other manifestation of tubercular toxicity disappeared: patients gained weight, improved in appetite and developed a renewed sense of well-being. Cough and expectoration decreased and in the course of time sputum, after months when it was positive for tubercle bacillus, failed to disclose any organisms…..An unequivocally favourable effect was also in evidence for the gravest forms of tuberculosis: military disease and tuberculous meningitis" [7].

But it did not work in every case, and in 1952 some patients made a partial recovery only to succumb to the disease. The problem was, again, the emergence of drug resistant forms of the disease as the necessarily lengthy treatment continued. But the technique of combination therapy, used to combine streptomycin with *para* amino salicylic acid, was also effective with Isoniazid. The following year details of regimes were published that recommended the use of Isoniazid combined with the administration of either PAS or streptomycin or both. Tuberculosis, formerly described as "the captain of death", was on the retreat.

Other drugs were to follow, including Pyrazinamide in 1954, Cycloserine in 1955, Ethambutol in 1962 and rifampicin in 1963.

Key Drugs which influenced the fight against tuberculosis



TB resurgent

While infection with TB was still a serious condition, it became rare in economically advantaged countries and cure was expected. However, in more recent years treatment resistant strains of TB have emerged and become widespread in some countries, particularly in Eastern Europe. When people do not take their medication strictly as prescribed, or where social breakdown means that medication is not consistently available, this allows resistant strains to emerge which can then spread rapidly through a population. These resistant strains can go on to develop resistance to other anti-TB treatments as well, further increasing the need for expensive alternative medications in multiple combinations – a cost which health systems under pressure in poor economies are not able to meet.

The last forty years or so has seen the emergence of the AIDS epidemic in full force. People with weakened immune systems are particularly prone to infection with TB and this has led to a large increase in the rates of TB in Africa and elsewhere. Most of this TB responds well to medication - provided it is available. Resistant TB can emerge in this setting too, for the same reasons as in Eastern Europe.

Treatment resistance is the main concern about the future risk posed by TB to mankind. The Captain of Death might have been demoted in the 1950s, but he wasn't court-martialled. Is he rising through the ranks again?

Acknowledgments

The struggles to find a cure for tuberculosis are well told in Long's text [7] and in the book by Ryan [9]. The latter presents a highly readable account of the personalities involved in the discoveries and we are grateful to the late Dr Anthony Mellersh (formerly of the City Hospital, Derby) for drawing our attention to it. Most of the early anti-tubercular drugs are dealt with in the text by Dyson [8], which is the source of the synthetic sequences featuring in this article. There are many internet articles on the subject of tuberculosis. A good (historical) one to start with is reference 10.

This article first appeared in *Education in Chemistry* in 2004 [11] but only as a hard-copy version. This slightly adapted Newsletter iteration is the first on-line appearance.

References

1. Specimens are stained with hot carbol-fuchsin, a red dye which contains detergents. This stains all bacteria red. Those which retain the dye on treatment with acidified alcohol are known as *acid fast*. See http://alan.kennedy.name/crohns/primer/bactid.htm.
2. H.L. Tidy, *A Synopsis of Medicine, 8th edn*. (Bristol: John Wright & Sons Ltd, 1945).
3. W.A. Guy, *Dr Hooper's Physician's VadeMecum: Or a Manual of the Principles and Practice of Physic* (London: John Churchill, 1851).
4. A.T. Dronsfield, J. Cassella and P.M. Ellis, *Educ. Chem*., 2002, 39, 72-75.

5. S. Waksman, Nobel Prize lecture, accessible at http://www.nobel.se/medicine/laureates/1952/press.html
6. J. Lehman, *Amer. Rev. Respiratory Disease*, 1964, 90, 953-956.
7. E.R. Long, *The Chemistry and Chemotherapy of Tuberculosis* (London: Balliere, Tyndall and Cox, 1958).
8. G.M. Dyson, *May's Chemistry of Synthetic Drugs* (London: Longmans, 1959).
9. F. Ryan, *The Forgotten Plague: How the Battle Against Tuberculosis was Won – and Lost* (Boston: Brown-Little,1993).
10. J.F. Murray, D.E. Schraufnagel and P.C. Hopewell, *American Thoracic Society Discoveries Series 2015*. Available at https://www.atsjournals.org/doi/pdf/10.1513/AnnalsATS.201509-632PS
11. A. Dronsfield, T. Brown and P. Ellis, *Educ. Chem*., 2004, 41, 15-18.

Alan Dronsfield, Pete Ellis and (the late) Trevor Brown

(Peter Ellis is a retired medical practitioner based in New Zealand)

BOOK REVIEWS

Catherine M. Jackson, *Molecular World: Making Modern Chemistry*, MIT Press, Cambridge, MA, and London, 2023. xiii+444pp. illustrated. pbk. £72.00.

At the outset it has to be said that *Molecular World* is a remarkable book. Catherine Jackson makes four key propositions, all of which are entirely correct in my view, namely:

1 Organic synthesis is an important part of chemistry and has been since the 1840s.

2 Thus, the history of chemistry as a whole cannot be complete without understanding the development of organic synthesis.

3 It involves both practical work and theory, and what Jackson calls laboratory reasoning is the bridge between the two.

4 The development of new types of glassware is a key part of the development of organic synthesis.

Hence this book is unusual, if not perhaps unique, in exploring not only practical chemistry, but also the laboratory context of that chemistry and the development of new apparatus, especially (and unusually) glassware. She goes on to argue that Germany and German chemists played a major role in the development of organic synthesis and that the contribution of Albert Ladenburg has been overlooked, although she also pays considerable attention to the work of Justus Liebig and August Wilhelm Hofmann.

Jackson begins her account, not with the so-called synthesis of urea as most histories of organic synthesis do, but with Justus Liebig's development of organic analysis and his concern with the nitrogen content of alkaloids. This problem is eventually solved by the Will-Varrentrap method developed in his laboratory. Ironically this success led to Liebig leaving the field of analysis when it became clear that even accurate empirical formulae could not solve all the mysteries of the pharmaceutically important alkaloids. Jackson then argues that Liebig's Kaliapparat led to a "glassware revolution" thanks to its use of glass-blowing. The next three chapters are about August Wilhelm Hofmann and his work at the Royal College of Chemistry. This included a shift from the study of natural products such as the alkaloids which were resistant to the efforts of chemists to understand them, to simpler synthetic products, the "turn to synthesis". Hofmann also used the type theory to explain the chemistry of aniline and related compounds, as Tony Travis also showed in *The Rainbow Makers* (1993). The next crisis was the issue of chemical identity and how it could be determined—Jackson emphasises the importance of collaboration in solving such problems. The penultimate chapter explains how the chemists in this volume shaped the development of the chemical laboratory and introduces the unsung hero of this volume, Albert Ladenburg. Organic synthesis in the sense of reproducing natural products—as opposed to making wholly synthetic compounds—only comes to the fore in the final chapter. Jackson concentrates on the synthesis of alkaloids and Ladenburg takes centre stage as the first chemist to synthesise an alkaloid, namely coniine.

In her conclusions, Jackson argues that to explain the development of chemistry in the nineteenth century we need to understand what chemists did and why they did it. Hence, she appeals for greater attention to the practice rather than the theory of chemistry in isolation. She shows how analysis, synthesis and chemical identity were interwoven in a complex web and how they influenced the development of the laboratory. Furthermore she highlights the close relationship between academic chemistry and industry,

and the important role played by Hofmann. To at least some extent these themes have appeared elsewhere, but what is unique to this volume is the idea of "laboratory reasoning", described as the tension between theory and laboratory practice, exemplified in the conclusions by the synthesis of three dyes, mauve, alizarin and indigo.

This is an attractive book which is both well structured and clearly written, thankfully free of either sociological or chemical jargon. It is thus a pleasure to read as well as shedding important new light on the development of organic chemistry. If I were to quibble slightly, I feel it is a stretch to claim (e.g. in the book's title) that this treatment explains the evolution of chemistry as a whole. It is strongly recommended to all historians of chemistry—especially those with a chemical background—and would make an excellent present for an organic chemist with no prior interest in the history of chemistry.

Peter Morris

RSCHG MEETING REPORTS

British X-Ray Crystallographers

Thursday 18 October 2023, Burlington House, Piccadilly, London

Following on from the "Women in Chemistry" meeting held in October 2022, this meeting provided the opportunity to focus on a number of female pioneers in crystallography and the importance of British contributors to the field. I am very grateful to Mike Glazer (Oxford) for his sterling help in suggesting speakers and giving advice more generally. I am also indebted to the British Crystallographic Association, in particular Richard Cooper and Jon Cooper, for paying for half of the cost of making this meeting a hybrid meeting and for publicising this meeting to the crystallographic community. The recordings that result from having a hybrid meeting will be of permanent historical value and are now available on the Historical Group's YouTube playlist:
https://www.youtube.com/playlist?list=PLLnAFJxOjzZu7N0f5-nVtHcLNxU2tKmpC

The meeting was held at the RSC's premises at Burlington House. 106 people registered for the in-person meeting and 28 registered for the online option. In practice, we had about 85-90 people present in person and 20 online viewers. The audience was largely, but not solely, comprised of X-ray crystallographers and some of them expressed an interest in joining the

Historical Group. The talks were a good mixture of different genres, which focussed on various aspects of the subjects' lives and careers. My thanks to all our speakers and to the many people who attended.

Peter Morris

John Desmond Bernal (1901-1971)

J.D. Bernal was born in Nenagh, Co. Tipperary in 1901. At Cambridge, he read *both* the Mathematical and Natural Sciences Tripos and became fascinated by arrangements of atoms in space. He began research at the Royal Institution in 1924. This was in the very early days of crystallography, in the development of which Bernal played a leading role – both in terms of X-ray instrumentation and the interpretation of crystal diffraction patterns. At the RI he determined the structure of graphite, and worked on structures of bronzes – one of the many problems which he typically passed on to others. Moving to Cambridge in 1927 he initiated many structural investigations, particularly fruitful being work on sterols, proteins (being the first, with Dorothy Hodgkin, to realise the importance of hydration) and viruses. He appointed Max Perutz to tackle the structure of myoglobin, and encouraged John Kendrew to join the Cavendish to work on haemoglobin.

Being refused tenure in Cambridge he moved to Birkbeck where, after contributing in major ways to the war effort, he established his Biomolecular Research Laboratory. Here work on proteins (Klug) and viruses (Franklin) was joined by studies of cements (Megaw, then Jeffery) and liquids (himself), as well as the development of early computers (Booth). His models of liquids generally (random packings) and water* (random networks) in particular broke new conceptual ground, and have subsequently been shown consistent with state-of-the-art experimental work.

He was one of the great polymaths of the twentieth century with wide social, political and artistic interests in addition to his science. He set several of his collaborators on the road to Nobel Prizes. That he himself was never so honoured might perhaps be because he gave away ground-breaking projects to others. For a detailed and stimulating biography, see *J.D. Bernal. The Sage of Science*, by Andrew Brown (OUP 2005).

*"My interest...came about...through my biochemical interests, in that all living structures are mostly composed of water"

John Finney

Dame Kathleen Lonsdale FRS (1903-1971)

Kathleen Lonsdale made considerable contributions to the development of X-ray crystallography. These were her experimental work and her work for the crystallographic community. She started her career at the Davy-Faraday Research Laboratory at the Royal Institution (RI), then moved to Leeds University, worked at home, before returning to the RI and then moved to University College London. During this time, her extensive experimental work included the determination of the structure of benzene, diffuse reflections, thermal vibrations in crystals and diamonds.

Lonsdale was particularly interested in mathematical crystallography and contributed a paper and a handwritten book, both designed to enable beginners to start working on X-ray analysis. She contributed to both the First and Second Editions of the *International Tables for the Classification of Crystals*, a definite resource and reference work for X-ray crystallographers. For the Second Edition, Lonsdale was Chair of the Editorial Committee, a position she held for fifteen years. She was also involved in the establishment of the International Union of Crystallography, becoming Vice President and then President, the first woman president. Lonsdale had a full scientific career spanning over fifty years, alongside marriage and a family, which was not typical of her generation.

Jenny Wilson

Helen Megaw (1907-2002)

Helen Dick Megaw was born in 1907 into an important Northern Irish family and in 1921 was at Roedean School in England. Following this, she spent a year at Queen's University, Belfast, and then in 1926, went to Girton College, Cambridge to study Natural Sciences. In 1930, she joined the research group under J.D. Bernal and was a contemporary student with Dorothy Crowfoot (later Hodgkin). While there, she published one of the first publications on the structure of ice, having measured the lattice parameters in both hydrogen and deuterated ice. In order to carry out this work, she devised a method of encapsulating water in a glass tube and then, by cooling the tube, was able to grow crystals of ice. It was this idea of encapsulating a crystal in liquor that Bernal later adopted for use with x-ray diffraction from protein crystals. It was for her work on ice that an island, Megaw Island, was named after her in the Antarctic. Her thesis was on the crystal structure of hydrargillite for which she was awarded a PhD in 1934. After a brief period in Vienna with Hermann Mark and then at Oxford with

Francis Simon, Helen spent some time school teaching in London. In 1943, she worked for Philips Lamps on the structure of barium titanate. This is a perovskite material, and Helen was the first to show that the structure of this important material was of tetragonal symmetry in which the cations were displaced along one axis, making this crystal polar. It is because of this that barium titanate was of strategic interest during WW2. Today, it is used in electrical capacitors for its high dielectric constant. In 1945, Helen returned to Bernal's laboratory before becoming a Fellow and Director of Studies at Girton College, Cambridge. In 1957, she published the first book on ferroelectricity, which became a classic work in its time. Later, in 1973, she published a fine book, *Crystal Structures – A Working Approach*.

In the 1940s, she had the idea that crystal structure drawings would make excellent patterns for fabrics, and she approached the Council of Industrial Design with her ideas. Because of this, Helen was appointed scientific consultant to the Festival Pattern Group, responsible for the designs used in the 1951 Festival of Britain. The result was that her patterns and those of other crystallographers were adopted as the basis for the designs used at the Festival. Thus, the curtains in the restaurant, as well as cups and saucers, linen, carpets, ties, and many other objects, carried designs based on Helen's advice. Much of this material is now housed in the Victoria and Albert Museum. She remained at the Cavendish Laboratory until she retired to her Ballycastle, Co Antrim home. In 1989, she became the first woman to be awarded the Roebling Medal of the American Mineralogical Society. She also was awarded an honorary degree at Queen's University, Belfast. She died in 2002 at her home in Ballycastle.

Mike Glazer

John Kendrew (1917-1997)

John Kendrew was born in 1917 in Oxford to Evelyn Sandberg and Wilfred Kendrew, a climatologist at Oxford University. Kendrew was educated at the Dragon School, Oxford, then at Clifton College, Bristol. He went up to Trinity College, Cambridge, where he was awarded a 1st Class Chemistry BA in 1939.

The outbreak of war interrupted his Cambridge PhD research on reaction kinetics and he joined the War Ministry as a temporary civil servant specialising in operational research. He met J.D. Bernal in Ceylon who was exploding 500 lb bombs, using rats in cages to test how much jungle they cleared. After the war, Kendrew was in the Air Ministry, where he strongly

believed that science should have a much bigger role in planning for post-war reconstruction. Disillusioned, in 1946, with Bernal's encouragement, he started PhD research in the Cavendish Laboratory in Cambridge with Max Perutz studying the structure of haemoglobin. His supervisor was William Taylor who thought protein crystallography was 'a waste of time'! Kendrew wanted to solve his 'own' protein and chose muscle myoglobin, only one quarter the size of haemoglobin. He sourced the material from aquatic mammals as they were rich in myoglobin. He was awarded his PhD in 1949.

Kendrew's wartime operational research experience was applied to great effect to the determination of the structure of myoglobin. He was keen to use computers (the Cambridge EDSAC-1) for the lengthy calculations required in X-ray crystallographic analysis, thereby saving hours of grinding labour. The method of multi-isomorphous replacement where crystals were soaked in heavy atom compounds, developed by Perutz, was used to obtain the sperm-whale myoglobin structure, the first protein structure ever determined. In 1957 it was solved at 6 Å resolution using 400 reflections, and by 1962 this had been improved to 1.4 Å with 25,000 reflections.

Having solved myoglobin, Kendrew became disillusioned since it was now clear that every protein had its own unique structure, and he did not want to determine more of them. He became active as a scientific politician, lobbying for a European Molecular Biology programme. He sat on the UK Council of Scientific Policy and the International Council of Scientific Unions. He served as President of St John's College, Oxford (despite being a Cambridge man) between 1981 and 1987.

He was a founding member of the European Molecular Biology Organisation in 1963 and its Secretary General between 1969 and 1974. Kendrew was the founding Director of the first European Molecular Biology Laboratory from 1975-1982. In 1959 he also established the influential *Journal of Molecular Biology* and was its Editor in Chief until 1987. Kendrew received many honours during his lifetime including the 1962 Nobel Prize in Chemistry with Max Perutz for 'their studies of the structures of globular proteins' and a knighthood in 1974.

Elspeth Garman

Max Perutz (1914-2002)

'Discovery is like reaching the top of a mountain and falling in love' – Max Perutz and his passion for research

Max Perutz said 'Imagination comes first both in artistic and scientific creation – but while the artist is confined only by the prescriptions imposed by himself and the culture surrounding him, the scientist has nature and his critical colleagues always looking over his shoulder.' His insights came at the end of a long and ultimately successful career. Max was born into a wealthy family in Vienna and was determined to do research, despite his father's opposition. He went to Cambridge in 1936 as a graduate student with the crystallographer John Desmond Bernal and chose to study haemoglobin. In 1940 he was interned as an enemy alien, only to be recruited later to a top-secret project – to make aircraft carriers out of ice. In 1959 he finally solved the structure of haemoglobin, for which he shared the Nobel Prize in 1962. The same year the MRC opened the Medical Research Council Laboratory of Molecular Biology (LMB), with Max as chairman. He carried on with his research on the 'breathing molecule' and wrote a series of essays for the New York Review of Books, published collectively as *I wish I'd made you angry earlier*. He fought some battles in his time, but as he liked to say, 'In science, truth always wins.'

Georgina Ferry

David C. Phillips, Lord Phillips (1924-1999)

David Phillips, grandson of a Welsh Coalminer, Union Official and Member of Parliament, was educated at University College South Wales, studying physics, electrical engineering and mathematics. His education was interrupted by World War II in 1944 by service for three years as a Royal Navy Radar Officer. He completed his degree in Cardiff in 1948 and gained a PhD in 1951. In 1965, at the London Royal Institution, using X-ray crystallography, his group determined the structure of lysozyme, the first enzyme defined in 3D. This work, together with study of structures of ligand complexes had a huge impact on our understanding of enzyme action. David was knighted and became Head of Structural Biology in Oxford. He also had a major impact on UK scientific politics, first becoming Biological Secretary at the Royal Society and then Chairman of the Advisory Board of the Research Councils in 1983. After appointment as a Life Peer in 1994 he became a Member and later Chair of the Select Committee on Science and Technology. His final years were spent alongside Dorothy Hodgkin's group in Oxford on structural biology. He was already suffering from cancer, and sadly died in 1999.

Tom Blundell

Rosalind Franklin (1920-1958)

Rosalind Franklin was distinguished by her major contributions to the determination of the structure of double-helical DNA, and to the structure of viruses in the period 1951-58. Her work on the hydration of DNA fibres led directly to her discovery of structural transitions in DNA and importantly to her success in obtaining well-resolved diffraction data of the B-form of DNA. This provided essential data for the subsequent model of the double helix.

Her DNA work was undertaken in an atmosphere of discord and tensions, which have been highlighted in many publications, as well as in films and plays. Access to archival material has enabled the origins of these problems to be determined and understood in the light of the personalities involved and shows that Rosalind Franklin's achievements in the face of these difficulties were all the more remarkable.

Stephen Neidle

Dorothy Crowfoot Hodgkin (1901-1994)

Dorothy Crowfoot Hodgkin remains our only British female science Nobel laureate for almost sixty years, which is amazing in many respects. Her wonderful work leading up to her Nobel Prize is well known, as is her subsequent research into the complex structure of insulin published in 1969, some thirty-four years after she took her first X-ray photographs of wet crystals on her return from Cambridge, where she had worked with J.D. Bernal. Her return to Oxford and connection with Somerville College were to remain central for the rest of her career and working life. Since her science has been covered in many journal articles and collected works and her biography in the book by Georgina Ferry (1998), this talk explored her family, childhood and early education at home and in school and in Egypt, where Dorothy was born in 1910. The talk was illustrated with original writings and many photographs from the Crowfoot family. The speaker explored whether there were influences from Dorothy's early life that helped her to exceed so brilliantly in her scientific career. Can we learn anything from exploring these backgrounds and her family relations?

Judith A.K. Howard

Judith Milledge (1927-2021)

Dr H. Judith Milledge (née Grenville-Wells) was born in South Africa where she attended Rhodes University just after the end of World War II.

After taking a BSc and an MSc from Rhodes, Judith went to work in the new DeBeers Diamond Research Laboratory in Johannesburg but she soon realised that she needed to take a PhD in crystallography and so, in 1949, she moved to London, working on diamonds at University College, supervised by Kathleen Lonsdale. Apart from a brief post-doctoral appointment in the USA (at MIT, working with Sidney Abrahams), Judith's entire career was spent at UCL; she was awarded a DSc by the University of London and held the position of University Reader in Crystallography, initially in the Department of Chemistry and later (from 1978) in the Department of Geology (now Earth Sciences). She was active scientifically until well into her eighties, and co-authored her last paper aged eighty-seven. She died in London in 2021, aged ninety-four.

Judith's interests were very wide-ranging and so this talk concentrated on three aspects of her work: (i) the design of crystallographic apparatus; (ii) her pioneering work (in the early 1960s) on crystallographic computing, together with her use of the Ferranti Pegasus computer; (iii) her research on diamonds. The talk concluded with a brief discussion of her development of methods for teaching crystallography to undergraduate chemists and Earth scientists and of her role in helping to transform UCL's Department of Geology, which in the 1970s was essentially a small "teaching Department" with relatively little research, into the much larger and much more research active Department of Earth Sciences that exists today.

Ian Wood

Speakers at the Crystallography Meeting
Front L to R: John Finney, Tom Blundell, Georgina Ferry, Stephen Neidle, Judith Howard, Jenny Wilson
Back L to R: Elspeth Garman, Ian Wood, Mike Glazer

REPORTS OF RSCHG WEBINARS

Creative Chemistry inside the Eighteenth-Century Crutchley Dye Houses, London – Anita Quye (September 2023)

Three hundred years ago the Crutchley family of dyers owned and managed a textile dyeing business on the Southwark bankside of the River Thames in London. Between 1721 and 1744 the Crutchleys recorded their dye-house activities in books, and these rare accounts, with colourful dyed samples, are now in Southwark Archives. Interdisciplinary research by heritage science and dye history between the University of Glasgow, CNRS (Lyon) and the University of Exeter has revealed the significance of the Crutchley dye books for Britain's textile history. They hold protected knowledge of commercial scale dyeing with natural materials that the Crutchley dyers and their eighteenth-century contemporaries used to create fashionable red colours on wool fabrics. In this talk the daily routines and professional skills in the Crutchley dye houses were described to illustrate the creative chemistry of historical textile dyeing.

100 years of Paediatric Clinical Chemistry 1923-2023: A Tribute to Evelyn Hickmans - Anne Green (October 2023)

The Clinical Chemistry Department at Birmingham Children's Hospital (BCH) was one hundred years old in 2023. It was founded single-handedly by Evelyn Hickmans, born in April 1882 in a Staffordshire mining village near Wolverhampton. Evelyn gained a BSc in 1905, and an MSc in 1906, from Birmingham University and in 1911, she went to Kings College, London to study household science. This was followed in 1919 by an appointment as lecturer at Toronto University in applied chemistry and dietetics. In 1922, Dr Leonard Parsons, an eminent Paediatrician at Birmingham Children's Hospital, asked her to establish chemical assays to support his clinical interest in marasmus and childhood anaemias. In 1923 Evelyn, undaunted by the task, created the first Paediatric Biochemistry Laboratory in the UK. She was only the second biochemist to be employed in a hospital in England. A report of the celebrations for BCH's centenary can be found later in this newsletter. See also Anne Green, "Evelyn Marion Hickmans: A Neglected Pioneer of Paediatric Biochemistry," *RSCHG Newsletter*, Summer 2021, 26-36.

Chemical Information: Pioneering People and Publications – Helen Cooke (November 2023)

This talk explored how chemical information has been published, organised and disseminated over the centuries, from the publication of early scientific journals until the advent of electronic databases. Factors which led to the birth, evolution and, in some cases, demise of publications were explored. How journals and abstracts reflected the development of chemistry and the changing needs of chemists was discussed, including challenges resulting from the ever-increasing quantity of information available and the innovative solutions developed to address this. The often-fascinating stories of some of the people who conceived or developed publications were featured. Some of the speaker's personal experiences of working as a chemical information scientist were mentioned too.

A Chemistry Christmas Carol – Dan Cornwell-Groves (December 2023)

This talk was themed around Charles Dickens' festive classic (which, coincidentally, was published exactly 180 years before the talk on 19 December 1843), with each of the novella's five chapters as the starting point for an examination of Chemistry past – and perhaps present and yet-to come! The stories included arsenic-laced humbugs (and instructions for not making these at home), nightmare-fuelling cheese, how both gasworks and electrochemistry might be used to explain the presence of ghosts, and fly agaric fungi and their spurious link to a well-known Christmas character.

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

A complete list of the recordings up to December 2023 is given below.

NB: This list does not include recordings of lectures given at one-day meetings/conferences

Main Talks

2023

December – Dan Cornwell-Groves: "A Chemistry Christmas Carol".

November - Helen Cooke: "Chemical Information: Pioneering People and Publications".

October -Anne Green: "100 years of Paediatric Clinical Chemistry 1923-2023: A Tribute to Evelyn Hickmans".

September - Anita Quye: "Creative Chemistry Inside the Eighteenth-Century Crutchley Dye Houses, London".

July - Vincent Daniels: "A Hundred Years of Conservation Research at the British Museum".

June – Alan Dronsfield: "Quinine-Urea: A Local Anaesthetic that Possibly Didn't Work".

May - Geoff Rayner Canham: "A Life-Changing Story: Harriet Brooks (1866-1933)".

April - Peter Morris: "Henry Enfield Roscoe: A Campaigning Chemist".

March -Jeff Seeman: "Putting the Chemistry Back into the History and Philosophy of Chemistry".

February - Catherine Walsh: "Eighty Years of Astrochemistry: From the First Detections of Molecules in Space to the Present Day".

January 2023 - Anna Marie Roos: "Newton and the Apothecary".

2022

November -Geoff Rayner-Canham: "Chemistry and Inuit Life and Culture".

October - Ayako Tani and John Liddell: "History and Practice of Scientific Glassblowing from the Viewpoint of Glassblowers".

September - Robert Slinn: "The Discovery of Sodium Chromoglycate (Intal)".

August - Helen Cooke: "Joseph Priestley, Discoverer of Oxygen" [recorded without an audience].

July - Alan Dronsfield: "Optical Activity: A Century of Perplexity".

June - Aviva Burnstock: "Material Matters: Looking Through Paintings".

May -Anna Simmons: "Pills, Powders and Purgatives".

April - Mary Virginia Orna: "Discovery of the Elements Predicted by Mendeleev's Table".

March - Kersten Hall: "Insulin: The Crooked Timber, From Thick Brown Muck to Wall Street Gold".

February - Diana Leitch: "Sir John Tomlinson Brunner and Henry Brunner- Their Lives and Legacy".

January - John Hudson: "Alchemy, or How to Make Gold".

2021

December - Peter Morris: "The History and Chemistry of Frankincense and Myrrh".

November - Helen Cooke: "Structures: The Key to Chemistry Communication".

October - Ann Ferguson: "The Ordeal Poison".

September - Tony Travis: "A Century of Global Synthetic Ammonia 1921 – 2021".

June -Peter Morris: "The History of Chemical Laboratories, 1600-2000".

April - Viviane Quirke: Drugs, "ICI and the Molecularisation of Disease".

History of Chemistry Series

May 2023 - Matteo Martelli and Eduardo Escobar: "Where Did Chemistry Begin? A Search for its Origins".

April 2023 - Matteo Martelli: "Alchemy in Graeco Roman Egypt".

February 2023 - Peter Forshaw: "Medieval Alchemy".

January 2023 - Philip Ball: "Paracelsus and the World of Renaissance Magic and Science".

November 2022 - Michelle DiMeo: "Where were Women in Chemistry in the 1600s?".

October 2022 - John Powers: "A Stroll Through Eighteenth-Century Chemistry".

September 2022 - Victor Boantza: "Revolution and Reaction: Politics and Chemistry".

June 2022 - Peter Ramberg: "Chemistry Becomes the Central Science, 1815-1914".

May 2022 - Peter Ramberg: "Training, Theory, Industry: Creating Modern Chemistry, 1815-1914".

April 2022 - Peter Morris: "History of the Chemical Industry in the Twentieth Century".

March 2022 - Peter Morris: "The History of Chemistry between 1914 and 2019".

EVENTS, EXHIBITIONS AND OUTREACH

The Summer of Science Festival at Nantwich Museum

Although a local-history museum, Nantwich Museum incorporates STEM subjects within its events and exhibitions wherever appropriate and is fortunate to have a number of scientists and engineers amongst its volunteers, providing a strong foundation for scoping, planning and delivering such activities. For example, in 2017, in partnership with Keele University, school visits and family workshops were organised which involved analysis of the quality of the water in the local River Weaver, and in 2019 during the International Year of the Periodic Table the Museum's Research Group developed the "From Nantwich to Oxygen" exhibition and associated events, exploring the life of Joseph Priestley (discoverer of oxygen and Nantwich resident 1758-61).

In the museum's experience, discussing science in a context to which people young and old can relate can help to reduce apprehension about science. At Nantwich Museum building connections between science and local history provides this opportunity and this was a key theme of the "Summer of Science" festival which took place from 20 July – 30 September 2023. The festival was also an opportunity to engage with relevant community groups, other external organisations and individuals, both local and from further afield, to enhance our offerings and strengthen relationships. The museum was delighted to welcome Professor Mark Ormerod (PhD chemist), Deputy Vice Chancellor and Provost at Keele University to open the festival.

Bringing our Objects to Life

Explaining how objects displayed at the Museum were made or how they worked (in the process revealing the science and technology embedded within them) became a key objective. For example, many visitors look at the Museum's cannon balls and muskets dating back to the Civil War, not realising that it's the chemistry of the gunpowder used when weapons were fired which makes them work. This reinterpretation should have long-term benefits for visitors of all ages. Therefore the museum created new roller banners featuring a variety of objects and Nantwich people with connections to science. They proved extremely popular with visitors, and have the added benefit of being portable and thus suitable for events outside the Museum. The banners featured: fire pump, mangle, weighing chair, salt, muskets, cannon balls, John Gerard, Joseph Priestley, and a Nantwich apothecary – more are in the pipeline.

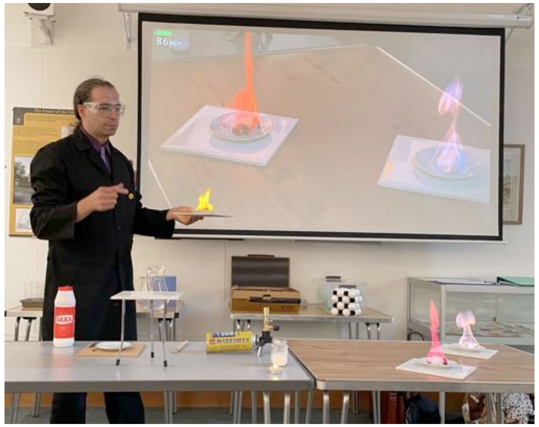
Family Drop-in Workshops

As the festival fell mainly in the school holidays, family drop-in events with a science theme were developed. Many were delivered by our volunteers, for example exploration of the salinity of local brine on “Salty Saturday”, but some were developed by external organisations, including a “Making Medicines” workshop led by pharmacists from the local hospital and “Shocking Saturday” delivered by the Institute of Physics North West branch. Workshops were free of charge, to help families with financial pressures and ensure inclusivity.

Talks and Demonstrations

The museum wanted to offer an engaging programme of talks to inspire adults as well as children, so that parents and grandparents might feel less intimidated by science and more confident to discuss it with children. Topics included a local apothecary, herbalist John Gerard, Nantwich gas works, the local salt industry, Joseph Priestley, sustainable power from the local River Weaver, the science of brewing, genetics, and the geology of the area. Some were delivered by members of our Research Group, others by external contributors.

The festival ran in parallel with the Museum’s “Nantwich Illuminated” exhibition on the history of the town’s gas works site, which included the production of gas from coal and the manufacture of by-products. This provided considerable scope for chemistry demonstrations and the Museum is especially grateful to Professor Fabio Parmeggiani (Politecnico di Milano) for the bespoke demonstrations he created involving coal, gases, how gas holders and Davy lamps worked, the chemistry of sodium, chlorine, salt, lead, and more. There were plenty of flames and bangs to keep everyone entertained. See a summary video here:
https://www.youtube.com/watch?v=SpaDWmg4Ad8



Live chemistry demonstration by Fabio Parmeggiani

Dr Mark Whalley (University of Chester and Institute of Physics) also entertained and informed the audience with demonstrations involving static electricity, the historic connection being Joseph Priestley’s explorations of electricity. In addition, the historic method of salt-making was re-enacted in the town’s main square, which showed how salt was made from local brine during Roman times, and for many centuries afterwards. This proved very popular with passers-by.

Acknowledgements

Nantwich Museum is extremely grateful for financial support from the RSC’s Outreach Fund, the RSC’s North Staffordshire & South Cheshire Local Section, and Museum Development North West’s Sustainable Improvement Fund.

Helen Cooke

CELEBRATIONS AT BIRMINGHAM CHILDREN’S HOSPITAL

A Tribute to Evelyn Hickmans

The Birmingham Children’s Hospital has had two special events in recent months, both honouring the work of Chemist Evelyn Hickmans (1882 -

1972) who has been featured in a Historical Group Webinar in October 2023 and also in the summer 2021 *Newsletter*.

100 years of Paediatric Clinical Chemistry, 1923-2023

After Evelyn's return to the UK in 1922, Dr Leonard Parsons, an eminent Paediatrician at Birmingham Children's Hospital, asked her to establish chemical assays to support his clinical interest in malnutrition and childhood anaemias. In 1923 Evelyn created the first Paediatric Biochemistry Laboratory in the UK. She was only the second biochemist to be employed in a hospital in England.

In June 2023 The Clinical Chemistry Department at Birmingham Children's Hospital (BCH) celebrated their one hundred years old special 'birthday' with a week-long event and an afternoon tea party in glorious sunshine for previous and existing staff. The laboratory is a far cry from the original laboratory which Evelyn had established, now with shiny automated analysers, advanced mass spectrometers and a wonderfully diverse workforce. There were guided tours of the laboratory for some of the renal dialysis patients and displays of posters and equipment for outpatients and visitors. Staff from other departments in the hospital and visitors were able to gain knowledge of different roles and jobs within chemistry (and wider pathology) and both understand how diagnoses are made using chemical

tests and learn about the history of the department. It was a wonderful opportunity to highlight the amazing work undertaken in the laboratory and reflect on the journey since 1923 with huge developments in technology, automation and IT.

Evelyn went on to develop many specialist chemical assays, the most notable being, in the late 1940s, the technique of paper chromatography for the study of amino acids in biological fluids. Her laboratory at BCH became one of the few places in the UK where this technique was applied successfully in a hospital setting. Using this technique in 1951 Dr Hickmans' laboratory diagnosed a two-year old infant, Sheila Jones, with the rare condition Phenylketonuria (PKU). There was no treatment available at the time, but Evelyn's expertise not only in chemistry but also in nutrition allowed her and her medical colleagues, Dr Horst Bickel and Dr John Gerrard, to prepare a special formula for this little girl. Sheila was the first person in the world to receive dietary treatment for PKU, a treatment that has gone on to benefit thousands of children across the world. This remarkable achievement was recognised internationally in 1962 with the John Scott Award to Evelyn and her colleagues.

Unveiling of 'The *Sheila Jones Plaque'*

On October 21 2023, seventy years after the publication of this work, BCH hosted a celebration with the unveiling of a plaque dedicated to Sheila Jones. The ceremony took place in the Outpatient Department of the hospital and honoured Sheila and the team who treated her in the 1950s - Dr Evelyn Hickmans, Dr Horst Bickel and Dr John Gerrard. The event was attended by almost one hundred people including members of Sheila's family, the family of John Gerrard, health professionals from all over the world and patients and their families.

Sheila's brother, Trevor Jones, who officially unveiled the plaque, said: "I'm overwhelmed. I can't believe how big it feels. I don't think I knew how big a contribution Sheila and my mum made around the world, I'm so in awe of them. I can't believe it was my Mum who was banging on the doctors' doors, she never came across like that, and I don't know how she had the time or the bus fare to do it".

Dr Evelyn Hickmans was decades ahead of her time and her expertise in Chemistry and Nutrition was key in enabling this incredible work to prepare the diet for PKU. She pioneered and laid the foundations for Paediatric

Chemistry as practised across the world, and so it is fitting that one hundred years later, her achievements as one of the pioneer women of science are celebrated. For more information about Evelyn Hickmans there is an on line lecture via this link:
https://www.youtube.com/watch?v=q4b3jnc1xUE&list=PLLnAFJxOjzZu7N0f5-nVtHcLNxU2tKmpC&index=4

Sheila Jones Plaque with Professor Anne Green, Mr Trevor Jones and Professor Anita McDonald (left to right)

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Anne Green

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.

Frank A.J.L. James, "When Ben met Mary: The Letters of Benjamin Thompson, Reichsgraf von Rumford, to Mary Temple, Viscountess Palmerston, 1793–1804", *Ambix*, vol. 70, issue 3, August 2023. Available open access.

This paper publishes the sixty-nine surviving very personal letters that Reichsgraf von Rumford wrote to Viscountess Palmerston after they met in Milan in 1793. The letters draw attention to the private domestic spaces of science and the critical importance of the aristocracy in scientific developments, topics that have both received some discussion recently. They also describe in some detail his thoughts about his activities as a member of the governing elite in Bavaria, his scientific and engineering researches (especially the writing and publication of his *Essays*), as well as what he would have termed his philanthropic efforts in Bavaria, Northern Italy, Britain, and Ireland. All this is framed within the context of the Revolutionary and Napoleonic wars that in so many ways, directly and indirectly, affected Palmerston's and Rumford's lives and work.

Peter J.T. Morris and Peter Reed, *Henry Enfield Roscoe: The Campaigning Chemist* is scheduled to be published by Oxford University Press in spring 2024. A review will appear in a subsequent issue of the newsletter.

Henry Enfield Roscoe (1833-1915) was one of the most prominent chemists and educational reformers in Victorian Britain. He was born in London, and was educated in Liverpool and at UCL in London. He then studied under Robert Bunsen in Heidelberg and thereafter admired German education. Having transformed the chemistry department at Owens College into one of the best in Britain, he assisted the conversion of the college into Victoria University (University of Manchester's official name until 2004) and then embarked on a campaign to reform technical education at all levels using Germany as a model. Roscoe became a Manchester MP in 1885 and after helping with the passing of the Technical Instruction Act in 1889, he pushed for a scheme of compulsory metrication in 1895. After losing his seat in the General Election of 1895, Roscoe oversaw the reform of the University of London as its Vice-Chancellor, assisted the formation of Imperial College, helped to found the Lister Institute of Preventive Medicine and was a director of the Castner-Kellner Alkali Company. His ability to bring together academic and industrial chemists resulted in the creation of the Society of Chemical Industry (1881) and his association with Eton College led to the formation of the forerunner of the Association for Science

Education. This biography aims to show how these different strands of Roscoe's career came together to make Roscoe one of the leading scientists of his generation; his impact is still felt today.

PUBLICATIONS OF INTEREST

The following journal issues have been published since the summer 2023 *Newsletter* was completed.

Ambix, The Journal of the Society for the History of Alchemy and Chemistry, vol. 70, issue 3, August 2023

Frank A.J.L. James, "When Ben met Mary: The Letters of Benjamin Thompson, Reichsgraf von Rumford, to Mary Temple, Viscountess Palmerston, 1793–1804".

Ambix, The Journal of the Society for the History of Alchemy and Chemistry, vol. 70, issue 4, November 2023

Umberto Veronesi, "The Archaeology of Alchemy and Chemistry: Past, Present, and Ideas for the Future".

George D. Elliott, "Gershom Bulkeley, "Saltbox Science," and the Colonial New England Laboratory".

Armel Cornu, "Senses and Utility in the New Chemistry".

Bulletin for the History of Chemistry, vol. 48, number 2, 2023

Alexander Kraft, "On the History of Prussian Blue: The Story of Soluble Prussian Blue".

Peter E. Childs, "Peter Woulfe (1727-1803): The Last of the Alchemists".

Veljko Dragojlovic, "First 60 Years of Melting Point in Organic Chemistry: 1790-1850".

William H. Brock and David E. Lewis, "A Dark Comedy of Errors and Polemics: Nierenstein, Freudenberg and the Structure of Catechin".

Howard D. Dewald "Wilbur Morris Stine: Pioneer Scientist".

Ian D. Rae, "Naming the Proton".

Tor Erik Kristensen "Discovery and Structural Elucidation of RDX and HMX, the World's Most Powerful Industrial Explosives".

Istvan Hargittal and Magdolna Hargitta, "On Edward Teller's Inner World: As Revealed in his Letters to Maria Goepper Mayer".

Yoshiteru Marno, Yoji Hisamatsu and Kazuhiro Egashira, "Kenji Yoshihara (1929-2022): Shedding Light on the Work of Masataka Ogawa on his Discovery of the Element 'Nipponium'. An Obituary-Tribute".

Book Reviews

Catherine M. Jackson, *Molecular World: Making Modern Chemistry,* reviewed by Gary Patterson.

Magdolna Hargitta, *Meeting the Challenge: Top Women in Chemistry*, reviewed by Marelene and Geoffrey Rayner-Canham.

Gisela Boeck and Alan J. Rocke (eds.), *Lother Meyer: Modern Theories and Pathways to Periodicity*, reviewed by Carmen Guinta.

The Back Story: Jeffrey I. Seeman, "Gilbert Stork and the Sweetness of Quinine".

Ambix Edited Collection: Expanding the Boundaries of Eighteenth-Century Chemistry and Alchemy

The eighteenth century has long been a period of central concern to the history of chemistry. In the past two decades, this scholarship has undergone an inspiring renewal, reflected in an influx of new methods, a greater diversity of actors and geographies, and in studies that question the very boundaries of both alchemy and chemistry. Gazing beyond laboratories, historians have investigated the mine, the domestic space, the factory, and the apothecary's shop as spaces where alchemical and chemical knowledge could be learned, questioned, and developed. The essays from *Ambix* in this collection, edited by Armel Cornu, are available open access for a limited period:
https://www.tandfonline.com/journals/yamb20/collections/Eighteenth-Century-Chemistry-and-Alchemy

SOCIETY NEWS

Society for the History of Alchemy and Chemistry

2024 Morris Award: Call for Nominations

The Society for the History of Alchemy and Chemistry (SHAC) solicits nominations for the 2024 John and Martha Morris Award for Outstanding Achievement in the History of Modern Chemistry or the History of the Chemical Industry. This award honours the memory of John and Martha Morris, the late parents of Peter Morris, the former editor of *Ambix*, who has contributed the endowment for this award. The recipient chosen to receive the Morris Award will be expected to deliver a lecture at a meeting of SHAC, where the awardee will be presented with an appropriate framed photograph, picture or document and the sum of £300. The award is international in scope, and nominations are invited from anywhere in the world. Past winners of the Award include Ernst Homburg, Yasu Furukawa, Anthony S. Travis, Mary Jo Nye and Raymond Stokes.

A complete nomination consists of

- a complete curriculum vitae for the nominee, including biographical data, educational background, awards, honours, list of publications, and other service to the profession;
- a letter of nomination summarising the nominee's outstanding scholarly achievement in either the history of the chemical industry or in the history of recent chemistry (post -1945) and the unique contributions that merit this award; and
- names of two or three individuals for the panel to contact for further information if needed.

Only complete nominations will be considered for the award and the nomination documents must be submitted in electronic form. The Award will be judged by the selection panel on the basis of scholarly publication. All nomination materials should be submitted by e-mail to Peter Morris at doctor@peterjtmorris.plus.com and a separate email which indicates that the material has been submitted should be sent to the same address (a precaution in case of incomplete transmission of documents) for arrival no later than 1 May 2024.

FUTURE WEBINARS, MEETINGS AND CONFERENCES

International Conference on the History of Chemistry

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. Further information will be available in the next newsletter.