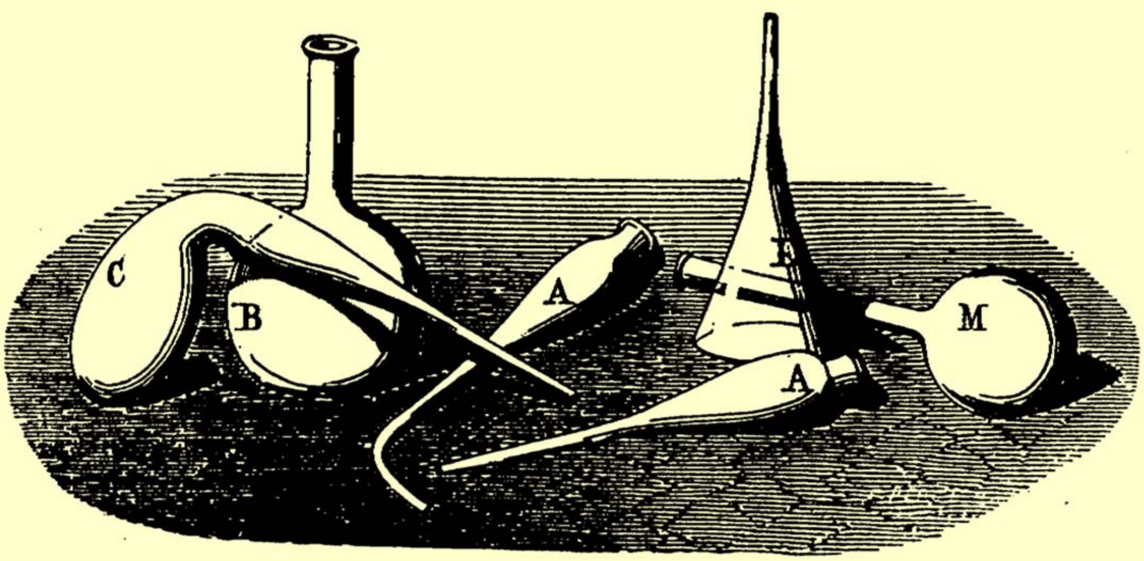
American Chemical Society

DIVISION OF THE HISTORY OF CHEMISTRY



PROGRAM AND ABSTRACTS

246th ACS National Meeting
Indianapolis, IN
September 8-12, 2013

S. C. Rasmussen, Program Chair

DIVISION OF THE HISTORY OF CHEMISTRY

Chair: Ned D. Heindel
Lehigh University
Department of Chemistry
Seeley G. Mudd Lab
Bethlehem, PA. 18015
Phone: (610) 758-3464
Fax: (610) 758-3461
Email: ndh0@lehigh.edu

Chair-Elect: Gary Patterson
Department of Chemistry
Carnegie Mellon University
Pittsburgh, PA 15213
Phone: (412) 268-3324
Fax: (412) 268-1061
Email: gp9a@andrew.cmu.edu

Past Chair: E. Thomas Strom
Department of Chemistry and Biochemistry
University of Texas at Arlington
P. O. Box 19065
Arlington, TX 76019-0065
Phone: (817) 272-5441
Fax: (817) 272-3808
Email: tomstrom@juno.com

Secretary-Treasurer: Vera V. Mainz
2709 Holcomb Drive
Urbana, IL 61802
Phone: (217) 328-6158
Email: mainz@illinois.edu

Program Chair: Seth C. Rasmussen
Department of Chemistry and Biochemistry
North Dakota State University
NDSU Dept. 2735, P.O Box 6050
Fargo, ND 58108-6050
Phone: (701) 231-8747
Fax: (701) 231-8831
Email: seth.rasmussen@ndsu.edu

***Bulletin* Editor**: Carmen J. Giunta
Le Moyne College
1419 Salt Springs Rd.
Syracuse, NY 13214-1399
Phone: (315) 445-4128
Fax: (315) 445-4540
Email: giunta@lemoyne.edu

Councilor: Mary Virginia Orna
Department of Chemistry
College of New Rochelle
New Rochelle, NY 10805
Phone: (914) 654-5302
Fax: (914) 654-5387
Email: mvorna@cnr.edu

Councilor: Roger A. Egolf
Pennsylvania State University - Lehigh Valley Campus, 2809 Saucon Valley Road
Center Valley, PA 18034
Phone: (610) 285-5110
Fax: (610) 285-5220
Email: rae4@psu.edu

Alternate Councilor: Joe Jeffers
Ouachita Baptist University
410 Ouachita Street, Box 3786
Arkadelphia, AR 71998-0001
Phone: (870) 245-5216
Fax: (870) 245-5241
Email: jeffers@obu.edu

Alternate Councilor: Arthur Greenberg
Department of Chemistry
University of New Hampshire
Parsons Hall
Durham, New Hampshire 03824
Phone: 603 862-1180
Fax: 603 862-4278
Email: art.greenberg@unh.edu

Historian: Gary Patterson
Department of Chemistry
Carnegie Mellon University
Pittsburgh, PA 15213
Phone: (412) 268-3324
Fax: (412) 268-1061
Email: gp9a@andrew.cmu.edu

Archivist: John Sharkey
Pace University
Department of Chemistry & Physical Sciences
One Pace Plaza
New York, NY 10038-1502
Phone: (610) 758-3582
Email: jsharkey@pace.edu

Final Program
HIST
DIVISION OF THE HISTORY OF CHEMISTRY

S. C. Rasmussen, *Program Chair*

SUNDAY MORNING

Section A

Indianapolis Marriott Downtown - Michigan

HIST Tutorial and General Papers

S. C. Rasmussen, *Organizer*
J. Jeffers, *Presiding*

8:30 1. HIST Tutorial: Molecules in motion - the kind we call heat. **C. Giunta**

9:10 2. Disability, despotism, and deoxygenation—outlaw to Academy Member. Nikolai Matveevich Kizhner (1867-1935). **D. E. Lewis**

9:40 Intermission.

9:55 3. Hidden gold: The nature of Purple of Cassius in the Dictionnaire de chymie. **T. P. Hanusa**

10:25 4. Samuel C. Lind: Father of US radiation chemistry. **R. L. Hudson**

10:55 5. Path to Conducting Polyacetylene. **S. C. Rasmussen**

SUNDAY AFTERNOON

Section A

Indianapolis Marriott Downtown – Michigan

HIST Award Symposium Honoring William R. Newman

S. Mauskopf, S. C. Rasmussen, *Organizers*
J. Heilbron, *Presiding*

1:00 Introductory Remarks.

1:15 6. Seeking true principles: The evolution of Wilhelm Homberg's *Essais de chimie*. **L. M. Principe**

1:55 7. Corpuscles, elements, and principles: The limits of fire analysis in Herman Boerhaave's chemistry. **J. C. Powers**

2:35 8. Working in time: The inner craftsman as teleological agent in Paracelsian biology. **J. Shackelford**

3:15 Intermission.

3:30 9. Corpuscular chymical tradition in Germany and the question of the metaphysical principles. **J. A. Klein**

4:10 10. Mercury and sulfur among some medieval European alchemists. **W. R. Newman**

SUNDAY EVENING

Indianapolis Marriott Downtown – Michigan

5:00 - 5:30 HIST Business Meeting

MONDAY MORNING

Section A

Indianapolis Marriott Downtown – Michigan

What's Your Number: A Centennial Remembrance of Henry Moseley

G. Patterson, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 11. Henry Gwyn Jeffries Moseley: A remembrance. **G. D. Patterson**

8:35 12. Ordering the elements: van den Broek and Moseley. **C. J. Giunta**

9:05 13. Bringing Law and Order to the Table. **P. J. Karol**

9:35 14. Bohr and Moseley. **J. L. Heilbron**

10:05 Intermission.

10:20 15. Blurring the boundaries among chemistry, physics, and astronomy: The Moseley Centenary. **V. Trimble**

10:50 16. Bibliography of H.G.J. Moseley. **G. D. Patterson**

11:20 Panel Discussion.

MONDAY AFTERNOON

Section A

Indianapolis Marriott Downtown – Michigan

Historical Origins of Mass Spectrometry

Cosponsored by Bolton Soc
Financially supported by American Society for Mass Spectrometry

M. Grayson, *Organizer*
G. Patterson, *Organizer, Presiding*

1:00 Introductory Remarks.

1:05 17. Natural history of positive electricity. **G. D. Patterson**

1:35 18. True origin of the first mass spectrometer. **O. D. Sparkman**

2:05 19. Isotopes: The era of the physicist. **M. A. Grayson**

2:35 20. MS/MS: From Thomson's day to ours. **R. G. Cooks**

3:05 Intermission.

3:20 21. Molecular mass spectra: the chemistry of gaseous organic ions. **F. W. McLafferty**

3:50 22. Time-of0flight mass spectrometry: from niche to mainstream. **K. G. Standing**

4:20 23. Ever-widening horizons of biological mass spectrometry. **C. E. Costello**

MONDAY EVENING

Indianapolis Marriott Downtown - Atlanta

5:00 - 8:00 HIST Executive Committee Meeting

MONDAY EVENING

Section A

Indiana Convention Center - Halls F&G

Sci-Mix

S. C. Rasmussen, *Organizer*

8:00 - 10:00

1, 2, 5, 12, 19, 23. See previous listings.

TUESDAY AFTERNOON

Section A

Indianapolis Marriott Downtown – Michigan

Helen Free: Science and Legacy of a unique Past ACS President

J. Hayes, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 24. The Early Years at Miles Laboratories. **R. Savol**, M. Sproull, C. Ringuette

2:20 25. The Scientific Legacy of Helen M. Free, 1993 ACS President. **D. V. Brown**

2:40 26. The woman who launched at least a thousand chemistry outreach programs. **D. Creech**

3:00 27. Helen Free and the National Inventors Hall of Fame. **R. Paiva**

3:20 Intermission.

3:40 28. The Helen M. Free Award for Public Outreach. **J. Butler**

4:00 29. Science-2-Go Bus. **P. Boehler**

4:20 30. Helen Free: The Family's Prespective. **E. Free**

4:40 31. Thanks and Serendipity. **H. M. Free**.

HIST 1 - HIST Tutorial: Molecules in motion - the kind we call heat

Carmen Giunta, *giunta@lemoyne.edu. Department of Chemistry, Le Moyne College, Syracuse, NY 13214, United States*

The random motion of atoms, ions, and molecules has long been recognized as the microscopic explanation of heat. An overview will be given of how natural philosophers, chemists, and physicists understood and explained heat from the 17th through the 19th centuries. Mechanical corpuscular theories of the 17th century included an understanding of heat as motion. Because heat was obviously related to fire it could be understood in terms of the phlogiston theory while that theory held sway. Even while challenging the existence of phlogiston, Lavoisier explained heat in terms of another imponderable material, caloric. At the very end of the 18th century, experiments by Rumford and Davy supported the interpretation of heat as motion. During the 19th century the idea of heat as motion was developed into a quantitative dynamical theory of heat through the work of Carnot, Joule, Mayer, Clausius, Thomson, Maxwell, and Boltzmann among others.

HIST 2 - Disability, despotism, and deoxygenation—outlaw to Academy Member. Nikolai Matveevich Kizhner (1867-1935)

David E. Lewis, *lewisd@uwec.edu.Chemistry. University of Wisconsin-Eau Claire, Department of Chemistry, University of Wisconsin-Eau Claire, Eau Claire, WI 54702, United States*

Nikolai Matveevich Kizhner (Николай Матвеевич Кижнер, 1867-1935) is immortalized in the name of the reaction he discovered, and that was discovered almost simultaneously by Ludwig Wolff (1857-1919). The Wolff-Kishner reduction, which is now just over a century old, is taught in practically every introductory organic chemistry course. Kizhner's career details are readily available, but they are also symptomatic of the fact that a famous chemist frequently becomes the captive of his fame, and this has certainly been the case with Kizhner. There are relatively few details about his non-professional life, but, fortunately, there is biographical material available about him during his first academic appointment, as the founding Director of the Chemistry Laboratory at the Imperial Tomsk Technological Institute, in Tomsk, Siberia. Here, during the first decade of his professional career, he passed through a remarkable series of events: he suffered the amputation of not one, but both legs below the knee, he organized teacher/student strikes against the government of Tsar Nicholas II, he was exiled from Tomsk for a year on the orders of the Governor-General of Western Siberia, and he discovered the reduction of ketones and aldehydes by base decomposition of their hydrazones. The early years of the career of this remarkable chemist will be discussed.

HIST 3 - Hidden gold: The nature of Purple of Cassius in the *Dictionnaire de chymie*

Timothy P. Hanusa, *t.hanusa@vanderbilt.edu. Department of Chemistry, Vanderbilt University, Nashville, Tennessee 37235, United States.*

The problem of reproducing the synthesis of metal nanoparticles is well known among practitioners of modern nanoscience, even if it is not often mentioned in the literature (see, e.g., Moshofsky and Mokari, *Chem. Mater.*, 2013). The poster child for such difficulties should probably be the gold-based pigment, Purple of Cassius. Known since the 17th century, Purple of Cassius' identity as a nanoparticulate gold hydrosol supported on tin oxide was not universally accepted until the work of Richard Zsigmondy in the 1890s. Zsigmondy, in turn, recognized that his results basically reaffirmed the conclusions of Michael Faraday, who with the aid of light-scattering experiments had deduced the same in 1857. Remarkably, eighty years before Faraday's work, Pierre Joseph Macquer wrote in the *Dictionnaire de chymie* (Paris, 1778) that the color of Purple of Cassius was due to gold that was finely divided ("*extrêmement divisé*"). Up until the time of Zsigmondy, however, many chemists, including J. J. Berzelius, held an alternate view: Purple of Cassius was considered to be a compound, probably derived from a gold oxide with tin oxide. The latter interpretation was not unreasonable, as the pigment failed classical chemical tests for gold (e.g., the gold was not extracted with mercury). The fact that the exact conditions under which the pigment was formed led to variations in its color made the replication of experimental results difficult, further complicating its study. In this presentation, we examine the arguments put forth in the *Dictionnaire de chymie* in defense of the presence of metallic gold in Purple of Cassius, which given

the nature of the material and the limitations of 18th century chemical theory, was a remarkably perceptive interpretation of the available data.

HIST 4 - Samuel C. Lind: Father of US radiation chemistry

Reggie L. Hudson, *reggie.hudson@nasa.gov. Astrochemistry Laboratory, NASA Goddard Space Flight Center, Greenbelt, Maryland 20771, United States.*

Samuel Colville Lind was an important figure in early-to-mid-20th century chemistry in the United States, serving as an ACS president, Priestley medalist, editor of the Journal of Physical Chemistry, president of the American Electrochemical Society, and member of the National Academy of Sciences. This presentation will review Lind's life, work, and legacy, focusing on his pioneering contributions to the then new field of radiation chemistry, particularly Lind's books on the subject.

HIST 5 - Path to Conducting Polyacetylene

Seth C. Rasmussen, *seth.rasmussen@ndsu.edu. Department of Chemistry and Biochemistry, North Dakota State University, Fargo, ND 58103,United States.*

The discovery that the conductivity of conjugated organic polymers can be controlled through oxidation or reduction led to materials combining the electronic properties of metals with the weight and density of plastics. For this reason, such materials have been studied extensively and their importance recognized with the awarding of the 2000 Nobel Prize in chemistry to Alan Heeger, Alan MacDiarmid, and Hideki Shirakawa. The award stemmed from their work on conducting polyacetylene via doping with oxidants which they carried out in the late 1970s. Prior to this, however, Berets and Smith reported conductive polyacetylene doped with BF_3 and BCl_3 in 1968, work which has been almost totally overlooked in the history of conjugated polymers. The work of Berets and Smith will be presented and then compared and contrasted with the later work of Heeger, MacDiarmid, and Shirakawa to try to give a more complete picture of the history of conductive organic polymers.

HIST 6 - Seeking true principles: The evolution of Wilhelm Homberg's *Essais de chimie*

Lawrence M. Principe, *lmafp@jhu.edu. The Charles Singleton Center for the Study of Pre-Modern Europe, The Johns Hopkins University, Baltimore, MD 21218, United States.*

Wilhelm Homberg (1653-1715) was one of the most prominent and ambitious chymists of the late seventeenth century. Once admitted to the Parisian Académie Royale des Sciences in 1691, he labored for the rest of his life to establish a sound foundation for chemistry, at once more practical and experimental than the airy speculations of the physicists and more theoretically rigorous than the recipe-based compliations of contemporaneous chemical textbook writers like Nicolas Lemery. His system was to be summarized in a comprehensive textbook of his own. While selected chapters were published serially from 1702 until 1709, the complete work was never published. Following extensive archival explorations, I have collected four versions of the text dating over a twenty-year period. This paper will examine the changes in Homberg's ideas about the constitutive principles of mixed bodies, the difficulties he faced in isolating them, and his remarkable experimental programs that forced him frequently to revise his conclusions as new observational results emerged from his laboratory.

HIST 7 - Corpuscles, elements, and principles:The limits of fire analysis in Herman Boerhaave's chemistry

John C. Powers, *jcpowers@vcu.edu. STS Program & Department of History, Virginia Commonwealth University, Richmond, VA 23284-2001, United States.*

In the 18th century, chemists saw fire as the traditional, central tool for conducting chemical operations and analysis. Yet, building on the critiques of Joan Baptista van Helmont and Robert Boyle, academic chemists placed analysis by fire as a technique for breaking chemical bodies into their constituent elements or principles under serious scrutiny. One such chemist was Herman Boerhaave (1668-1738), who claimed, following Boyle, that many examples of analyses were, in fact, not reductions into a body's elements, but rather the rearrangement of particles by the fire. As a result, Boerhaave undertook an examination to determine the true effects of chemical operations in matter, focusing primarily on the nature and effects of fire. This paper will discuss some of Boerhaave's experiments and conclusions from this examination, which relate to his definition of a chemical element, his notion of the pabulum ignis as principle of inflammability, and his operational definition of chemical species. In addition, I show that these aspects of Boerhaave's work have ramifications for later developments in chemistry, especially those of Lavoisier and his compatriots during the Chemical Revolution.

HIST 8 - Working in time: The inner craftsman as teleological agent in Paracelsian biology

Jole Shackelford, *shack001@umn.edu. Medical School, University of Minnesota, Minneapolis, MN 55455, United States.*

The importance of the archaeus for Paracelsus' understanding of physiology is well known, as is the longevity and various permutations of the concept in Helmontian medicine. Recently historians have reconsidered the archaeus as a craftsman, that is, as a mechanic, and pondered how this affects the traditional distinction drawn in the history of science between Paracelsian vitalism and what became known as the “Cartesian” mechanical philosophy. I will explore this concept by considering time – duration and timing – as an essential characteristic of Paracelsian bodies, much as color, saltiness, hardness, and other characteristics traditionally associated with Aristotelian form, and offer some ideas about why this inner temporality accounts for the continued usefulness of the archaeus, often anonymously, into the nineteenth century.

HIST 9 - Corpuscular chymical tradition in Germany and the question of the metaphysical principles

Joel A. Klein, *kleinja@indiana.edu. Indiana University, United States, The Chemical Heritage Foundation, United States.*

William Newman's research has demonstrated the importance of medieval alchemy and early-modern chymistry to the development of modern science, and in particular, his recent work has shown the importance of experimental chymical atomism in the development of corpuscular theories in the seventeenth century. Conversely, following the work of Betty Jo Teeter Dobbs and Robert Siegfried, a group of historians of chemistry have demarcated the eighteenth-century understanding of elements and principles from earlier chymistry and alchemy, wherein, they argued, the principles were viewed as metaphysical and intangible. I have maintained elsewhere that early-modern chymistry was an art defined by the analysis and synthesis of materials to discover internal, sensible principles, and that this emphasis on tangible principles allowed chymists to defend the exceptionality of their discipline against competitors from the sixteenth through the eighteenth century. In this paper I further explore the sensible nature of the chymical principles and question their alleged metaphysical status and the purported discontinuity between the seventeenth and eighteenth centuries. The current understanding of metaphysical principles was based almost exclusively on the French textbook tradition, neglecting multiple other groups. I thus focus on several German chymists who developed an influential view of the chymical principles that grew from the adoption of corpuscular chymistry into academic medicine and natural philosophy. These chymists promoted an experimental and corpuscular understanding of nature that furthered the conceptual understanding of composition, the purity of substances, and affinity. Some chymists even argued directly against the notion that the chymical principles were metaphysical.

HIST 10 - Mercury and sulfur among some medieval European alchemists

William R. Newman, *wnewman@indiana.edu. Department of History & Philosophy of Science, Indiana University, Bloomington, IN 47401, United States.*

The influential 1968 paper "Composition: A Neglected Aspect of the Chemical Revolution," by Betty Jo Dobbs and Robert Siegfried, had as one its core features the belief that the traditional alchemical components of metals, mercury and sulfur, were somehow idealized principles representing states or types of matter rather than the common materials corresponding to their names. Although that may have been true in some instances, there is considerable evidence to challenge this view among the founding documents of European alchemy, particularly in the case of those composed in the High and Late Middle Ages. Since many of these treatises were still being widely read and analyzed in the early modern period, their significance to the debate should not be underrated. My talk will therefore focus on several alchemical treatises from the thirteenth and fourteenth centuries in order to complement the other papers in the session (particularly Joel Klein's paper) that deal with later chymical authors.

HIST 11 - Henry Gwyn Jeffries Moseley: A remembrance

Gary D Patterson, *gp9a@andrew.cmu.edu. Department of Chemistry, Carnegie Mellon University, Pittsburgh, PA 15213, United States.*

One of the greatest scientists of the 20th century died an early death under tragic circumstances of war. But, during his short lifetime Henry Gwyn Jeffries Moseley lived a remarkable and active life. This introductory talk will detail his aristocratic birth, remarkable childhood, education, and his final fatal military service. The focus will be on his character and his drive. The details of his research will be reserved for many other speakers.

HIST 12 - Ordering the elements: van den Broek and Moseley

Carmen J Giunta, *giunta@lemoyne.edu. Department of Chemistry and Physics, Le Moyne College, Syracuse, NY 13214, United States.*

The atomic number, the number of protons in the atomic nucleus, has been recognized as the proper ordering principle of the periodic table for nearly a century. But the notion of assigning ordinal numbers to the elements is as old as the periodic table, and a proposal linking that ordering number to nuclear charge is about as old as the nuclear model of the atom. This presentation will trace the origins of the atomic number concept, focusing primarily on the contributions of Antonius van den Broek and Henry Moseley.

HIST 13 - Bringing Law and Order to the Table

Paul J Karol, *pk03@andrew.cmu.edu. Department of Chemistry, Carnegie Mellon University, Pittsburgh, PA 15213, United States.*

Ernest Rutherford’s students included Niels Bohr, Bentram Boltwood, James Chadwick, John Cockcroft, Kazimierz Fajans, Hans Geiger, Otto Hahn, Douglas Hartree, Pyortr Kapitsa, and Frederick Soddy. Yet he esteemed Henry Moseley as the best of the young people he had ever had. Moseley spent only a few years with Rutherford, first working on radioactive decays and then jumping to his own interest in exploring an intriguing craze, the nature and application of X-rays, overcoming the initial resistance of Rutherford to this risky venture. A confluence of instrumental and theoretical advances enabled the ingenious and insightful Moseley to demonstrate his eponymous Law, taking advantage the new field of X-ray spectrometry and rapidly bringing order to the Periodic Table one century ago.

HIST 14 - Bohr and Moseley

John L. Heilbron, *john@heilbron.eclipse.co.uk. Department of History of Science and Technology, University of California, Berkeley, CA 94720, United States.*

Early in 1913, Niels Bohr returned briefly to Ernest Rutherford's physics department at the University of Manchester, where he had spent a few months during the academic year 1911/12. His purpose was to convince Rutherford, who had agreed to submit his revolutionary paper on the spectrum of hydrogen and helium for publication, of the importance of every single word in it. Rutherford's prize student Henry Moseley was then just beginning the researches that would make him famous. Very likely he was aware of the lively debate over the length and content of the revolutionary paper and took the opportunity to discuss his research plans with the stubborn Danish visitor who could do battle with Rutherford. In a subsequent exchange of correspondence, Moseley and Bohr tried with indifferent success to relate the details of Moseley's findings about x-ray spectra to Bohr's quantum atom. Soon after Moseley's death in 1915, some of his last, unpublished results came into Bohr's hands. These may have included the contents of a notebook, now lost, which Moseley's mother had entrusted to Rutherford. Moseley placed a very high value on this notebook. A speculation about its contents will be hazarded.

HIST 15 - Blurring the boundaries among chemistry, physics, and astronomy: The Moseley Centenary

***Virginia Trimble**, vtrimble@astro.umd.edu. Department of Physics and Astronomy, University of California at Irvine, Irvine, CA 92697, United States.*

Scientists, like other human beings, are territorial creatures, not just about our parking spaces and seats in the colloquium room, but also about our scientific territories, from the narrowest thesis topic to the whole of chemistry or physics or astronomy. Many 19th century astronomers resented spectroscopes invading their observatories; chemists objected to Moseley's use of X-rays outgaming their retorts and test tubes in 1913; and chemists and physicists typically disbelieve astronomers suggesting new science on the basis of astronomical data (Mendeleev did not welcome Lockyer's helium, and physicists were reluctant to admit that the apparent deficit of neutrinos coming from the sun arose from incomplete physics rather than scruffy astrophysics). The talk will explore some of these transgressions, both some spectacular successes and rather more awkward failures. Moseley's own contributions included sorting out the rare earths, putting paid to nebulium and coronium as elements between H and He, many years before improved understanding of atomic structure led to correct identifications of the ionization states and transitions actually responsible for the lines credited to them, and putting Prout's hypothesis on a firm foundation, ready for the structure Cameron and B2FD would eventually erect there. Back in 1935, Gamow asked whether the new discipline should be called nuclear chemistry or nuclear physics. Both now exist, within ACS and APS respectively, but with rather different meanings. Decades later, chemist L.S. Trimble was still complaining that the physicists had grabbed away the territories of atomic and nuclear composition, which should have been part of chemistry!

HIST 16 - Bibliography of H.G.J. Moseley

***Gary D Patterson**, gp9a@andrew.cmu.edu. Department of Chemistry, Carnegie Mellon University, Pittsburgh, PA 15213, United States*

While Henry Gwyn Jeffries Moseley (1887-1915) published only a few papers himself, he spawned a vast number of papers and books on the x-ray spectroscopy of the elements. In this paper a bibliography of works by and about both Moseley as a person and about his contributions to x-ray spectroscopy will be presented. The talk will conclude with a look at the monumental work on “Chemical Analysis by X-Rays and its Applications” (1932) by Georg von Hevesy (1885-1966, Nobel 1943).

HIST 17 - Natural history of positive electricity

***Gary D Patterson**, gp9a@andrew.cmu.edu. Department of Chemistry, Carnegie Mellon University, Pittsburgh, PA 15213, United States*

Since antiquity it was known that some objects attracted one another and other objects repelled one another. Benjamin Franklin was able to unify the 18th century understanding of electrical phenomena by invoking two kinds of electricity. Joseph Priestley ended the century with further explanations and unifications. Michael Faraday was able to study electric current inside vacuum tubes and the electromagnetic theory of Maxwell stimulated a search for the fundamental sources of negative and positive current. Jean Perrin studied the behavior of Crooke's tubes and determined that the current was carried by negative particles. J.J. Thomson subjected these particles to magnetic fields and the "electron" was born. But, if electrons were going in one direction, what was going in the other direction to equalize the charge? Sure enough, there were cations in Crooke's tubes as well: rays of positive electricity!.

HIST 18 - True origin of the first mass spectrometer

***O David Sparkman**, ods@compuserve.com. Department of Chemistry, University of the Pacific, Stockton, California 95211, United States*

Was J.J. Thomson's 1913 book *Rays of Positive Electricity* the first monograph to report what has become known as “the mass spectrometer”? Francis William Aston was awarded the 1922 Nobel Prize in Chemistry in part for the development of a mass spectrograph. Thomson first observed that neon produced two separate signals in his rays of positive electricity apparatus, but he was not able to say what they were. Aston recognized what the singles represented and capitalized on this. This presentation will attempt to answer those questions that come up in every course on mass spectrometry of who and when was the mass spectrometer developed. One hundred years after what is considered to be the first mass spectrometry book was published, the question is still a question, until now; maybe.

HIST 19 - Isotopes: The era of the physicist

***Michael A Grayson**, mikeagrayson@gmail.com. American Society for Mass Spectrometry, St. Charles, MO 63303, United States*

The story of isotopes and mass spectrometry begins with J. J. Thomson who observed a line at mass 22 in the positive ray analysis of neon in 1912. Interestingly, while Thomson accepted the existence of isotopes among the radionuclides, he held firmly to the belief that stable elements were monoisotopic. In truth, we should credit Aston with the discovery of isotopes of the stable elements – as he was when awarded the Nobel Prize in Chemistry in 1922. Aston chose the exploration of isotopes of the elements as his primary research enterprise; and began by creating a new and improved positive ray analyzer. His competitor and colleague in this enterprise was A. J. Dempster, an expatriate Canadian at the University of Chicago, who – developing his own mass analyzer – was the first to report the isotopes of several elements, mainly because he did not feel the need to use gas discharge as the only method of sample ionization. As the importance of Einstein's classic equation relating energy and mass became more widely understood, the physics community was intent on determining the exact masses and relative abundance of the isotopes for all of the elements. This was a strong motivator for the design and construction of mass analyzers capable of ever more precise mass determinations as well as accurate abundance measurements. Nier joined this group of physicists in 1935 when he reported a previously unknown isotope of potassium. Both Dempster, Bainbridge and Nier made important contributions to the understanding of nuclear fission in uranium. While physicists dominated this endeavor, we can credit a petroleum chemist, Meyerson, for prompting the physics community to revisit and correct the relative abundance of chlorine isotopes in 1961.

HIST 20 - MS/MS: From Thomson's day to ours

***R Graham Cooks**, cooks@purdue.edu. Department of Chemistry, Purdue University, West Lafayette, Indiana 47907, United States*

Collision-induced dissociation has been known almost as long as mass spectrometry. This presentation covers the history of this subject, from early adventitious observations through systematic studies of the kinematics and dynamics of inelastic ion/molecule in/surface collisions over a range of collision energies, through the development of collision-induced dissociation as a method of characterization of ions to the examination of individual constituents of complex mixtures using tandem mass spectrometry. The later development of alternatives to collision-induced dissociation is also mentioned. The talk can be summarized by the acronyms related to the methodology: m*, MIKES, MS/MS, MRM, SID, etc. and alternatively by the people mostly responsible for these developments –White, Jennings, McLafferty, Futrell, etc.

HIST 21 - Molecular mass spectra: the chemistry of gaseous organic ions

***Fred W McLafferty**, fwm5@cornell.edu. Department of Chemistry and Chemical Biology, Cornell University, Ithaca, New York 14850, United States*

When I joined the Mass Spectrometry Section of the Dow Chemical Company in 1950, MS was a successful method for the quantitative analysis of small hydrocarbons. “Electron ionization (EI)” excited gaseous molecules, with those sufficiently excited undergoing unimolecular decomposition into product ions. This “gaseous ion” chemistry was poorly understood. The early “Quasiequilibrium Theory” of Rosenstock, Wallenstein, Wahrhaftig, and Eyring provided a theoretical foundation for understanding the EI mass spectrum of propane. Better understanding of gaseous ion chemistry began with specific studies of common chemical classes. A major breakthrough came through the extensive collection of non-hydrocarbon reference EI spectra. Crazy reactions that change the atomic order of the molecule, “rearrangements”, were suddenly not only understandable, but highly valuable for structure elucidation. Although new methods such as electrospray ionization only yield “evenelectron” ions which do not exhibit this chemistry, it can now be applied to far larger molecules with “Electron Capture Dissociation”.

HIST 22 - Time-of-flight mass spectrometry: from niche to mainstream

***Ken G Standing**, standing@cc.umanitoba.ca. Department of Physics, University of Manitoba, Winnipeg, Manitoba, Canada*

World War II electronic advances suggested the use of time-of-flight for mass measurements (Stephens), and subsequently to the development of commercial TOF instruments by Bendix and by Bioion (TOF/PDMS/MacFarlane), as well as to the use of TOF/SIMS (Standing). Although the latter TOF methods were the only ones capable of measuring the masses of really large biomolecules, most mass spectrometrists were still wedded to sector/quadrupole instruments for high/low-end mass measurements. The coup-de-grâce for TOF (as generally believed) was the discovery (Barber1981) of a suitable matrix (glycerol), which enabled the use of sector/quadrupole instruments for measurements of large biomolecules ("fabulous FAB"). Ironically, it was the discovery of suitable matrices for laser excitation (MALDI/Hillenkamp/Karas) that revived TOF, aided by the additional accuracy provided by the reflecting geometry (Mamyrin), and the subsequent development of orthogonal injection (Dodonov). Thus TOFMS/MALDI, along with electrospray, are the prime methods now used for the mass spectrometry of biomolecules.

HIST 23 - Ever-widening horizons of biological mass spectrometry

***Catherine E Costello**, cecmsms@bu.edu. Department of Biochemistry, Biophysics and Chemistry, Boston University School of Medicine, Boston, Massachusetts 02188, United States*

Physicists and physical chemists started the field of mass spectrometry (MS) and the petroleum industry promoted development of commercial instrumentation, but it is mass spectrometry's relevance to biology and medicine that has propelled much of its growth and public attention. MS defines biochemical pathways, taking particular advantage of stable isotope-labeled tracers. Early work that focused on drug metabolism and toxicology has led to critical roles in sports competitions and forensics. MS enabled amino acid sequencing of peptides and precise structural determinations of steroids, glycans, oligonucleotides, toxins and perfumes; today it is the fundamental approach for proteomics, glycomics, lipidomics, metabolomics and dynamic imaging. The needs of biological MS have motivated increases in mass range, scan speed, sensitivity, resolution and mass accuracy; today's amazing instruments are capable of analyzing vanishingly small amounts of materials that are components of extremely complex mixtures, well beyond the imagination and dreams of early practitioners.

HIST 24 - The Early Years at Miles Laboratories

***Rosanne Savol**[1], rsavros@aol.com. Mary Sproull[2], Celeste Ringuette[2]. (1) Rosebud Consulting, Granger, IN 46530, United States (2) Unaffiliated, United States*

Helen Free began her career at Miles Laboratories in Elkhart, IN. In this presentation we will share stories of her early adventures in chemistry.

HIST 25 - The Scientific Legacy of Helen M. Free, 1993 ACS President

***Daniel V. Brown**, daniel.brown@bayer.com. Bayer Diabetes Care, Mishawaka, IN 46544, United States*

Helen Mae Murray Free maintained a profound interest in raising public awareness to the many beneficial contributions of chemistry to society, but to some members, her own part in those contributions might not be well understood. Helen began her career in chemistry at Miles Laboratories in Elkhart, Indiana. After a short stint in the Quality Control department, she joined her future husband's research team. Al and Helen, who married in 1947, became lifelong research partners. Initially the Frees and their research team focused on improving tablet-based clinical chemistry tests for glucose and ketones, but eventually turned their attention to inventing dipstick-type methodologies that are common today.

Key technical challenges that the researchers overcame included enhancing assay specificity for glucose over other sugars, and impregnating filter paper-based strips to effect a stable, convenient, cost-effective reagent. The Frees became recognized experts in the field of urinalysis, publishing numerous texts and monographs. Urine strip testing is a standard practice for patients seen in physicians' offices, medical clinics and hospitals as an initial indicator of metabolic or kidney disorders.

HIST 26 - The woman who launched at least a thousand chemistry outreach programs

Denise Creech, *D_Creech@acs.org. American Chemical Society, United States*

Helen Free was a critical element of the launch of many of ACS's public outreach programs including National Chemistry Day/Week having served as its Task Force chair and shepherding the program from a day to a biannual weekly celebration to an annual celebration in 1993. She led the first International Chemistry Celebration in 1999 and was active with the ACS Kids-n-Chemistry program. In 1995, the Helen M. Free Award in Public Outreach was inaugurated and Helen Free was its first recipient. This talk will describe Helen's contributions to the ACS's commitment to educating the public about the contributions that chemists make to improve people's lives.

HIST 27 - Helen Free and the National Inventors Hall of Fame

Rini Paiva, *rpaiva@invent.org. National Inventors Hall of Fame, United States*

This presentation will introduce the National Inventor's Hall of Fame and the National Medal of Technology and Innovation. The major example will be how Helen and Al Free's work resulted in Helen receiving both of these honors.

HIST 28 - The Helen M. Free Award for Public Outreach

J. Keith Butler, *keith.butler@aollc.biz. American Ordnance LLC, Milan, TN 38358, United StatesAwards Subcommittee Chair, ACS Committee on Public Relations and Communications, United States*

The Helen M. Free Award for Public Outreach recognizes outstanding achievements in the field of public outreach by a member of the ACS who improves public recognition and appreciation for the contributions of chemistry. This award was established in 1995 by the American Chemical Society Committee on Public Relations and Communications to honor Dr. Free. As the 1993 president of ACS she pledged to initiate and support activities that would improve the public's awareness of chemistry's contributions to the quality of daily life. There have been 18 winners of this award all committed to public outreach by chemists and chemical engineers. For the purposes of this award, public outreach activities are defined as those that reach lay audiences, as opposed to science professionals.

HIST 29 - Science-2-Go Bus

Patsy Boehler, *patsy@ethos.org. ETHOS, Goshen, IN 46528, United States*

Science-2-Go Bus is an outreach activity of the Ethos Center of Elkhart, IN. Helen Free and the Al and Helen Free Foundation have provided both funding and encouragement and support for this unique program to encourage technology and hands on science. As Executive Director, the speaker will both describe the program and Helen's support for Ethos Center.

HIST 30 - Helen Free: The Family's Prespective

Eric Free, *efree49@yahoo.com. Unaffiliated, Cape Coral, FL 33914, United States*

As Helen's oldest son, the speaker will reflect on the personal, domestic, and recreational side of this outstanding lady.

HIST 31 - Thanks and Serendipity

Helen M Free, *Hmfree23@aol.com. Bayer Chemicals, Elkhart, IN 46515, United States*

Helen's opportunity to respond.