Historical Group

NEWSLETTER
and
SUMMARY OF PAPERS

No. 77 Winter 2020

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COMMITTEE

RSC Historical Group Newsletter No. 77 Winter 2020

Contents

From the Editor (Anna Simmons) 2
Letter from the Chair (Peter Morris) 3
ROYAL SOCIETY OF CHEMISTRY HISTORICAL GROUP MEETINGS 3
The Handed World: 150 Years of Chiral Molecules 3
ROYAL SOCIETY OF CHEMISTRY HISTORICAL GROUP NEWS (

the newsletter by post and wish to look at the electronic version which includes colour photographs it can be found at http://www.rsc.org/historical or http://www.sbcs.qmul.ac.uk/rschg/

The Historical Group posts the hard copy version of the newsletter to those members who request it. Printing and posting the hard copy version is expensive and if you are receiving the newsletter in hard copy and would be happy to read it online, please send an email to our Membership Secretary, Bill Griffith (w.griffith@ic.ac.uk). Similarly, email Bill if you don't currently receive the hard copy and would like to do so. Group members should receive an email from the RSC informing them when the latest version is available, but for the record the Newsletter appears twice each year – usually in January/February and July/August. It is often available online for several weeks before official notification is sent out by the RSC, so please do look out for the newsletter on both the RSC and Queen Mary Historical Group websites given above.

Anna Simmons
UCL

Letter from the Chair

Pro

Then, on 19 October, we held a join meeting with the Society for the History of Alchemy and Chemistry at the Royal Institution, London, organised by Frank James on the life and work of Sir William Crookes. Accounts of the papers given at this meeting appear elsewhere in the Newsletter. As usual, it was a well-attended meeting and attracted much interest from all those who could be there.

Lastly, I am happy to report that we published two editions of the Group Newsletter during the year. These are very high standard publications, to which the term “newsletter” does less than justice. Thanks go to Anna Simmons, who as editor does an excellent job of persuading or cajoling a large number of individuals to contribute, and making it the high-quality publication that we all enjoy.

John Nicholson

Follow-up from the Summer 2019 *RSC Historical Group Newsletter*

The Periodic Table Upside

Ambix: The Journal of the Society for the History of Alchemy and Chemistry

Ambix, vol. **66**, issue 4, November 2019

Alan J. Rocke, "Lothar Meyer's Pathway to Periodicity".

Frank A.J.L. James, "Humphry Davy's Early Chemical Knowledge, Theory and Experiments: An Edition of his 1798 Manuscript 'An Essay on Heat and the Combinations of Light' from the Royal Institution of Cornwall, Courtney Library, MS DVY/2".

William H. Brock, "A German Partington". Essay review of Jost Weyer's *Geschichte der Chemie. Band I – Altertum, Mittelalter, 16. bis 18. Jahrhundert. Band II – 19. und 20. Jahrhundert.*

Bulletin for the History of Chemistry

Bulletin for the History of Chemistry, vol. **43**, number 2, 2018

Jeffrey I. Seeman, "*Profiles, Pathways and Dreams*: From Naïveté to the Hist Award".

G.J. Leigh and Carmen J. Giunta, "The Scientific Publications of Alexander Marcet".

Joäo Paulo André, "Frederick Accum: An Important Nineteenth-Century Chemist fallen into Oblivion".

relevant image is provided. Alongside is a giant touch screen. When the name of an element is tapped, the illumination of the corresponding box in the table changes to orange, and information about the element is displayed on the screen. The information that appears will be changed by Catalyst staff, so that it is always relevant and up to date. For example, when lithium was tapped, a few sentences appeared conveying the information that the previous week the 2019 Nobel Prize for Chemistry had been awarded to John Goodenough, Stanley Whittingham and Akira Yoshino for their work developing lithium-ion batteries. Thus, the exhibit is interactive in the sense that the user can learn interesting details about any element or elements of their choice, and the information will be continually updated, making the exhibit future-proof.

The launch was attended by around seventy people, including patrons and supporters of Catalyst, representatives of local organisations and the RSC, and parties of schoolchildren and their teachers. The proceedings commenced with addresses from Martin Pearson, Chief Executive of Catalyst, and Diana Leitch, Chair of Trustees. David Phillips, previous President of the RSC, then gave a speech in which he revealed he had spent a post-doctoral year in the former USSR, and he described how proud the Russians were that the periodic table had been the work of one of their number. He then cut a ribbon which had been placed across the touch screen and declared the exhibit open.

The Giant Periodic Table at Catalyst

By Spring 2020 the refurbished gallery will be completed with the installation of a further twenty-four new exhibits. These, along with the interactive periodic table, will enable Catalyst to expand further its provision for visitors and groups in the local community. As David Phillips said “Catalyst is an inspiration…. It demonstrates the utility of chemistry for the world and it is in the site where so much of the chemical industry was founded and still continues today. It is a very, very special place”.

John Hudson

Division of History of the American Chemical Society: Presentation of the 2019 HIST Award in San Diego, August 2019

One-time University College London (UCL) undergraduate (1942-44) and postgraduate (1944-46) Otto Theodor (“Ted”) Benfey received the 2019 HIST Award for Outstanding Achievement in the History of Chemistry by the Historical Division of the American Chemical Society at its meeting in San Diego in August 2019. Ted made his undergraduate studies in Aberystwyth when the UCL chemistry department was evacuated to Wales; he then studied solvent effects on Sn1 mechanisms for his PhD with Christopher Ingold before post-doc studies with Louis Hammett at Columbia University in 1947. Benfey, a German Jewish child refugee in 1936 when he was ten years of age, became a lifelong pacifist. He never returned to the UK, but instead taught organic chemistry in a number of American Quaker colleges before becoming editor of the ACS’s High School magazine *Chemistry* in 1964. While teaching chemistry at Earlham College (1955-64) he became closely involved in the Chemical Bond curriculum project (1957-64) that mirrored the Nuffield teaching project in the UK. He also became well-known to historians of chemistry for the outstandingly-useful and meticulously-edited source book, *Classics of the Theory of Chemical Combination* (Dover: New York, 1965) and its later companion text, *From Vital Force to Structural Formulas* (ACS: Washington, 1975), many papers and translations on the history of chemistry, and his co-editorship with Peter Morris of *Robert Burns Woodward, Architect and Artist in the World of Molecules* (CHF: Philadelphia, 2001). He has an extensive *Wikipedia* entry and lives in retirement at a Quaker refuge at Guilford, Connecticut.

Unfortunately, Ted was unable to be physically present at the meeting when, under the affable chairmanship of

For all their fundamental importance to physics, these reactions were of little direct (synthetic) interest to chemists, merely producing naturally occurring non-radioactive nuclides in tiny quantity.

Induced Transmutation Releases the Potential of the "Tracer"/"Label" Technique

In 1934, Joliot and Joliot-Curie effected the first transmutation in which a previously unknown and intensely radioactive nuclide, ^{30}P, was produced:

! " #$%$&' ( )$$$$$$ → $*+ , $%$- . (eq. 3)

(see first Box) [6, 7]. By the end of 1935, radionuclides of other elements of low atomic number had been discovered, using both bombardment with charged particles and also bombardment with neutrons. (A neutron has the advantage that it is not electrostatically repelled by the target nucleus, which commonly captures it so that its mass number is raised by 1.)

Joliot and Joliot-Curie's Astonishingly Simple Chemistry with ^{30}P

The key product in eq. 3, ^{30}P, has a half-

Hevesy and the “Tracer”/“Label” Technique

Hevesy’s in

number, equal of course to the number of electrons surrounding the nucleus in the uncharged atom. The arrangement, in 18 vertical columns (groups), is by the ground state electronic structures of the uncharged atoms, a few irregularities being ignored.

The table is a useful, approximate (and iconic) systematisation of a vast amount of information – including chemical information since the oxidation states of elements depend on electronic structure [18].

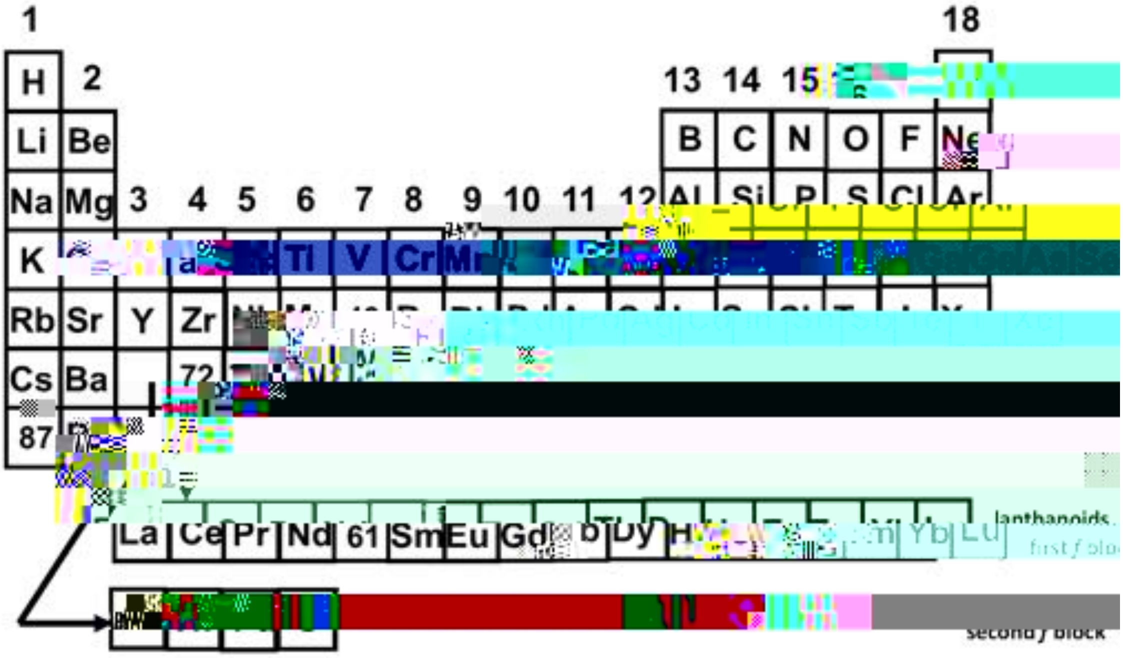

Fig. 1: Periodic Table in "medium-long" layout currently recommended by the International Union for Pure and Applied Chemistry, IUPAC, but showing only elements known in 1919, with then-"missing" elements indicated by their atomic numbers. The group numbers 1 to 18 replace previous numbering systems. The terms "lanthanoid" and "actinoid" replace earlier terms "lanthanide" and "actinide".

The periodic table, had it not been for induced transmutation, would have gathered few further elements: in 1923 and 1925, elements 72 and 75 (Hf and Re) were discovered in minerals; and in 1939 element 87 (Fr) became the last element to be first discovered in a natural radioactive decay series. All other missing elements were first discovered by means of induced transmutation. The first such element was 43 (Tc) dis

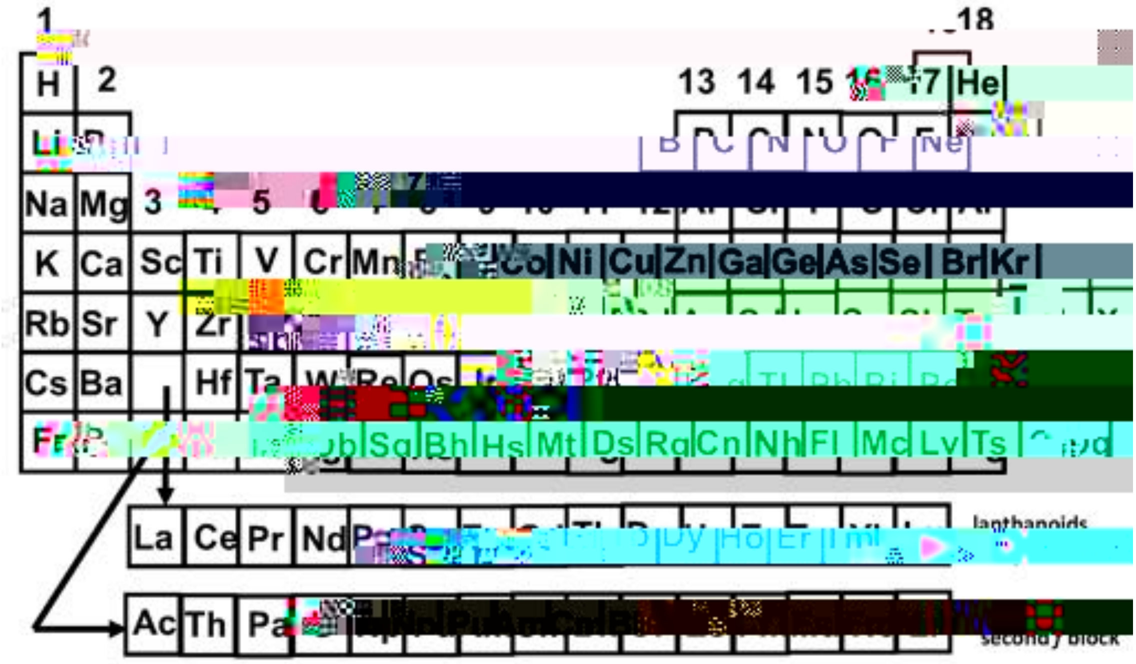

Fig. 2: Periodic Table with elements acknowledged by IUPAC, 1 December 2018.

Therefore, before the transuranic elements were discovered from 1940 onwards, Ac, Th, Pa, and U were *not* shown as in Figs. 1 and 2, but were spread across groups 3 to 6 of the fourth long row, i.e. with Ac on its own in the group 3 box and with Th, Pa, and U in the boxes now occupied by Rf, Db, and Sg in Fig. 2 [24]. The modern arrangement, proposed in essence by the trans-uranic discoverer Seaborg himself [25], is a compromise in favour of the later actinoids and the elements from Rf onwards, at the expense of the earlier actinoids. As noted previously, the periodic table is – and can only be – an approximate systematisation.

Radionuclides from Induced Transmutation in Medicine

An important product of reactors such as Oak Ridge after the Second World War was ^{60}Co for external beam therapy of cancer with 1.17 and 1.33 MeV gamma rays (the use of which has been superseded by accelerators capable of delivering X-ray photons of even higher energies).

Nowadays, the principal medical use of radionuclides manufactured by induced transmutation is in *gamma ray imaging*. The radionuclide is administered to the patient and gamma radiation is detected externally to create an image. Thus, ^{99m}Tc, whose nuclei decay from the excited state to ^{99}Tc emitting 0.14 MeV gamma ray photons, is used to scan hearts for damage after heart attacks [26]. To do this, it must be incorporated in a compound that is readily taken up by heart muscle. Such a compound, trade mark "Myoview", was invented in the late 1980s at the British company Amersham International, now GE Healthcare, with cumulative sales exceeding £1.3 bn by 2007 [27]. The active species is the singly charged cation shown in Fig. 3.

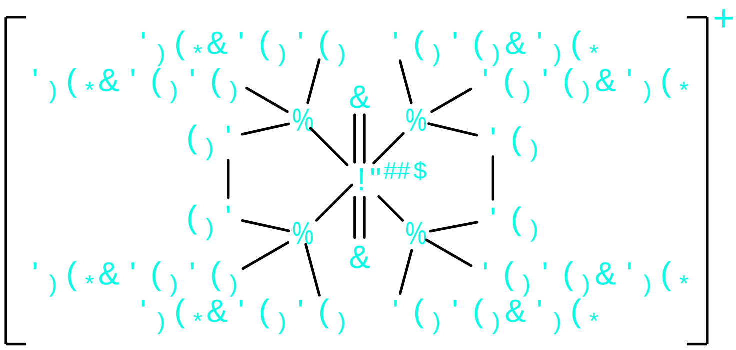

Fig. 3: the cation in Myoview.

The cation apparently interacts strongly with the mitochondria in the cardiac muscle cells. Because Myoview is *less* taken up by *damaged* heart muscle, the areas of damage show up in the image as *darker* than the healthy muscle.

Conclusion

In 1919, Rutherford discovered induced transmutation by bombarding ^{14}N nuclei with alpha particles. From 1932 onwards, bombardment particles other than alpha particles came into use. From 1934 onwards, induced transmutation delivered radioactive isotopes both of known elements and of previously unknown elements.

http://www.rsc.org/periodic-table/, accessed 15 September 2019; https://iupac.org/what-we-do/periodic-table-of-elements/ accessed on 15 September 2019.

21. There are irregularities. La, Ce, Gd, and Lu have one 5*d* electron but the other lanthanoids have no 5*d* electrons, so that for instance the number of 4*f* electrons jumps from 1 to 3 between Ce and the next lanthanoid Pr: Nikolas Kaltsoyannis and Peter Scott, *The f Elements* (Oxford: University Press, 1999), p. 6.

22. For instance, Th has two 6*d* electrons and no 5*f* electron whereas the corresponding lanthanoid Ce has one 5*d* electron and one 4*f* electronraraivS 0 0TmTf [(te) -3 (r) -1 (S) -5 (c) -3 (o) - e

"-naphthol and 2 mols of 4-nitroso-N,N-dimethylaniline hydrochloride and refluxing the mixture in ethanol for a was the publication of the free journal *Aldrichimica Acta*, which included highly informative and well written reviews on the chemistry and uses of Aldrich's new ranges of chemicals. Again, whilst there was an undeniable commercial motive, it was another example of Alfred Bader reaching out to the organic research community.

Alfred Bader did not have an extravagant lifestyle; his one indulgence was to pursue his love of Dutch painting. He couldn't yet afford actual Rembrandts, so he started collecting School of Rembrandt paintings, which he proudly displayed on the covers of the annual Aldrich catalogues. As a process research chemist developing solvent

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BOOK REVIEWS

Annette Lykknes and Brigitte Van Tiggelen (eds.), *Women in their Element: Selected Women's Contributions to the Periodic System* (Singapore: World Scientific Publishing, 2019), Pp. xxiv +531, ISBN: 978-981-120768-6, £40.00 (softback), £115.00 (hardback).

In the year celebrating the sesquicentenary of the periodic table, Annette Lykknes and Brigitte Van Tiggelen's publication draws much needed attention to women's contributions to the periodic system. The thirty-eight essays in the book highlight the diversity of women's involvement with the elements. They include accounts of well-known figures, such as Marie Curie, Jane Marcet and Kathleen Lonsdale and others less so, such as Vicenta Arnal, María Del Carmen Brugger, Trinidad Salinas, Sonja Smith-Meyer Hoel and Mary Almond. Split into six sections the book begins with old and new understandings of the elements and examines the work of Dorothea Juliana Wallich, Emilie du Châtelet and Madame Lavoisier. Later sections focus on analytical chemistry; instrumental methods; women in radioactivity; manufacturing elements; the instrumental revolution and the interface between chemistry and industry; and social activism.

In the careers of the women featured a number of themes arise. The importance of family and marital support is central to many of the stories, whilst the versatility and adaptability of a chemical training often proved invaluable as women's career paths shifted. The crucial role of influential mentors in supporting women's careers through the provision of laboratory space, recognition of research activity and introduction to networks is clearly shown. However, certain institutions and academics were more supportive of women than others. Particularly striking is the case of Celia Payne-Gaposchkin, the first student (not only the first woman) to receive a PhD in astronomy from Radcliffe College and the Harvard College Observatory in 1925. Despite the ground-breaking nature of her thesis proposing that stars were composed primarily of hydrogen and helium, she taught introductory courses without a formal appointment for most of her career. It was not until 1956 that she was promoted to full professor, the first woman to hold this rank at Harvard. Political history and the impact of two world wars also dominate the experiences of many of the women featured. This is seen most tragically in the lives of Clara Immerwahr and Stefanie Horovitz. Immerwahr, who worked on electroaffinity, collaborated with Richard Abegg, and was mar,rislHasr n 2 (r) 4 (

Wothers possesses an extensive collection of rare books, and he has used these to provide many illustrations and quotations. In the main Wothers concentrates on the better-known elements; for more complete coverage the reader is referred to the monumental treatise *Discovery of the Elements* by M.E. Weeks (6th ed., 1960) which discusses every element up to Nobelium, the latest element to be known up to the time of its writing. Nevertheless Wothers has included a great deal of material in his book, and any chemist interested in the history of his subject will enjoy it. Some will wish to read it from cover to cover, while others will dip into it for information on particular elements. If anyone wants to know why manganese and magnesium have such similar names it's all there, and Wothers recounts a convoluted story with admirable clarity.

John Hudson

CHEMICAL LANDMARK PLAQUES

Chemical Landmark Plaque Commemorating H.G.J. Moseley (1887–1915): Replacement Plaque Erected in Oxford

The author observed in early 2017 that Moseley's RSC Chemical Landmark plaque, on the old Clarendon physics laboratory building in Oxford, was in poor condition. The plaque was then less than ten years old, and had been erected in a sheltered position. Nevertheless, the blue paint background was bubbling up revealing some bare metal, and the white of the raised lettering had in several places disappeared revealing underlying blue (Fig. 1).

It is with great pleasure that the author can report that the plaque has now been replaced by the RSC (Fig. 2) with the support of Professor Andrew Boothroyd of the Oxford University Department of Physics. The two plaques are identical in inscription but at the head the "RSC" logo of 2007 has been replaced by the current "Royal Society of Chemistry" logo. (Earlier in the 2000s, plaques display yet another logo, "RS C" in distinctive font.)

Deterioration of Chemical Landmark plaques as shown in Fig. 1 is apparently not a widespread problem; there are plaques of the same general construction which are weathering well, such as the Harwell Laboratory plaque, recently moved to a more prestigious location on the Harwell Campus [1]. A more significant problem is the inconspicuousness of the earliest Chemical Landmark plaques (rectangular with black lettering on steel); replacement plaques have been made in two cases [2].

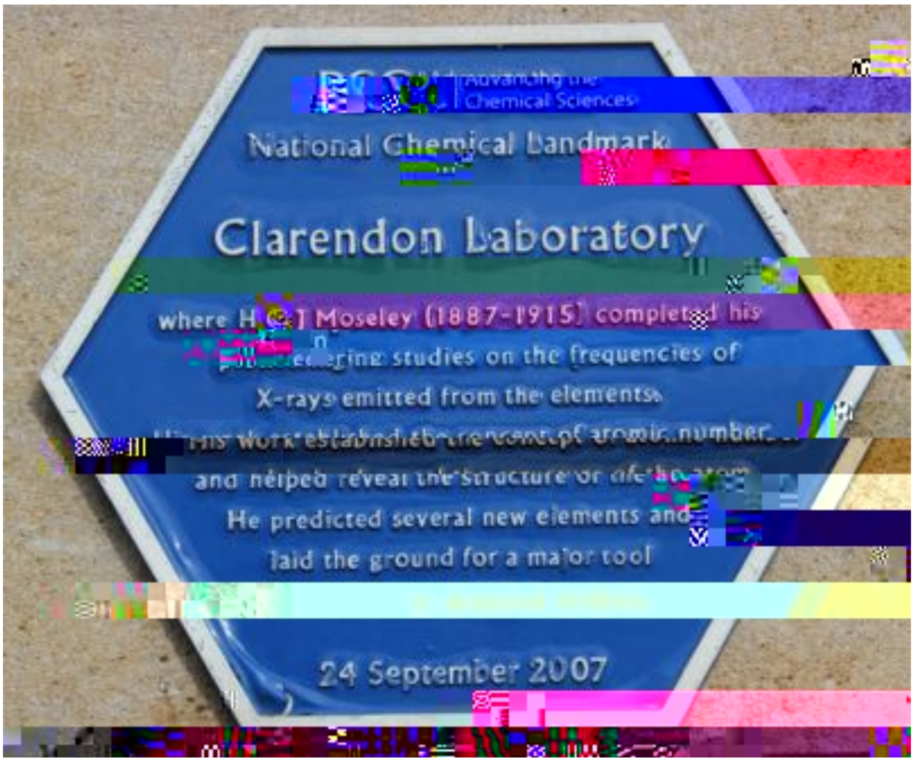


Fig 1: The plaque in March 2017. By March 2019, the area of exposed metal in the bottom left corner had increased and there was a new area of exposed metal in the bottom right corner.

not college – examinations were necessary to obtain a bachelor’s degree, and the subjects taken do not necessarily have to correspond

William Crookes and Michael Faraday

Frank James (Royal Institution and UCL)

In this talk James considered the three main interactions in the 1850s and 1860s between Crookes and Faraday, his senior by some forty years. According to a much later account by Crookes, he first met Faraday at a couple of table-turning seances arranged in June 1853 by the Secretary of the Royal Institution and close friend of Faraday's, John Barlow, whom Crookes later described as his pupil at the Royal College of Chemistry. Unfortunately, Faraday's notes of the seances do not refer explicitly to Crookes's presence. At these meetings Faraday demonstrated versions of the detector that he had devised to show what he regarded as the unconscious involuntary motions of the table-turners in causing the effect. At this point it is doubtful if Crookes was much concerned with such phenomena, but later used Faraday's work as a justification for his own scientific study of them. Their second interaction was Crookes's role in publishing the last two series of Faraday's Christmas Lectures for juveniles at the Royal

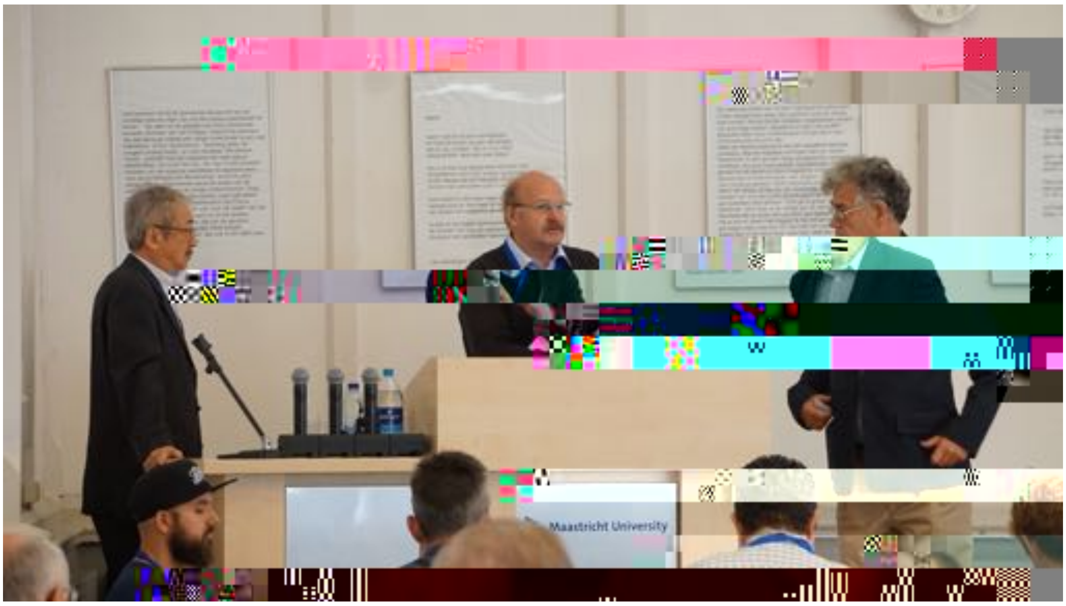
rays" that he was currently exploring in radiometers fitted with electrodes (the Crookes tube). As was usual with his "big" set-piece speeches and presentations, Crookes ended the 1886 address with a fine example of purple prose that suggested that with the fourth state of matter and Prout's evolutionary model of periodicity, he had touched the borderland between known and unknown where lay "ultimate realities, subtle, far-reaching, wonderful". This can be read as a forecast of the structured atom and the relation between matter and energy; but it also clearly referred back to Crookes's psychic investigations of the 1870s when he had hoped to find linkages between a material world and a more subtle spiritual world with which it might one day be possible to communicate. Quoting Edmund Spenser's *Fairie Queene* (1590), Crookes noted there had been unknown geographical regions of the world that remained unknown until discovered by intrepid explorers. "And later times things more unknowne shall show. Why then should witless man so much misweene [wrongly think]/ That nothing is, but which he have seene?"

Report on the Twelfth International Conference on the History of Chemistry

29 July to 2 August 2019, Maastricht

Some 120 historians of chemistry met in Maastricht for the 12th International Conference on the History of Chemistry (12ICHC). The meeting was organized by the EuChemS Working Party on the History of Chemistry and hosted by the Maastricht University under the auspices of the Royal Netherlands Chemical Society (KNCV), the Maastricht University, and with the support of the Science History Institute, the Solvay company, the Polymer Research Platform (DPI), the Society for the History of Alchemy and Chemistry (SHAC), the Holland Chemistry, the ACSeBooks and the Linda Hall Library. The local organizing committee was chaired by Ernst Homburg; Christoph Meinel and Ignacio Suay-Matallana served as chairs of the programme committee.

The keynote lectures were given by Ernst Homburg, who presented on the Dutch contributions to the history of chemistry; Lissa Roberts, who talked about the relations between history of chemistry and global history; Marco Beretta who invited the audience to explore Lavoisier and contemporaries' laboratories including the lesser-known apparatuses or instruments; and Carsten Reinhardt who gave an insider's look into the global chemical industry in the twentieth century and discussed the changing role of chemistry for science, technology and society at large. The history of chemistry in Japan was the central issue of the lecture of the Society for the History of Alchemy and Chemistry's 2018 Morris Award winner, Yasu Furukawa.



Presentation of the 2018 Morris Award to Yasu Furukawa

The general programme offered a wide range of research topics and historiographical perspectives on the history of alchemy and chemistry, chemical analyses, sites of chemical knowledge, material and visual culture of chemistry, women in STEM and chemical industries, among many others. There were two special panels: "150 years of the Periodic System" organized by Gisela Boeck, Annette Lykknes, Isabel Malaquias and Luis Moreno-Martínez and "IUPAC and the other international scientific organizations: competition or synergy?" organized by Brigitte Van Tiggelen and Danielle Fauque. The conference closed with two roundtables. The first one with Alan Rocke, Ernst Homburg, Peter Ramberg, Marco Beretta and Marcus Carrier focused on the upcoming six-volume Cultural History of Chemistry: ancient, medieval, early modern, eighteenth, nineteenth and twentieth century chemistry and discussed the importance of engaging history of chemistry with cultural topics, such as art, genre or pedagogy. The second roundtable was chaired by Brigitte van Tiggelen with John Christie, Jeff Johnson, Annette Lykknes, Cyrus Mody and Peter Morris as discussants. It was devoted to the challenge of writing the twentieth-century history of chemistry.

A Roundtable Discussion at ICHC

The Working Party of the History of Chemistry business meeting was also held on the final day of the conference. Annette Lykknes was nominated chair-elect, and Ignacio Suay-Matallana was re-elected as secretary of the Working Party. In addition, Isabel Malaquias was elected as vice-chair, and Yoanna Alexiou was appointed as

There was a wide range of topics. Three presentations were about diverse aspects of lac dye, the red insect dye from *Kerria lacca*: the trade and production of lac dye in the medieval period and today in north-east India; its use in eighteenth-century dyeing in France and England; and up to the minute identification in sub-millimetre samples using UV-visible diffuse reflectance spectrophotometry with fibre optics (FORS). Several presentations and posters were on synthetic dyes, including Vincent van Gogh's use of coal tar inks in drawings; the use of a particular group of triphenyl methane dyes by the Dutch Talens company to make pigments, from an investigation into their