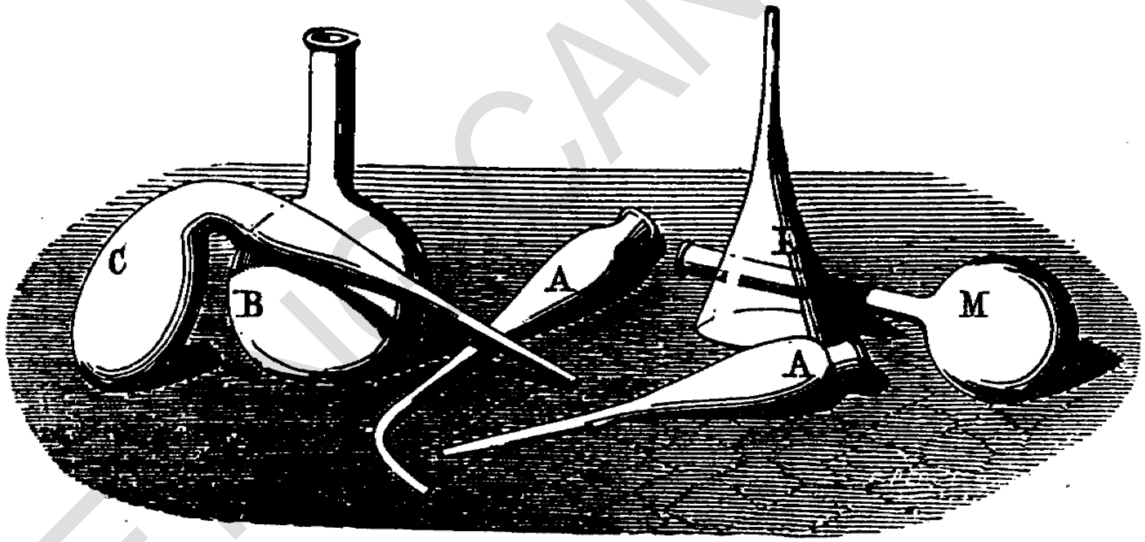
American Chemical Society

DIVISION OF THE HISTORY OF CHEMISTRY



PROGRAM & ABSTRACTS

259th ACS National Meeting
Philadelphia, PA
March 22-26, 2020

Nicolay V. Tsarevsky, Program Chair

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Final Program

DIVISION OF THE HISTORY OF CHEMISTRY (HIST)

N. V. Tsarevsky, *Program Chair*

SUNDAY MORNING

Section A

Pennsylvania Convention Center,

120C

General Papers & Tutorial

N. V. Tsarevsky, *Organizer, Presiding*
C. J. Giunta, S. C. Rasmussen, *Presiding*

8:45 HIST 1. Teaching history of chemistry: Pedagogical elements leading to student success. **S.B. Mitchell**

9:15 HIST 2. Marie M. Daly, Ph.D.: Scientific contributions and legacy. **L.C. Meade-Tollin**

9:45 HIST 3. Dr Marie Maynard Daly: Her life and work. **J.E. Brown**

10:15 Intermission.

10:30 HIST 4. Paul Caspar Freer (1861-1912): Expatriate American chemist. **W. Palmer**

11:00 HIST 5. Nikolai Aleksandrivich Menshutkin (1834-1907): Physical organic chemistry four decades before Hughes and Ingold. **D.E. Lewis**

11:30 HIST 6. Early women chemists in Chicago: Romp through the first decade of The Chicago Chemical Bulletin (1914-1924). **M.E. Schott**

SUNDAY AFTERNOON

Section A

Pennsylvania Convention Center,

120C

The Life & Legacy of Alfred Bader

Cosponsored by SCHB
M. Orna, *Organizer, Presiding*

1:00 Introductory Remarks.

1:05 HIST 7. Alfred Bader: Extraordinary journey remembered. **M.S. Jacobs**

1:30 HIST 8. How seeds grow: Project SEED mentor perspective. **S.L. Haynie**

1:50 HIST 9. How project SEED propelled one undergraduate into a potential research career. **M. Ortiz**

2:10 HIST 10. Visiting the University of Wisconsin at Eau Claire. **A.A. Denio**

2:30 HIST 11. Alfred Bader: Masterpiece of a life. D. Herschbach, **M. Orna**

2:55 HIST 12. Alfred Bader: Chemistry connector and art collector. **V. Snieckus**

3:25 Concluding Remarks.

SUNDAY EVENING

Pennsylvania Convention Center,

120C

5:00 - 7:00 HIST Executive Committee Meeting

MONDAY MORNING

Section A

Pennsylvania Convention Center,

120C

History of Polymer Science

Cosponsored by CELL‡
G. D. Patterson, S. C. Rasmussen, N. V. Tsarevsky, *Organizers, Presiding*

8:30 HIST 13. From polymer to macromolecule: Historical evolution of polymer terminology. **S.C. Rasmussen**

9:00 HIST 14. Learning about the macromolecules of life through historical developments in biophysical chemistry. **W.K. Olson**

9:30 HIST 15. Early observations and studies of the radical polymerization of vinyl and vinylidene compounds. **N.V. Tsarevsky**

10:00 HIST 16. Following the PVC pipeline: Misconceptions and milestones from discovery to industrialization. **E.W. Culver**, S.C. Rasmussen

10:30 Intermission.

10:40 HIST 17. History of Poly(organophosphazenes). **H.R. Allcock**

11:10 HIST 18. History vs. legend: Discovery and development of conducting polymers. **S.C. Rasmussen**

11:40 HIST 19. All things Bakelite: Age of plastics documentary film. **H. Karraker**

MONDAY AFTERNOON

Section A

Pennsylvania Convention Center,

120C

History of Polymer Science

Cosponsored by CELL‡
G. D. Patterson, S. C. Rasmussen, N. V. Tsarevsky, *Organizers, Presiding*

1:30 HIST 20. Nifty fifty: Polymer scientists who created the discipline. **G.D. Patterson**

2:30 HIST 21. Staudinger, Sakurada, and the macromolecular debate in the 1930s. **Y. Furukawa**

3:00 HIST 22. Walter H. Stockmayer and polymer science: Dartmouth years. **J. Lipson**

3:30 HIST 23. Professor Mihai Dimonie’s contribution to polymer science and the education of many generations of students at the Politehnica University of Bucharest. **M.C. Stefan**, M. Teodorescu, H. Iovu, S. Coca, G. Hubca, L. Dinca

4:00 Intermission.

4:10 HIST 24. Brief history of the Polymer Science and Engineering Department at the University of Massachusetts. **T.P. Russell**

4:40 HIST 25. Origin and development of polymer science in India: Historical perspectives. **S. Sivaram**

5:10 HIST 26. Chemical philately and a stamp collector's view of polymer science. **D. Rabinovich**

MONDAY EVENING

Section A

Pennsylvania Convention Center,

Exhibit Hall A

Sci-Mix

N. V. Tsarevsky, *Organizer*

8:00 - 10:00

HIST 3, **10**, **14**, **17**, and **24**: see previous listings.

HIST 27, **31**, **32**, **33**, and **35**: see subsequent listings.

TUESDAY MORNING

Section A

Pennsylvania Convention Center,

120C

General Papers & Tutorial

N. V. Tsarevsky, *Organizer, Presiding*
C. J. Giunta, S. C. Rasmussen, *Presiding*

8:45 HIST 27. Invention of the GC-MS. **M.E. Jones**, S. Rovner

9:15 HIST 28. Advancements in chromatography and mass spectrometry for detecting the use of performance enhancing drugs at the Olympic Games. **A.R. Roerdink**

9:45 HIST 29. Drugs that shaped the FDA from elixir sulfanilamide to thalidomide. **J.L. Epstein**

10:15 HIST 30. Withdrawn

10:45 Intermission.

11:00 HIST 31. Use of a graph database to explore the history of chemistry: Chemistry of history. **K.J. Boyd**, D. Escudero

11:30 HIST 32. Artists' perspectives on the history of chemical disasters. **D.B. Cordes**

TUESDAY AFTERNOON

Section A

Pennsylvania Convention Center,

120C

General Papers & Tutorial

N. V. Tsarevsky, *Organizer, Presiding*
C. J. Giunta, S. C. Rasmussen, *Presiding*

1:00 HIST 33. Manufacturing white lead in the new republic: Review of the Wetherill's stack process. **K.C. Cannon**

1:30 HIST 34. Indigo plantation in India: Connecting history with chemistry. **A. Rahman**, J. Hua, Y. Yoon, X. Jiang, R. Rajeev

2:00 HIST 35. Ski wax: Skier's edge in extracting competitive advantage. **B.J. Love**

2:30 HIST 36. Superphosphate and the development of industrial chemistry at Newtown Creek in 19th century New York. **P. Spellane**

Historical Perspectives on Cellulose & other Renewable Materials

Sponsored by CELL, Cosponsored by BIOT, HIST‡ and MPPG‡

ABSTRACTS

HIST 1

Teaching history of chemistry: Pedagogical elements leading to student success

Sally B. Mitchell, sbmitchell2@gmail.com. Science, Rye High School, Rye, New York, United States

In celebration of the International Year of the Periodic Table #IYPT2019 and the 150th birthday of the periodic table, the Rye High School ChemClub teamed up with students in the first chemistry class to create the “Peepiodic table of the elements” in the Open Notebook’s Peep’s contest. Each student adopted one element to research and then decorated a peep to display one concept or fact about the element. A short abstract was written about the history of the element and the “inspiration” as to why the peep was decorated in such a manner. This tutorial will explore the pedagogical elements that led to the success of the project in terms of fulfillment of the goals of the chemistry course and of the Next Generation Science Standards.

HIST 2

Marie M. Daly, Ph.D.: Scientific contributions and legacy

Linda C. Meade-Tollin, lmt2050@gmail.com. Surgery, University of Arizona College of Medicine, Tucson, Arizona, United States

Marie M.Daley,Ph.D., a scientific pioneer, was the first female African American to receive a Ph.D. in chemistry. This presentation will provide an overview and discussion of her research and academic contributions during a highly respected career that spanned the years between 1949 and 1985.

HIST 3

Dr Marie Maynard Daly: Her life and work

Jeannette E. Brown, jebrown@infionline.net. SisterChemists LLS, Hillsborough, New Jersey, United States

Dr. Marie M. Daly was the first African American Woman to receive a Ph.D in Chemistry. I will speak about her life grouwing up and going to school. Then I will talk about now she went to college and grad school. Finally I will speak about her work and why she should be considerd for a photo award at one of the places she worked and or her college.

HIST 4

Paul Caspar Freer (1861-1912): Expatriate American chemist

William Palmer, drspalmer@optusnet.com.au. Education, Curtin University, Brighton, Victoria, Australia

Paul C. Freer was born in 1862 in Chicago. His father was a successful doctor who eventually became President of Rush Medical College. He died young in a severe epidemic of typhoid fever. Paul’s mother was born in Germany but had moved to New Orleans. After the death of her husband, she took the children back to Germany where Paul received his elementary education. The family returned to Chicago where Paul received his secondary education becoming top of his class. After high school Paul entered Rush Medical College and to study medicine but was finally attracted to chemistry. He graduated from Rush Medical College with the class of 1882, aged twenty. He then studied under Professor von Baeyer at the University of Munich obtaining his doctorate ‘summa cum laude’. He spent a short time in England in the private laboratory of Sir William Perkin working on aniline dyes and later at Owens College in Manchester. He returned to Ann Arbor, Michigan in 1889, being employed as a lecturer at University of Michigan. Later, he became Professor of Chemistry. He successfully re-organised the Department on the German model emphasising chemical research. He had a long-standing interest in science education and was an excellent public speaker. He wrote one of the better school textbooks of its era entitled, *Elements of Chemistry*. In 1905, he was appointed to the US Bureau of Science (as Director) and became superintendent of the government laboratories in Manila in the Philippines. He was expected to have a very influential career. However, his death in April 1912 from a stomach complaint (intestinal abscesses) tragically cut short his career. He was fondly remembered by both Americans and Filipinos for his scientific work in the Philippines.

HIST 5

Nikolai Aleksandrivich Menshutkin (1834-1907): Physical organic chemistry four decades before Hughes and Ingold

David E. Lewis, lewisd@uwec.edu. Chemistry Department, UW-Eau Claire, Eau Claire, Wisconsin, United States

The deaths of Beilstein (1906), Mendeleev (1907) and Menshutkin (1907), following the deaths of Markovnikov (1904) and Vagner (Wagner, 1903) signaled the end of an era in organic chemistry in the Russian Empire. Each of these chemists in one way or another is well known to modern organic chemists: Mendeleev through his Periodic Table, and the others through eponymous reactions, rules and tests. One of the less appreciated members of this group, Nikolai Aleksandrovich Menshutkin (the first Editor of the *Journal of the Russian Chemical Society*, is the subject of this paper. In an era when organic chemistry was basically a qualitative science, Menshutkin was among the first to obtain quantitative data for the influence of structure on the rates of chemical reactions. In one study, he studioed the rates of quaternization of tertiary amines with alkyl bromides and iodides, a reaction that has come down to us as the Menshutkin reaction. However, this was not the only reaction he studied. He also studied the effects of structure on the rate of the Williamson ether synthesis, and the effects of alcohol structure on the rates of esterification. Menshutkin's life and chemistry will be explored.

HIST 6

Early women chemists in Chicago: Romp through the first decade of The Chicago Chemical Bulletin (1914-1924)

Margaret E. Schott, m-schott@northwestern.edu. Chemistry, Northwestern University, Evanston, Illinois, United States

In October 1914 the Chicago Section of ACS began publishing a monthly newsletter called The Chicago Chemical Bulletin. This publication was a wide-ranging one that incorporated chemistry-related news from several major Midwest cities surrounding Chicago, editorials, news from “the front” during World War I, advertisements, humorous stories, information on upcoming meetings, and more. The same publication continues today as The Chemical Bulletin. This presentation will look at the increasing role of women in the activities of the Chicago Section and in industry through the lens of the bulletin during its first decade of existence. Consider, for example, this statement from an article in the April 1916 issue: “The reasons urged against employing women, other than habit and prejudice, are that a chemist needs a first-hand knowledge of the factory processes and must be able to go out and collect samples – ‘to go and test a coal mine, to sample a car of coal in the railroad yard.’” Thankfully, things began to change gradually over time. In addition to coverage of employment matters, one can find stories on new women’s

buildings on college campuses and letters on the paucity of women members in the Chicago Section and in ACS. Additionally, there is coverage of the first Section meeting planned by women in December 1918, colorfully worded mention of the lack of courtesy shown to women when meeting rooms are full of smoke, descriptions of opportunities for women during and after the war effort, pointers for women chemists, and women in leadership roles. Links to the archives of The Chemical Bulletin can be found online at Hathitrust and at the Chicago Section website.

HIST 7

Alfred Bader: Extraordinary journey remembered

Madeleine S. Jacobs, madeleine.susan.jacobs@gmail.com. Strategic Science, North Potomac, Maryland, United States

Alfred Bader began life under difficult circumstances that got worse before they got better. Despite the hardships he endured, he succeeded in building a successful chemical business, found the love of his life, and became a renowned art collector. Then, he became a philanthropist, giving to many worthwhile causes, including ACS's Project SEED. This remarkable journey is remembered.

HIST 8

How seeds grow: Project SEED mentor perspective

Sharon L. Haynie[1,2], lorimers@earthlink.net. (1) DuPont, Philadelphia, Pennsylvania, United States (2) Hypatia Technology Works, LLC, Philadelphia, Pennsylvania, United States

This talk will share my insights from my experiences with Project SEED students at the DuPont Experimental Station Laboratory. The Project SEED students were from high schools in Newcastle County, Delaware and were usually the only young teenager in a large research community and I had to learn what conditions best cultivated a good welcoming growth environment. I will share a few of the research contributions and educational and life trajectories beyond their summer SEED experiences.

HIST 9

How project SEED propelled one undergraduate into a potential research career

Mirka Ortiz, mirka.ortiz@yahoo.com. Chemistry, New Jersey City University, Jersey City, New Jersey, United States

Mirka Ortiz participated in Project SEED as both a Summer I and Summer II student. Her first summer as a rising junior, in 2016, was with Dr. Reed Carroll at New Jersey City University (NJCU) where she worked on regulating the balance of neural and chemical activity in the brain. She returned to NJCU the following summer to work with Dr. Robert Aslanian on the development of improved microwave-assisted synthetic methods of hydroxamic acids and esters from carboxylic acids. The following fall, Mirka applied for the Alfred and Isabel Bader Scholarship, and received $5,000 towards her freshman year at NJCU. She found that her summer experiences in Project SEED helped to advance her to Sophomore and Junior-level chemistry courses, and to a slot in an organic chemistry research internship as a freshman. This made her incredibly competitive when she later applied for CIBA and Loconti scholarships. Mirka was unanimously selected as the very first Joseph D. Loconti Scholar, guaranteeing an additional three years of scholarship funding. She joined the university chemistry undergraduate student research club and attends technical seminars given by NJCU alumni. One such speaker was a Project SEED alumnus who offered her an internship with Merck for her sophomore year in college. Mirka hopes to pursue a Ph.D. in chemistry and a possible career in pharmaceutical chemistry. Mirka will share how her experience as a SEED student has impacted her view on chemistry as a career and has influenced her time as a college student.

HIST 10

Visiting the University of Wisconsin at Eau Claire

Allen A. Denio, alvaldenio@verizon.net. Chemistry, Univ. of Wisconsin-Eau Claire, Newark, Delaware, United States

I joined the faculty at UWEC in 1964 in a rapidly growing Department of Chemistry. We purchased many chemicals from the Aldrich Chemical Company in Milwaukee. Dr. Alfred Bader decided to visit our department to learn more about a customer. He was impressed by our new Chemistry/Business Major and eventually hired some of our grads. In one of his visits he gave a lecture in the School of Business in the morning, a Chemistry Seminar at noon, followed by a talk in the Art Department on Art History in the afternoon! After his Art Department visit, he offered to loan us some of his art collection for an exhibit in the new gallery. After a visit to his home and the Aldrich Chemical Company to see what was available, he loaned us a nice collection of his paintings for what turned out to be a very impressive gallery exhibit. We mourn the loss of this great chemist/humanitarian.

HIST 11

Alfred Bader: Masterpiece of a life

Dudley Herschbach[2], Mary Virginia Orna[1], maryvirginiaorna@gmail.com. (1) Chemistry, The College of New Rochelle, New Rochelle, New York, United States (2) Chemistry, Harvard University, Cambridge, Massachusetts, United States

In 1995, Alfred Bader, at the age of 71, published his autobiographical book, “Adventures of a Chemist Collector.” Thirteen years later, a welcome sequel, “Chemistry and Art: Further Adventures of a Chemist Collector,” appeared. Both volumes, reviewed by the first author of this paper, together chronicle an extraordinary life marked by resolve and enterprise in the face of almost insurmountable difficulties. Bader was a virtual orphan, persecuted refugee, “enemy alien,” and penniless emigré who emerged with a Harvard Ph.D. and went on to found a billion dollar chemical business. This paper will summarize Bader’s remarkable career from his start as an astute entrepreneur who recognized and capitalized on a niche market to his passionate art collecting and his equally passionate desire to give back through helping the neediest and the ablest via many massive and creative philanthropic projects.

HIST 12

Alfred Bader: Chemistry connector and art collector

Victor Snieckus, baderadm@chem.queensu.ca. Chemistry, Queen's University, Kingston, Ontario, Canada

An unmatchable legacy. With devotion and love, Alfred Bader championed his lifelong pursuits of chemistry and art by donations, program initiations, and assistance in immeasurable ways. His “Please bother us” on an Aldrich Chemicals catalogue is recognized by chemists worldwide. The regular dedicated visits of Alfred and Isabel Bader to Queen’s and its UK campus (the Bader International Study Centre, Herstmonceux Castle) are vibrant reminiscences that will stay forever with our students and faculty. In this lecture, a perspective from Queen’s University, our Department of Chemistry, and personal will be offered.

HIST 13

From polymer to macromolecule: Historical evolution of polymer terminology

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

The common term “polymer” was initially introduced in 1832 by Jacob Berzelius, although its initial meaning differed significantly from the modern use. The accepted meaning of the word then changed over time, particularly with the growing number of reactions being referred to as polymerizations in the late 1800s and early 1900s. As the field of polymeric materials developed, the broader uses of the term polymer was one factor that led Hermann Staudinger to introduce the alternate term “macromolecule” in the 1920s to specifically designate long-chain polymeric species. Of course, further terms were also eventually required to differentiate between different types of polymeric species, including “copolymer”, “homopolymer”, and “oligomer”. The origins, history, and evolution of these various terms used in reference to polymeric materials will be presented.

HIST 14

Learning about the macromolecules of life through historical developments in biophysical chemistry

Wilma K. Olson, wilma.olson@rutgers.edu. Rutgers, the State University of New Jersey, Piscataway, New Jersey, United States

Teaching from the scientific literature allows students to trace the history of key discoveries and scrutinize the thinking of scientists as new observations and ideas emerge over time. This presentation will describe the historical perspective taken and the literature used as source material for a graduate course offered by the speaker on the three-dimensional structures, interactions, and properties of proteins, nucleic acids, and their macromolecular assemblies. The course starts with early ideas on the structures of fibrous proteins and synthetic polypeptides and includes deep examination of a series of articles spanning a period of ~70 years on the development of principles and predictions of protein energetics, folding, motions, and assembly. The study of nucleic acids covers papers on the discovery of the double helix, influences of sequence and environment on DNA and RNA at increasing molecular levels, and principles of protein-nucleic acid recognition. The class also discusses relevant scientific correspondence available through on-line historical resources and gains familiarity with various databases and software tools helpful in understanding and manipulating the 3D structures of biological macromolecules.

HIST 15

Early observations and studies of the radical polymerization of vinyl and vinylidene compounds

Nicolay V. Tsarevsky, nvt@smu.edu. Department of Chemistry, Southern Methodist University, Dallas, Texas, United States

By the close of the 19th Century numerous observations had been made related to the ability of unsaturated (vinyl and vinylidene) compounds to form thick oils or resinous substances with the same elemental composition as the starting material when stored and especially when heated or exposed to light. For instance, in 1835, Victor Regnault reported the polymerization of vinyl chloride and three years later, he described that vinylidene chloride, when stored in sealed ampoules, deposits a white non-crystalline substance, which he considered an isomeric form. While studying the properties of acrolein and acrylic acid in 1843, Josef Redtenbacher noticed that the former formed resin, named “disacryl”, when heated. In the same year, the formation of glass-like material from styrene (which refracted light very strongly and was “not improbable that it might be applied to several optical purposes”) was described by John Blyth and August Wilhelm von Hoffman. In fact, the “steady conversion of the oil [styrene] by air, light, and heat to a rubberlike substance” was communicated in 1839 by E. Simon who assumed the compound was styrene oxide. The nature of these and many other similar transformations was unclear and was the subject of speculations and (occasionally, lucky) guesses. There were indications that radicals were involved in the processes. For example, as early as 1924, Charles Moureu and Charles Dufraisse showed that hydroquinone, which inhibits the oxidation of acrolein (a chain reaction), also inhibits the formation of resin from it. In 1928, George Stafford Whitby and Morris Katz assumed that the chain growth in the thermal polymerization of indene (and presumably other unsaturated compounds) involved hydrogen migration. However, only within several years of these studies, the mechanism of radical polymerizations was already well understood and it was established that the reactions were comprised of three distinct steps (now termed initiation, propagation, and termination). Papers published in 1934 by William Chalmers, in 1935 by H. Dostal and Herman Mark, and by G. V. Schulz, and in 1937 by Paul Flory described the kinetics of the polymerizations as well as the molecular weight distribution functions of the polymers. The mentioned early studies of radical polymerization will be presented and discussed.

HIST 16

Following the PVC pipeline: Misconceptions and milestones from discovery to industrialization

Evan W. Culver[1], culver.evan@gmail.com, Seth C. Rasmussen[2]. (1) Chemistry and Biochemistry, North Dakota State University, Fargo, North Dakota, United States (2) Department of Chemistry and Biochemistry, North Dakota State University, Fargo, North Dakota, United States

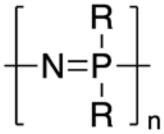
Historical accounts in chemistry have often been subject to biases that lead to incorrect claims and timelines of important scientific discoveries. The story of polyvinyl chloride (PVC) is no exception. One problem that is frequently encountered when telling the history of PVC is who should be given credit for the discovery and when the discovery was made. The confusion frequently arises due to a limited understanding of the macromolecular nature of polymeric materials prior to the 1920s. Additionally, the historical emphasis on plastics often ignores contributions that preceded the patenting and commercialization of polymeric products. The history of PVC is no different in that credit has been incorrectly attributed to industry patents in the early 20th century, along with other erroneous attributions prior to and after the historically accepted account of Eugene Baumann in 1872. It is not to say that the contributions made in the 20th century were not substantial, as without the contributions of Fritz Klatte, industrial scalability would still have been out of reach. The presentation will focus on how PVC made it from a material of only academic interest, to the billion-dollar industry we know today.

HIST 17

History of Poly(organophosphazenes)

Harry R. Allcock, hra1@psu.edu. Chemistry, Pennsylvania State University, University Park, Pennsylvania, United States

The broad field of poly(organophosphazenes) (1) began in 1964 with a chemical reaction that most observers believed was impossible - the replacement by organic nucleophiles of thousands of chlorine side atoms arrayed along an inorganic polymer chain to yield stable macromolecules with unique properties. Today, several hundred different poly(organophosphazenes) with a wide range of unique property combinations have been produced by this technique and by related methods. Applications that utilize the polymers are known that range from biomedical materials, aerospace elastomers, films, membranes, fibers, ionic conductors, and fire-resistant materials, and controlled surfaces, together with block- and graft-copolymers with classical organic macromolecules and silicones. This talk will trace the development of the field and its unique challenges. It is an example of the value of academic research coupled in its early stages with the involvement of industry, government agencies and laboratories in the search for new property combinations and high technology applications.



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(1)

HIST 18

History vs. legend: Discovery and development of conducting polymers

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

The discovery that the conductivity of conjugated organic polymers can be controlled through oxidation or reduction (i.e. doping) has led to organic materials that combine the electronic properties of metals with the weight and density of plastics. For this reason, such materials have been studied extensively and their importance has been recognized with the awarding of the 2000 Nobel Prize in chemistry to Alan Heeger, Alan MacDiarmid, and Hideki Shirakawa “for the discovery and development of conductive polymers.” Due to the wording of this award, as well as other factors, the common view has become that these materials originated with the collaborative work of the Nobel Laureates on doped polyacetylene in the late 1970s. At odds with this view, however, are numerous similar reports of conducting organic polymers dating back to 1963. An overview of the history of conjugated polymers from their origin in 1834 up through the polyacetylene work of the 1970s will be presented, with a focus on the known reports of conducting polymeric materials.

HIST 19

All things Bakelite: Age of plastics documentary film

Hugh Karraker, info@allthingsbakelite.com. All Things Bakelite, Redding Ridge, Connecticut, United States

Most people under the age of 50, who are not in the chemical or plastic industries and not a professor or student of material sciences don’t know what Bakelite is or who invented it. For three years, the film has been enlightening and entertaining both the cognoscenti and the general public about this material and its inventor, Leo H. Baekeland. The film celebrates the first totally synthetic plastic, touches on the negative impacts of plastics and ends with a glimpse into the development of new polymers.

HIST 20

Nifty fifty: Polymer scientists who created the discipline

Gary D. Patterson[1,2], *gp9a@andrew.cmu.edu.* (1) Carnegie Mellon University, Pittsburgh, Pennsylvania, United States (2) Science History Institute, Philadelphia, Pennsylvania, United States

As noted in *A Prehistory of Polymer Science,* a true scientific community of polymer scientists gelled at the 1935 Faraday Discussion on Polymerization. These men were from many different scientific fields, and from many different countries. But they all chose to commit their time and effort to articulating the paradigm of chain molecules. This talk will detail fifty of them, with more extended treatments of perhaps ten of them. Some from each of the decades since 1890 are included. Some of them are even still alive, like Richard Stein. I have personally met more than half of them in my career both as a polymer scientist and as a historian of the field. A professional length biography of Paul Flory has appeared (and can be purchased).

HIST 21

Staudinger, Sakurada, and the macromolecular debate in the 1930s

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Ichiro Sakurada (1904-1986) is today widely known as the pioneer in polymer chemistry and synthetic fibers research in Japan. However, he had been a harsh critic of the macromolecular theory proposed by Hermann Staudinger, the founder of polymer chemistry, until the mid-1930s. This paper examines the controversy between Staudinger and Sakurada during and after the latter's stay in Germany (1928-1931). It also discusses how Sakurada changed his mind and turned out to play a pivotal role in spreading Staudinger's views in Japan's chemical community and establishing an institutional basis for polymer science in postwar Japan.

HIST 22

Walter H. Stockmayer and polymer science: Dartmouth years

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Walter H. Stockmayer was a pioneer in polymer science. He was a scientist who moved with ease from theory to experiment, equilibrium to dynamics, gas phase to melt, gel, solution, and solid, and from city (Boston, MA) to small town (Hanover, NH). Stocky (as he was known by all who really knew him) brought the exciting and relatively new field of polymer physical chemistry to Dartmouth when he arrived from MIT in 1961. His vision for what was noteworthy and exciting was broad, with interests in the Dartmouth years ranging from the statistical mechanics of wormlike chains to quasi-elastic light scattering of linear and branched polymers, to phase separation in complicated polymer mixtures, and beyond. Stocky's international reputation and connections - aided by his role as one of the founding Associate Editors of Macromolecules – made the Dartmouth Chemistry Department a destination for distinguished visitors and energetic colleagues. His legacy has lived on in polymer science, and also at Dartmouth, where a vibrant program in polymer and materials chemistry is thriving, still. In this talk I will give a sense of the scientific range of Stocky's work at Dartmouth, highlighting his collaborations with other leaders in the field, connecting those threads to current areas of research. Aside from science, Stocky was a dedicated musician, an avid climber, and someone who deeply appreciated a well-crafted practical joke. I will touch on all of these aspects, as well.

HIST 23

Professor Mihai Dimonie's contribution to polymer science and the education of many generations of students at the Politehnica University of Bucharest

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Professor Mihai D. Dimonie was born in Ploiesti (Romania) on January 17, 1934. He received his BS in Chemical Engineering from Politehnica University of Bucharest (Romania) with specialization in the Technology of Organic Compounds. He received his Ph.D. in Chemistry under the supervision of S.S. Medvedev from Lomonosov Moscow Institute of Fine Chemical Technology in 1965. He joined the Department of Organic and Macromolecular Compounds at Politehnica University (Bucharest) in 1957 as Junior Assistant Professor. He was promoted to Assistant Professor in 1965, to Associate Professor in 1969, and Professor in 1980. Professor Dimonie was the Head of the

Department of Technology of Organic and Macromolecular Compounds in the period 1990 to 2004. He was also the Head of Elastomers Department at the National Institute of Chemical Research (ICECHIM) in 1990 and 1991.Professor Dimonie taught Technology of Polymer Synthesis, Ionic and Coordination Polymerizations, Ring Opening Polymerizations, Emulsion Polymerizations, Stereospecific Polymerizations, and Modern Methods for Investigation of Polymerization Processes undergraduate and graduate courses. He advised the dissertation theses of ~200 undergraduate students, and he advised ~30 Ph.D. students in his entire career. The Polymer Technology course he developed and taught for more than 40 years was the most important course for undergraduate students who majored in Chemical Engineering with Polymer Science Specialization. Professor Dimonie published more than 300 papers, four books, and 35 patents in the field of polymer science and technology. He received the Nicolae Teclu Award of the Romanian Academy in 1980 and the Opera Omnia Award from Politehnica University of Bucharest for his entire scientific career. Professor Dimonie published papers in the fields of heterogeneous media polymerizations, ionic and coordination polymerizations, ring-opening polymerizations, composites and nanocomposites, and polymer additives for road bitumen. His most recognized research in the field of ring-opening metathesis polymerization targeted the synthesis of polypentenamer and polyoctenamer elastomers. Professor Dimonie was a role model for students and an outstanding mentor who shaped the careers of many of his students.

HIST 24

Brief history of the Polymer Science and Engineering Department at the University of Massachusetts

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Eleven years after joining the Chemistry Department at the University of Masschusetts at Amherst, Richard S. Stein formed the Polymer Research Institute in 1961. William MacKnight then joined in 1965 and in the following year, Roger Porter was hired to chair the newly formed Polymer Science and Engineering Program. The program continued to grow, being award a Materials Research Laboratory from the NSF, probably one of the most significant factors that allowed the program to elevate the program to the department level in 1974 in the College of Natural Sciences and Mathematics. Since that humble beginning the Polymer Science and Engineering Department has and continues to excel in performing forefront research in polymer science, being competitive with materials science departments internationally, becoming a National Center for Polymer Research in 1991. This experiment, begun at a time when polymers was not a popular academic discipline, but rather thought primarily of importance in the industrial sector, has turned into a remarkable success.

HIST 25

Origin and development of polymer science in India: Historical perspectives

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Polymer science as a discipline took roots in India in the early 1950s, almost concurrently with the birth of this discipline in many other parts of the world. From its small beginning, polymer science has grown into a vibrant discipline practiced, in both, industry and academia in India. This talk will trace the origins and the early pioneers who established this discipline in India. Many of these early pioneers received their training in Brooklyn Polytechnic under the most venerable Hermann Mark. 1970s saw the birth of Indian polymer manufacturing and processing industry, which continues to grow in double digits even today. In the early 2000s, several global companies set up their R&D Centers in India in the area of polymers, to take advantage of the large pool of talent available in this discipline in India. This talk will highlight the drivers for the growth of the discipline in its early years and what sustains this discipline today. Major themes of current research in the area in both, academic institutions as well as industry in India, will be described.

HIST 26

Chemical philately and a stamp collector's view of polymer science

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This presentation will rely on the use of postage stamps to illustrate the history of polymer science, starting with natural polymeric materials known for centuries, such as silk and caoutchouc. Milestones in the development of early polymer chemistry will be described, including the work of Schönbein on nitrocellulose, Chardonnet’s production of artificial silk, the beginning of the textile industry, and the vulcanization of rubber. Contributions from key personalities in the history of plastics, such as Baekeland, Staudinger, Flory, Ziegler, and Natta, will also be discussed. Last but not least, an array of fascinating topics that are (unexpectedly) found on postage stamps will be presented, for example hydrogels and the pioneering research of Otto Wichterle, the introduction of plastic banknotes, and the discovery of conductive polymers.

HIST 27

Invention of the GC-MS

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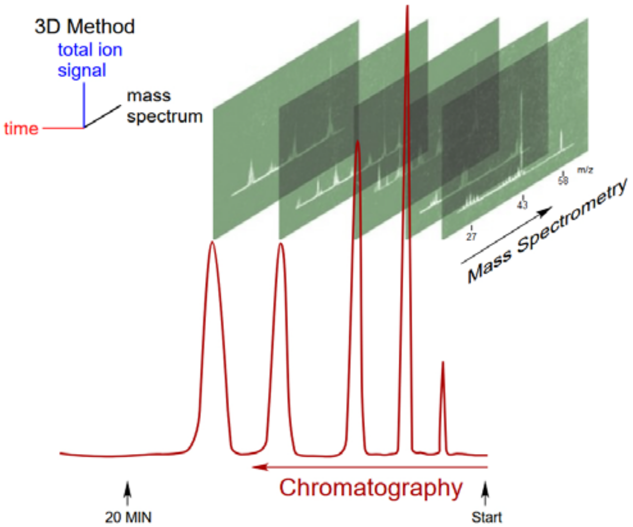
The history of the GC-MS, as the coupling of a gas chromatograph and mass spectrometer is called, recalls a time when both gas chromatography and mass spectrometry were in their infancy. It was a time of rapid innovation, with methods and equipment in flux. Today, it is hard to imagine an analytical lab without a GC-MS. The analytical power unleashed by combining chromatographic separation with positive mass spectral identification is compelling. On June 8th, 2019, Midland, Michigan became a National Historic Chemical Landmark recognizing the invention of this important technology. Dow researchers Fred McLafferty and Roland Gohlke demonstrated the first pairing of gas chromatography with mass spectral detection in the winter of 1955. GC-MS is now one of the most widely deployed, most powerful technologies in the analytical chemist's toolbox.



Coupling of GC separation with MS identification

HIST 28

Advancements in chromatography and mass spectrometry for detecting the use of performance enhancing drugs at the Olympic Games

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Throughout its history, the Olympic Games have been promoted as a means of bringing the youth of the world together in athletic competition with the goal of building a peaceful and better world. Nevertheless, many countries used this platform to propagandize their political ideologies. Many nations fueled their athletic successes by the use of chemical enhancements. Even after the fall of the Iron Curtain, athletes from all over the globe continue to utilize performance enhancing drugs (PEDs) as prize money, performance fees, and endorsements have inundated traditionally amateur sports. This project continues the investigation of the influence analytical chemistry has had on the Olympic Games. Specifically, the advancement over the past forty years in chromatography and mass spectrometry used to detect PEDs will be addressed.

HIST 29

Drugs that shaped the FDA from elixir sulfanilamide to thalidomide

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The United States Food and Drug Administration (FDA) currently regulates pharmaceuticals, medical devices and food products. Since the inception of the FDA in 1906, two key pieces of legislation have shaped the FDA into the organization that we recognize today: The Federal Food, Drug and Cosmetic Act (FD&C Act) of 1938 and the Kefauver-Harris amendment in 1962. The FD&C Act of 1938 gave the FDA authority to oversee the safety of food, drugs and cosmetics. The law authorized the FDA to require evidence of safety for new drugs, issue standards for food, and conduct factory inspections. The Kefauver-Harris amendment to the FD&C Act in 1962 required each new drug application (NDA) contain evidence from “adequate and well-controlled studies” demonstrating that a new drug was effective for its intended use and that the established benefits of the drug outweighed its known risks. Companies were required to present animal studies to the FDA *before* obtaining approval to test on humans. Furthermore, clinical studies on humans required informed consent from participants. Each of these pieces of legislation dramatically shaped the FDA and the pharmaceutical industry in the United States (US). They were the product of mounting consumer activism and political pressure, and they were ultimately pushed to passage by high-profile medical disasters: elixir sulfanilamide in 1937 and thalidomide in 1962.

HIST 30

Withdrawn

HIST 31

Use of a graph database to explore the history of chemistry: Chemistry of history

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A graph database of people, places, publications, and ideas in the history of chemistry has been developed and coupled to a physics engine for visualization and exploration. In addition to the immediate ability to explore the spatiotemporal progress of the development of chemistry, this database allows the history of chemistry to be explored by techniques analogous to those used to study chemistry itself. By representing the concepts and people as atoms or functional groups, the history of chemistry can be viewed as having a structure analogous to that of a crosslinked polymer. The use of a physics engine allows heuristic models to be used to explore the connections among people, places, and ideas, which allow the investigation of long-reaching connections invisible to cursory analysis. Techniques modeled after 2-D spectroscopies can be used to look at couplings between well-separated ideas or developments. Methods developed for molecular dynamics studies of polymers can be used to assess the long-range (in space or time) effects of individual ideas or influences. This database method is also of interest in integrating a history of chemistry class into the curriculum, where direct links can be made between the methods used in both cases. Students can be exposed to concepts of data science which are hard to incorporate into the rest of the chemistry curriculum.

HIST 32

Artists' perspectives on the history of chemical disasters

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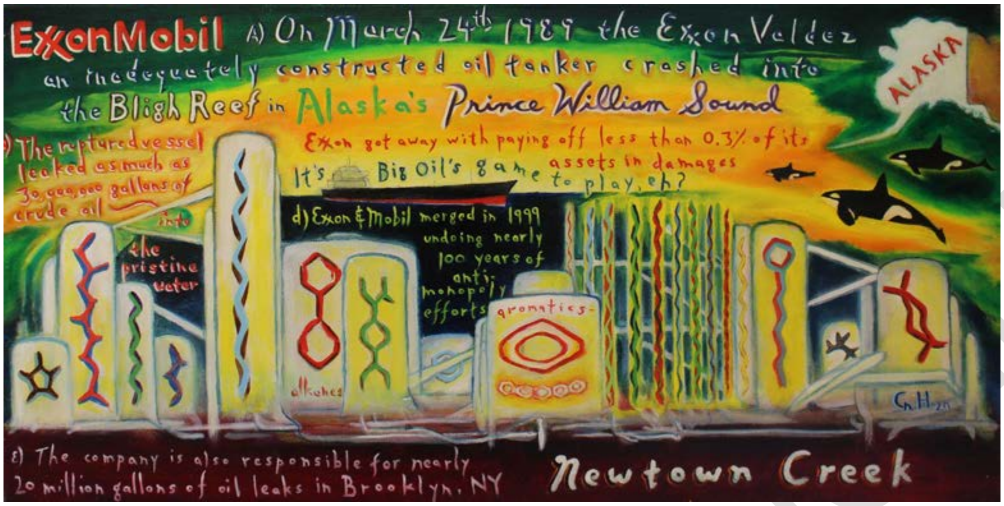
This study explores how visual art can be used to chronicle and examine the history of some well-known chemical disasters that have occurred during the past two hundred years. A series of contemporary paintings illustrating chemical accidents and disasters such as the *Exxon Valdez* oil spill and the Halifax Explosion are examined and explained.

The presentation will review how this approach fits in with more traditional chemical iconography and visual representations of chemical history, the chemical industry, and chemical processes. It also emphasizes new ways in which historians, chemists and other scientists can engage each other and the public through the fine arts.



Chemical Disasters - "The Exxon Valdez"

HIST 33

Manufacturing white lead in the new republic: Review of the Wetherill's stack process

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The production of white lead, an important paint pigment, was one of the early American chemical industries residing in early 19th century Philadelphia. Samuel Wetherill & Sons, "...Druggists as well as Oil and Colour Men," built the first factory to manufacture white lead in 1804. Overcoming considerably start-up challenges, the Wetherill company became a leading national manufacturer of white lead and other pigment products until it was acquired by National Lead in 1931. The stack process initially used by the Wetherills will be reviewed, along with some modern variations of the process.

HIST 34

Indigo plantation in India: Connecting history with chemistry

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Indigo is an organic compound whose uses have been predominantly utilized in colonial India by the British Empire. Referred to as “blue gold,” it incited the Indigo revolt in 1859 in Bengal, India due to the mistreatment of the workers designated to extracts the precious substance. Due to the attention this event garnered and the evident success of the indigo market from the fertile lands of India, sources of indigo have continued to be cultivated and the country is considered one of the indigo dyeing centers of the world, with more than 2700 square miles dedicated to such by the end of the 19th century. Indigo is derived from a compound known as indican, which can be obtained from tryptophan. One of the products of the hydrolysis of the compound indican is indoxyl, which can be further oxidized to achieve the final product of indigotin. In regards to the chemistry of indigo, the substance is insoluble in water and must undergo reduction in achieve the desired hue that is valued for. In terms of practical extraction, the fabric with which the indigo is contained is immersed in water, and the compound’s exposition to oxygen allows for the reversion to an insoluble, colored form of indigo. While indigo can be found naturally, synthetic indigo is a form that has been utilized to a great extent in the modern era for uses in textiles and other materials. During this presentation some historical data including the laboratory synthesis of the indigo blue will be discussed.

HIST 35

Ski wax: Skier's edge in extracting competitive advantage

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The confluence of factors that affect ski performance are quite varied and include the ski stiffness and dimensions, the relative grooming of the slope, the weight and balance of the skier, the temperature and other environmental conditions of the surfaces, the type of skiing being executed and the hardness and ablative capacity of the wax constituents that as the lubrication between the skier and the mountain. There are quite different requirements for waxes to perform in sprint type-functions like ski jumping where the sliding distance is very short vs endurance events such as biathlon and cross-country and distance races. In this fun, little diversion, I will present details about the historical design requirements for ski waxes, the types of ski waxes that have evolved from paraffinic and perfluorinated substances to other polymeric structures and combinations thereof. I will also explain the mechanics of lubrication in different regimes of skiing, and provide some insights on how analytics and instantaneous weather tracking are contributing to real time wax selection and application. The ability for waxes to crystallize and their hardness once formed are key factors regulating how easily these are abrasively worn off of the skis with sliding distance. There may be a separate racer-to-racer distinction in sequential races (e.g. ski-jumping, slalom) where the wax wear debris from a previous racer can alter the coefficient of friction of the ski slope as the next racer goes down. The bottom line is that in recent history, wax selection has been the major delineator in performance in olympic venues.

HIST 36

Superphosphate and the development of industrial chemistry at Newtown Creek in 19th century New York

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The bond between industrial chemistry and agriculture began with the bones of dead animals. Bones are composite materials consisting of a continuous organic phase, mainly collagen, interspersed with a discrete clusters of inorganic material, mainly carbonated hydroxyapatite, a form of calcium phosphate. In nature, phosphate is cycled between flora and fauna: plants need phosphate to grow, to make DNA and RNA and the smaller molecules that store and provide energy; the bones of dead animals provide the phosphate plants need to thrive. Plant phosphate is returned to animals that consume plants. Plants are nurtured as farmers spread ground bone on growing fields. Grinding bone improves the availability of bone phosphate to plants, but sulfuric acid does a better job of it. Animal bones are phosphate-rich, but phosphate rock is even richer. Just as sulfuric acid can free phosphate from crushed bones, it can free the phosphate in phosphate rock. Phosphate freed from its bound state by sulfuric acid came to be called "superphosphate." As demand for superphosphate fertilizer grew, demand for sulfuric acid grew. A reliable supply of sulfuric acid, in turn, made petroleum refining possible. This talk concerns superphosphate and the development of industrial chemistry in New York harbor in the middle years of the 19th century.