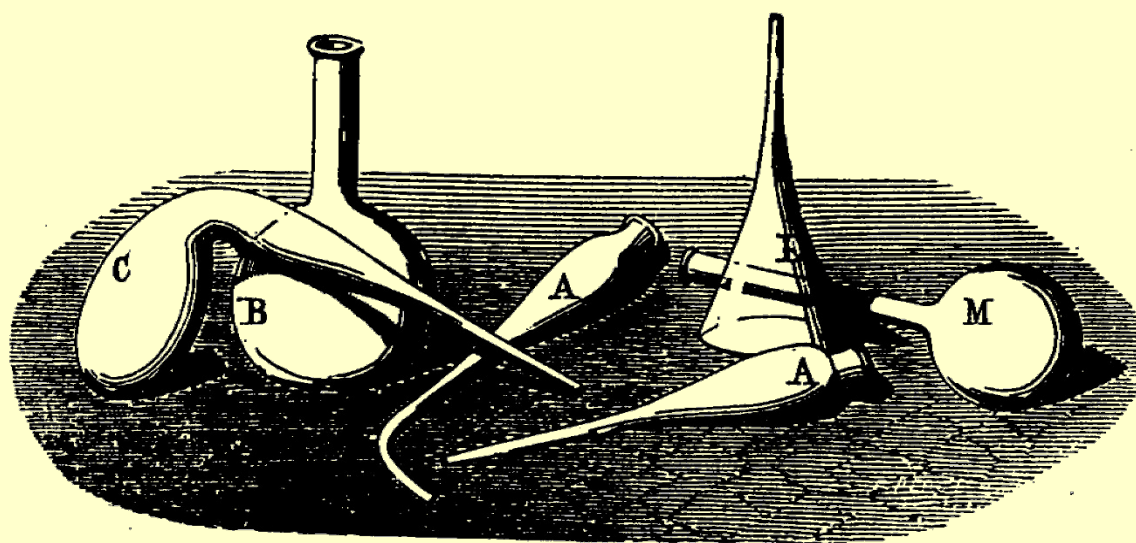




ACS
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American Chemical Society
**DIVISION OF THE
HISTORY OF CHEMISTRY**



PROGRAM & ABSTRACTS

Spring 2024 ACS National Meeting
New Orleans, LA (Hybrid)
March 17-21, 2024

Nicolay V. Tsarevsky, Program Chair

Officers - Division of the History of Chemistry

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

Chair-Elect: Joe S. Jeffers
823 N 26th St
Arkadelphia, AR 71923
Phone: 870-464-7223
Email: jeffers@obu.edu

Immediate Past 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
Email: seth.rasmussen@ndsu.edu

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

Program Chair: Nicolay V. Tsarevsky
Department of Chemistry
Southern Methodist University
3215 Daniel Avenue
Dallas, TX 75275
Phone: 214-768-3259
Email: nvt@smu.edu

Associate Program Chair: Christine E. Hahn
Department of Chemistry
Texas A&M University-Kingsville
700 University Boulevard, MSC 161
Kingsville, TX 78363
Phone: 361-593-3592
Email: Christine.Hahn@tamuk.edu

Bulletin Editor: Carmen J. Giunta
PO Box 522
Manlius, NY 13104
Phone: 315-632-4992
Email: giunta@lemoyne.edu

Councilor: Mary Virginia Orna
ChemSource, Inc.
309 Bradley Ave.
Mount Vernon, NY 10552
Phone: 914-310-0351
Email: maryvirginiaorna@gmail.com

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

Alternate Councilor: David E. Lewis
816 Third Avenue
Eau Claire, WI 54703
Phone: 715-563-2633
Email: lewisd@uwec.edu

Alternate Councilor: Christopher L. Heth
1118 13th St NW
Minot, ND 58703
Phone: 701-361-7123
Email: christopher.heth@gmail.com

Historian: Gary Patterson
3725 Wauna Vista Drive
Vancouver, WA 98661
Phone: 412-480-0656
Email: gp9a@andrew.cmu.edu

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

Communications Chair: Kristine Konkol
Department of Natural Sciences
Albany State University
504 College Dr.
Albany, GA 31705
Phone: 229-500-2316
Email: kristine.konkol@asurams.edu

HIST Programming

Message from the HIST Program Chair

Dear friends and supporters of HIST, welcome to the 267th ACS National Meeting and to the beautiful and packed with history city of New Orleans! My fellow “chemstorians” and I are delighted to extend a warm invitation to you and your friends and colleagues (who may be unaware of our activities) to join us at our technical sessions. As always, all attendees will get exposed to fascinating stories related to the long and tortuous journey of our discipline, while at the same time they will have the opportunity to build new or strengthen existing connections with kindred spirits.

As has often been the case, we will start our programming early in the morning on Sunday with a *General Papers* session, which will continue in the afternoon. The variety of topics to be covered is quite impressive: from the birth and evolution of concepts and ideas, to the history of useful compounds and materials, to the connections between chemistry and art, to the life and work of individuals who changed our understanding of chemistry. There will be something for everyone.

On Monday (all day), we will offer our first specialized symposium: *The Birth of the 3rd Dimension in Chemistry*, which is organized by Art Greenberg and David Lewis. We are, of course, accustomed to think of molecules as not being flat, and we understand the rules that govern bond lengths, valence angles, and the overall molecular shapes, but how much do we know about the thought processes and discoveries that led to that knowledge? Well, the symposium is designed to enlighten all of us about that. In addition, it will offer a lot of interesting and useful information to educators teaching general, organic, inorganic, or structural chemistry, as well as experimental techniques employed to ascertain the structure of molecules.

At noon on Monday, there will be a poster session close by in the Convention Center, and I invite you to stop by the HIST posters and talk with the presenters. In the evening of that day, there will be more posters at SciMix, which you would not want to miss. While attending the event, please stop by our table at Division Row. Several of us will be there to share news about the Division or simply to meet and converse with you in an informal atmosphere. Please help us spread the word about HIST and bring with you friends, coworkers, or perhaps your students. We'd love to greet them and welcome new members. You and they will also be able to pick up a copy of our *Newsletter* or our outstanding publication, the *Bulletin for the History of Chemistry*.



We will reconvene on Tuesday morning for our second specialized symposium dedicated to the *History of Catalysis*. The symposium is organized by Christine Hahn who has assembled a program of talks, which will cover several centuries of observations and innovation.

The schedule and abstracts of all HIST lectures and poster presentations are given on the following pages. We strongly suspect you'd want to stay with us till the very end of our program. Then, full of the newly acquired knowledge, spend some time for a well-earned animated banter with friends over a sazerac (the New Orleans "official" cocktail), a sweet Hurricane (with a similarly prominent NOLA ring to it), or a glass of wine at a good old Bourbon (or another) Street bar. You will be able to continue the conversation with other history of chemistry connoisseurs while enjoying the inspiration juices the wonderful Louisiana city has to offer. And there is a lot more to enjoy on the streets of New Orleans: art galleries, antiques shops, live music, and obviously – great food. Have fun!

We very much look forward to seeing you again soon. In the meantime, never hesitate to get in touch with us and share your thoughts about future history of chemistry events you'd like to attend or – why not? – organize. Have an inspiring and productive meeting, and be well.

Nick Tsarevsky, HIST Program Chair

HIST SYMPOSIA, Spring 2024 ACS National Meeting (March 17-21, 2024)

Schedules and abstracts are listed at the end of this Newsletter.

UPCOMING MEETINGS AND HIST DEADLINES

Subject to change. Check the HIST website (<http://www.scs.illinois.edu/~mainzv/HIST/>) for updates.

Fall 2024 ACS National Meeting (Denver, CO, August 18-22, 2024)

HIST Award Symposium Honoring James and Virginia Marshall (Invited) E. Thomas Strom, Dallas, TX 75232, Phone: 214-376-9602, Email: tomstrom@juno.com

Solving Mysteries with Chemistry: History of Forensic Chemistry (Invited and contributed) Nicolay V. Tsarevsky, Department of Chemistry, Southern Methodist University, Dallas, TX 75275, Phone: 214-768-3259, Email: nvt@smu.edu

150th Anniversary of the Centennial of Chemistry Meeting (Invited and contributed) Roger Egolf, Department of Chemistry, Pennsylvania State University - Lehigh Valley, Center Valley, PA 18034, Phone: 610-285-5110, Email: rae4@psu.edu

Tutorial and General Papers (Seeking contributions) Nicolay V. Tsarevsky, Department of Chemistry, Southern Methodist University, Dallas, TX 75275, Phone: 214-768-3259, Email: nvt@smu.edu

Spring 2025 ACS National Meeting (San Diego, CA, March 23-27, 2025)

Chemical Technologists (Invited and contributed) Gary Patterson, Vancouver, WA 98661, Phone: 412-480-0656, Email: gp9a@andrew.cmu.edu

Chemistry in the 18th Century (Invited and contributed) Gary Patterson, Vancouver, WA 98661, Phone: 412-480-0656, Email: gp9a@andrew.cmu.edu; Art Greenberg, Durham, NH 03824, Phone: 603-862-1180, Email: art.greenberg@unh.edu

Light It Up: Light-Induced Processes (Invited and contributed) TBA

Tutorial and General Papers (Seeking contributions) Nicolay V. Tsarevsky, Department of Chemistry, Southern Methodist University, Dallas, TX 75275, Phone: 214-768-3259, Email: nyt@smu.edu and Christine E. Hahn, Department of Chemistry, Texas A&M University-Kingsville, Kingsville, TX 78363, Phone: 361-593-3592, Email: Christine.Hahn@tamuk.edu

Fall 2025 ACS National Meeting (Washington, DC, August 17-21, 2025)

HIST Award Symposium (Invited) TBA

Past ACS Presidents: Frank Wigglesworth Clarke (1847-1931) (Invited and contributed) Gary Patterson, Vancouver, WA 98661, Phone: 412-480-0656, Email: gp9a@andrew.cmu.edu; Carmen Giunta, PO Box 522, Manlius, NY 13104, Phone: 315-632-4992, Email: giunta@lemoyne.edu.

Tutorial and General Papers (Seeking contributions) Christine E. Hahn, Department of Chemistry, Texas A&M University-Kingsville, Kingsville, TX 78363, Phone: 361-593-3592, Email: Christine.Hahn@tamuk.edu

Final Program

DIVISION OF THE HISTORY OF CHEMISTRY (HIST)

N. V. Tsarevsky, *Program Chair*

Sunday, March 17, 2024: Morning session

Location: Ernest N. Morial Convention Center, Room 209

General Papers and Tutorial

N. V. Tsarevsky, C. E. Hahn, *Organizers, Presiding*

8:00 Kuhnian revolution in chemistry. **B. Wicker**

8:30 Historical and modern perspectives on valence theory in chemistry education. **R.M. Jones**, E.H. Rudler, C. Preston

9:00 Creating visual art to explore the history of organic and nuclear chemistry. **D.B. Cordes**

9:30 Role of music in major discoveries in the history of chemistry. **T.J. Fuhrer**

10:00 Intermission.

10:20 Development of scientific enquiry: Alchemy, witchcraft, phlogiston, and nuclear bombs. **A.H. Shelton**, J. Glass

10:50 The chemistry of ink: From papyrus to paper, applications to the written word. **K.L. Konkol**

11:20 Discovery of the cannabinoids: Delta-10-THC and the isolation of *cannin*. **R.P. Jensen**

Celebrating the Life and Legacy of Dr Olga Kennard

Sponsored by CINF, Cosponsored by COMP and HIST

Sunday, March 17, 2024: Afternoon session

Location: Ernest N. Morial Convention Center, Room 209

General Papers and Tutorial

N. V. Tsarevsky, C. E. Hahn, *Organizers, Presiding*

2:00 Development of 4-hexylresorcinol as an antiseptic. **A. Haddy**

2:30 Die chemie ist schwierig: Winkler and the discovery of germanium. **C.S. Weinert**

3:00 New London, Texas school explosion of 1937: History and legacy. **E. Terrell, G. Reinke**

3:30 Nuclear magnetic resonance in Costa Rica: A historical perspective. **A.A. Borloz, I.F. Cespedes-Camacho**

4:00 Intermission.

4:50 Dr. Henry Eyring and Dr. Taikyue Ree's collaboration and contribution to the chemistry of South Korea and the United States. **C.H. Do, Y.K. Sung, G.D. Patterson**

5:20 Writing chemistry laboratory manuals: A co-operative venture. **W.P. Palmer**

Sunday, March 17, 2024: Evening

Location: Ernest N. Morial Convention Center, Room 211

06:30-8:30 pm HIST Executive Committee meeting

Monday, March 18, 2024: Morning session

Location: Ernest N. Morial Convention Center, Room 209

The Birth of the 3rd Dimension in Chemistry

Cosponsored by PRES
A. Greenberg, D. E. Lewis, *Organizers, Presiding*

8:00 Introductory remarks.

8:10 Stamps are planar, carbon is not: A philatelic history of stereochemistry. **D. Rabinovich**

8:35 History of the use of models to represent and understand the behavior of molecules. **N.V. Tsarevsky**

9:00 Le Bel: Polymath extraordinary. **P. Laszlo**

9:25 Intermission.

9:40 The tetrahedral carbon atom four years before van 't Hoff and Le Bel: The life of Emanuele Paternò (1921-1932). **G.S. Girolami**

10:05 "Missed it by that much!" How Butlerov almost proposed the tetrahedral carbon. **D.E. Lewis**

10:30 How sweet it is! Emil Fischer's stereochemical studies of glucose. **D.E. Lewis**

10:55 Intermission.

11:10 René Just Haüy and the contribution of crystallography to 3-dimensional chemistry. **G.D. Patterson**, C. Schmechel

11:35 Disseminating three-dimensional chemistry data and knowledge across generations. **I. Bruno**

Monday, March 18, 2024: Noon

Location: Ernest N. Morial Convention Center, Hall C

HIST Poster Session

12:00 – 2:00 pm

Generating and analyzing natural paints. **A. Lamm, A. Millsap**

Energetics analysis of medieval black powder. A.K. Imig, V. Ibrahimi, B.E. Dolin, J.R. Orr, S.V. Cowart, J.C. Hunter, **D.E. Riegner**

Monday, March 18, 2024: Afternoon session

Location: Ernest N. Morial Convention Center, Room 209

The Birth of the 3rd Dimension in Chemistry

Cosponsored by PRES
A. Greenberg, D. E. Lewis, *Organizers, Presiding*

2:00 Introductory remarks.

2:10 Alfred Werner: Coordination theory and the stereochemistry of metal complexes. **S.C. Rasmussen**

2:35 Primo Levi's undergraduate thesis on Walden inversion. **B.E. Kahr**, M. Rossi

3:00 Historical evolution, stereochemistry, and structural limitations for the C=C bond. **R.P. Johnson**

3:25 Intermission.

3:40 Exploring variation in bonding and structure for tetravalent carbon: [1.1.1]propellane and inverted carbon. **K.M. Morgan**, K.B. Wiberg

4:05 Role of stereochemistry in the quantum chemical revolution. **J. Seeman**

4:30 Studies of chiral centers other than carbon: William Jackson Pope and Kurt Mislow, pioneers of stereochemistry. **A. Greenberg**

4:55 History of stereochemistry: Progress and prospects. **P. Ramberg**

5:20 Concluding remarks.

Monday, March 18, 2024: Evening

Location: Ernest N. Morial Convention Center, Hall C

HIST Sci-Mix Poster Session and Division Row

8:00 – 10:00 pm

Kuhnian revolution in chemistry. **B. Wicker**

Role of music in major discoveries in the history of chemistry. **T.J. Fuhrer**

Development of scientific enquiry: Alchemy, witchcraft, phlogiston, and nuclear bombs. **A.H. Shelton**, J. Glass

New London, Texas school explosion of 1937: History and legacy. **E. Terrell**, G. Reinke

Die chemie ist schwierig: Winkler and the discovery of germanium. **C.S. Weinert**

Development of 4-hexylresorcinol as an antiseptic. **A. Haddy**

Marie Maynard Daly and the mid-century race to quantify nucleic acid components. **M.E. Schott**

Dr. Henry Eyring and Dr. Taikyue Ree's collaboration and contribution to the chemistry of South Korea and the United States. **C.H. Do**, Y.K. Sung, G.D. Patterson

From glass to plastic: The past and future of cell culturing glassware. **R. Orkin**, V. Cerrillos, **Z. Zarbis**, **M. Part**

Generating and analyzing natural paints. **A. Lamm**, **A. Millsap**

Learning from the Manhattan Project: Challenges and opportunities in federal funding. **S. Hill**, J. Curtis

Energetics analysis of medieval black powder. A.K. Imig, V. Ibrahimi, B.E. Dolin, J.R. Orr, S.V. Cowart, J.C. Hunter, **D.E. Riegner**

Primo Levi's undergraduate thesis on Walden inversion. **B.E. Kahr**, M. Rossi

Tuesday, March 19, 2024: Morning session

Location: Ernest N. Morial Convention Center, Room 209

History of Catalysis

C. E. Hahn, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 Early observations and studies of biological catalytic processes. **N.V. Tsarevsky**

8:35 Withdrawn

9:05 Karl Ziegler and Giulio Natta and their impact on modern catalysis. **P. Villarreal**, C. Hahn

9:35 Catalysis research in the former German Democratic Republic. **C. Hahn**

10:05 Intermission.

10:30 Asymmetric Catalysis: The beginnings with diazo compounds. **M.P. Doyle**

11:00 Selective catalytic routes for light hydrocarbon upgrading. **A.M. Gaffney**

11:30 Metal-catalyzed reductions of amides to amines using silanes: Learning more than chemistry from a historical analysis of such a specific "Green" transformation. **K.H. Pannell**

ABSTRACTS

HIST 3983414

Kuhnian revolution in chemistry

Benjamin Wicker, benjamin.wicker@eku.edu. Chemistry, Eastern Kentucky University, Richmond, Kentucky, United States

The Kuhnian cycle of scientific revolution has been the subject of academic debate for over 60 years, although his model has not been applied to the development of chemical theory. In this talk I will present the fundamental tenets of the Kuhnian revolutionary cycle and discuss the application of Kuhn's model towards describing a chemical revolution in the development of modern chemical theory. This interpretation of the Kuhnian revolutionary cycle is consistent with chemistry undergoing a "paradigm shift" with Dalton's presentation of the atomic theory.

HIST 3989199

Historical and modern perspectives on valence theory in chemistry education

Rebecca M. Jones, drrebeccajones@gmail.com, Eva-maria H. Rudler, Conner Preston. George Mason University, Fairfax, Virginia, United States

A fundamental concept in chemistry, valence theory offers a perspective to understand bonding and chemical reactions. This presentation takes a historical perspective on how valence theory has been taught in general chemistry for the last 130 years. Once primarily taught as the "combining capacity" of atoms, valence is now taught alongside very different concepts, such as electron configurations and oxidation states. Different divisions of chemistry focus on specific aspects of the theory, suggesting different understandings and perceptions of the concept. Beyond textbooks and lectures, YouTube and Wikipedia offer alternative methods of communicating the concept to students. As chemistry education progresses in the 21st century, we seek to understand the historical evolution of this fundamental chemistry concept and identify spaces of ambiguity that inhibit learning. This presentation will offer suggestions and possibilities for advancing how we think about and teach the concept of valence.

HIST 3988985

Creating visual art to explore the history of organic and nuclear chemistry

David B. Cordes, cordes@pacificu.edu. Chemistry, Pacific University, Forest Grove, Oregon, United States

This presentation will review some ways in which the creation of original visual artwork can be employed to support explorations of the history of chemistry. Such works can improve public access to science and serve as departure points for conversations about the complex interaction between science and culture that shapes and influences scientific understanding and practice. Several illustrated narratives from the history of organic and nuclear chemistry will be considered.

HIST 3990627

Role of music in major discoveries in the history of chemistry

Timothy J. Fuhrer, tfuhrer@radford.edu. Chemistry, Radford University, Radford, Virginia, United States

Many of the major discoveries in chemistry in the last 150 years have been made by scientists who were also very skilled musicians and or were extensively educated in the performance of music and music theory. In this work we compare and contrast several of these scientists' works and musical training in the hopes of distilling out the essence of why so many musically trained scientists are so successful. Scientists we will examine include Max Planck, Ludwig Boltzmann, Albert Einstein, Werner Heisenberg, Edward Teller, Frances Arnold, Barbara McClintock and others.

HIST 3997653

Development of scientific enquiry: Alchemy, witchcraft, phlogiston, and nuclear bombs

Abigail H. Shelton¹, ashelt18@utm.edu, John Glass². (1) Department of Chemistry and Physics, The University of Tennessee at Martin, Martin, Tennessee, United States (2) Office of Honors Programs, The University of Tennessee at Martin, Martin, Tennessee, United States

Instructing non-chemistry-major students on the nature of scientific investigation has allowed a platform to examine prominent historic chemical theories and scientists, cultural shifts that aided in the transition from early to modern chemistry, social views of chemistry, and the creation of the chemistry laboratory. Presented will be attempts at advancing the knowledge and appreciation of the history of chemistry through the texts, topics, and

laboratory experiments included within five years of instructing the Development of Scientific Enquiry course.

HIST 3995524

The chemistry of ink: From papyrus to paper, applications to the written word

Kristine L. Konkol, kristine.konkol@asurams.edu. Department of Natural Sciences, Albany State University, Albany, Georgia, United States

Ink, the pigmented writing, drawing, and printing material, has been utilized for millennia as a chemical technology for recording chemistry and the written word. The oldest extant examples of ink-containing writings are papyrus records dating to ~3000 BCE. The usage of ink, in many respects, mirrors the usage and spread of the writing materials the ink was applied to, which include papyrus, parchment, and paper. Previously, the advancement and proliferation of writing materials from antiquity to the modern era has been explored. In this presentation, the author will focus on the chemistry of ink as applied to writing materials, the regional and historic variability of the formulations, and the proliferation of the chemical technology from antiquity to the modern era. This will also include an examination of how the chemical history of ink relates to that of dyes and pigments. Finally, some of the more well-known kinds of ink will be discussed, including carbon-based ink and iron gall ink.

HIST 3985314

Discovery of the cannabinoids: Delta-10-THC and the isolation of *cannin*

Robert P. Jensen, robert.p.jensen@gmail.com. Florascience Inc., Milwaukie, Oregon, United States

The earliest cannabis chemistry articles in the literature are rich in information, but many are esoteric and inscrutable to those who do not work with cannabinoids themselves. One such article provides interesting context to the discovery of tetrahydrocannabinol (THC) – in June of 1940, researchers led by A.J. Haagen-Smit at Caltech reported the isolation of a physiologically active principle from *Cannabis sativa* in the journal Science. This molecule was given the trivial name *cannin* and was reported one month before Roger Adams published his first report on THC isomers generated by cyclization of cannabidiol. The isolation of *cannin* could not be replicated, and this report fell into obscurity; here it is discussed with 80+ years of hindsight, and evidence is presented that the researchers had in fact isolated one epimer of delta-10-THC, a rare isomer of tetrahydrocannabinol which remains poorly understood by most people in the cannabis industry to this day. These remarks serve to demonstrate that the complete story of the discovery and elucidation of the cannabinoids is an ongoing process spanning generations.

HIST 3995429

Development of 4-hexylresorcinol as an antiseptic

Alice Haddy, aehaddy@uncg.edu. Chemistry and Biochemistry, UNC Greensboro, Greensboro, North Carolina, United States

In the early 1900s before the development of antibiotics, interest in the synthesis of new antiseptic compounds was high and drove an active field of research. Many new compounds were based on experience with phenol, commonly called carbolic acid, which had been developed as an antiseptic treatment by Joseph Lister and subsequently revolutionized surgery by reducing infection. Chemists explored compounds related to phenol to improve the effectiveness and to reduce undesirable characteristics such as irritation and strong odors. Numerous substituted phenols, including xylenols, alkyl chlorophenols, and resorcinols, were developed and tested over the decades. Phenol itself remained a standard for comparison of germicidal or bactericidal activity through use of the "phenol coefficient", as determined by the Rideal-Walker or similar methods. Treat B. Johnson, Professor of Chemistry at Yale University, was a well-known synthetic organic chemist with interests in compounds of therapeutic or biochemical relevance, including the development of antiseptics. In 1913, Johnson and Willard Hodge published a method for the synthesis of alkylated resorcinols based on zinc-catalyzed reduction of the corresponding ketone. By 1921, he and Frederick Lane synthesized a series of alkylresorcinols and demonstrated that antiseptic strength increased with the length of the alkyl group. This led to the development of 4-hexylresorcinol, which became highly successful commercially for topical application. It was even characterized as a possible internal antiseptic, for example, to treat bladder infections. Today hexylresorcinol is still used in skin care products and throat lozenges.

HIST 3991409

Die chemie ist schwierig: Winkler and the discovery of germanium

Charles S. Weinert, weinert@chem.okstate.edu. Department of Chemistry, Oklahoma State University, Stillwater, Oklahoma, United States

The brilliant prediction of Mendeleev in 1871 of the existence of *eka*-silicon became reality through the persistence of Clemens Winkler in 1886, who identified an unknown component of a new ore from the Himmelfürst mine outside Freiberg, Germany as the element germanium. This presentation will focus on the biography of "der Entdecker" of the new element germanium Clemens Winkler including his life as an analytical chemist, his accomplishments, and his refusal to give up on his discovery of this new element despite the challenges that existed at the time. This will include overcoming the opposition to naming the new element germanium and Winkler's interactions with both Dmitri Mendeleev and Lothar Meyer. It will include some original photographs and accounts by the presenter taken in Freiberg during a visit in the summer of 2014. This is an oral presentation of the paper that was selected for the Paul R. Jones Outstanding Paper Award in 2022.



HIST 3981153

New London, Texas school explosion of 1937: History and legacy

Evan Terrell¹, evan.terrell@usda.gov, Grace Reinke². (1) USDA-ARS Southern Regional Research Center, New Orleans, Louisiana, United States(2) University of New Orleans, New Orleans, Louisiana, United States

In March of 1937 in the city of New London, TX, a natural gas leak caused an explosion underneath the city's junior/senior high school. This disaster resulted in the deaths of approximately 300 people, the great majority of whom were between the ages of 10 and 17. Natural gas (at the time odorless) from local oil production was used for utilities in school and broader community. Upon investigation, officials determined that the explosion was caused by a small spark created by machine shop equipment in the school building's crawl space, igniting the gas leak. In response to the disaster, the Texas legislature quickly passed a law requiring odorization of natural gas to make it more readily detectable. This law formed the basis for the widespread practice of adding malodor compounds (typically mercaptans) to natural gasses for public use, as a safety measure. Texas also passed a law to establish more rigorous registration and certification for the state's engineering profession. These laws, all of which were eventually adopted on a national scale, also restricted the title of "engineer" in professional practice. This presentation will explore this event's history and its legacy in terms of the chemical engineering profession and industry. Because the explosion occurred nearly 90 years ago, there are very few remaining community members with living memory of the event. This research aims to reclaim the history of the explosion and its aftermath and consider the lasting impact of the disaster in the chemical engineering field. The presentation will feature photographs of important artifacts collected at the New London Museum in New London, Texas.

HIST 3982051

Nuclear magnetic resonance in Costa Rica: A historical perspective

Andrés Borloz-Chinchilla^{1,3}, andres.borloz@estudiantec.cr, Isaac F. Cespedes-Camacho^{2,3}. (1) School of Physics, Tecnológico de Costa Rica, Cartago, Cartago, Costa Rica(2) School of Chemistry, Tecnológico de Costa Rica, Cartago, Cartago, Costa Rica(3) Centro de Investigación y de Servicios Químicos y Microbiológicos (CEQIATEC), Tecnológico de Costa Rica, Cartago, Cartago, Costa Rica

Nuclear Magnetic Resonance (NMR) is a widely used technique for the elucidation and structural characterization of organic and inorganic molecules due to the interaction of matter with a magnetic field. Since the acquisition of the first NMR in the country, Costa Rican science has taken a significant step, by generating impact research and many publications and academic and commercial projects that use the NMR technique in different disciplines. Nevertheless, a lot of work needs to be done in solid-state NMR, hyperpolarization, and other NMR experiments, almost nonexistent in the country. This project aims to show a historical compilation and general overview of the NMR technique in Costa Rica by presenting the different magnets used in the country in the last 50 years and the results obtained with them. Moreover, the authors will highlight the development of the technique through the years and a perspective of the NMR to increase the Research, Development, and Innovation indexes of the country.

HIST 3997482

Dr. Henry Eyring and Dr. Taikyue Ree's collaboration and contribution to the chemistry of South Korea and the United States

Choon H. Do¹, choondo@scnu.ac.kr, Yong K. Sung², Gary D. Patterson³. (1) Korean Chemical Industry Specialists Association, Ulsan-gun, Korea (the Republic of)(2) Dongguk University, Jung-gu, Seoul, Korea (the Republic of)(3) Carnegie Mellon University, Pittsburgh, Pennsylvania, United States

Dr. Henry Eyring and Dr. Taikyue Ree's collaboration had contributed greatly to the development of chemistry of South Korea and the United States. Dr. Eyring was the president of ACS in 1963 and is well-known for his chemical reaction rates and his transition state theory. Dr. T. Ree was the first Korean to receive the Ph.D. degree in chemistry, which he got from Kyoto University in 1931. Dr. Ree met Dr. Eyring at Princeton University and joined Dr. Eyring's research group. In 1948, Dr. Ree was invited to join Dr. Eyring's group in the University of Utah. During Dr. Ree's stay at Utah for 25 years many Korean students got their Ph.D. degrees under their joint supervision and many other Korean scientists visited as well. Their students and visitors became leaders in the academic, research and industrial areas in South Korea.

HIST 3987496

Writing chemistry laboratory manuals: A co-operative venture

William P. Palmer, bill_palmer15@hotmail.com. Curtin University, Perth, Western Australia, Australia

The theme of this paper can be summarised in the words of a popular song 'From little things big things grow'. The task of writing chemistry laboratories manuals was sometimes undertaken by chemistry teachers and sometimes by Chemistry university lecturers. Occasionally a group of chemistry teachers co-operated together to produce a manual which lasted for many years. In this instance, a manual prepared by a Committee of the Chemistry Teachers of the Chicago High Schools illustrates one such publication where the authors changed over time. Their laboratory manual was first published as *A Laboratory Manual of Chemistry* by Charles E. Boynton, Frank L. Morse and Fred J. Watson. The manual was a modest start with the first edition published by D. C. Heath and Co. in 1899. The manual was small in size and contained no space for student input; it gave instructions of how to carry out ninety chemical experiments to students. No review of this manual has been found. Charles E. Boynton was involved with two other chemistry teachers based in Chicago, Frederic B. Emery and Elizabeth W. Miller in the publication of a new chemistry manual entitled *Applied Chemistry: A Laboratory Manual* which was published in 1925. The companion volume was a textbook entitled *Chemistry in Everyday Life* by Frederic B. Emery, Elzy F. Downey, Roscoe E. Davis and Charles E. Boynton. The manual and textbook were large and innovative, receiving several favourable contemporary reviews. The life story of Elizabeth W. Miller is of particular interest in that she married Professor Fred C. Koch and they became nationally known authorities on hormones and vitamins demonstrating the benefits of marital co-operation in research. Brief biographies of each of the co-operating teachers will be included in the full paper.

HIST 3985285

Stamps are planar, carbon is not: A philatelic history of stereochemistry

Daniel Rabinovich, Dan.Rabinovich@uncg.edu. Dept. of Nanoscience, Joint School of Nanoscience and Nanoengineering, Greensboro, North Carolina, United States

Stereochemistry, the branch of chemistry dealing with the three-dimensional arrangement of atoms and molecules in space, and how it affects chemical reactivity, is of critical importance in biological systems and the pharmaceutical industry. This presentation will use postage stamps to discuss some milestones in the development of modern stereochemistry, starting with the pioneering work of Louis Pasteur, who discovered molecular chirality and spontaneous resolution in 1848 by studying crystals of tartaric acid and various tartrate salts. The seminal 1874 contributions of Jacobus H. van't Hoff in the Netherlands and Joseph Le Bel in France, who independently explained optical activity in terms of the tetrahedral arrangement of the atoms bound to carbon, will be described. And the work of

Vladimir Prelog, who shared with John Cornforth the 1975 Nobel Prize in Chemistry “for his research into the stereochemistry of organic molecules and reactions“, will be outlined.



HIST 3987062

History of the use of models to represent and understand the behavior of molecules

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

The use of spherical objects representing atoms to construct models of atomic aggregates, such as crystals, was likely initiated by Robert Hooke (1635-1703) who not only provided pictures of crystal models in his *Micrographia* (1665), but also stated that “positions or postures of globular particles... I have demonstrated... with a company of bullets, and some few other very simple bodies.” With the acceptance of atomic and molecular constitution theories, molecular models could also be designed. The first examples were described by August Wilhelm von Hofmann (1818-1892) in 1866. His sets consisted of colored croquet balls that could be connected via metallic tubes and pins screwed in the balls. Unfortunately, these early ball-and stick models did not reflect the actual arrangement of atoms. Most molecules were represented as either linear or planar assemblies of interconnected atoms. However, once the tetrahedral model of the carbon atom was proposed (1874) and accepted, more accurate models could be made. They were useful in explaining isomerism, and an early depiction of the three hypothetical isomers of dibromoethane appears in a publication from 1869 by Emanuele Paterno (1847-1935). In 1934, H. A. Stuart designed some early space-filling models that soon became commercially available, although they were rather costly. Over the following years, Joseph Hirschfelder attempted to make similar models from cheaper materials (cork, plaster of Paris), and eventually, in collaboration with Fisher Scientific, from wood. The wooden colored balls had drilled holes and could be connected with double-taper brass pegs. Soon, the original connectors were replaced by snap connectors, designed by Hugh Taylor. The improved more robust sets became popular as Fisher-Hirschfelder-Taylor models and were widely available. However, space filling models were not very useful in solving stereochemical problems; ball-and-stick and skeletal models were more suited. One of the most successful designs was proposed by Andre Dreiding in 1958. The atoms in his sets were situated at the intersection of a construct made of stainless-steel tubes and rods, which snapped together to make molecules. Since the 1960s, molecular models have become increasingly popular with both researchers and educators and have been helpful tools in understanding various aspects of molecular reactivity. This talk will describe some of the milestones of the history of molecular models and their uses.

HIST 3976915

Le Bel: Polymath extraordinary

Pierre Laszlo^{1,2}, clouds-rest@wanadoo.fr. (1) Chimie, Universite de Liege, Liege, Belgium(2) Chimie, Ecole Polytechnique, Palaiseau, Île-de-France, France

Joseph-Achille Le Bel was born into privilege. His father Louis-Frédéric Achille, an agronomist, also owned an oil well in Pechelbronn, in the Alsace and thus independently wealthy. His son was endowed with a superb mind and a wide-ranging curiosity. Gifted as he was, he entered *École polytechnique* (Class of 1865). There, he was trained, among other fields, in Monge's *géométrie descriptive*, that emphasized complex three-dimensional structures. This presentation will include a brief analysis of his writing style. In addition to co-establishing stereochemistry, Le Bel was a pioneer in prehistoric archeology. Thus, he used his wealth to purchase - and protect (!) - a shelter from the Neolithic, at Laugerie Basse, near Les Eyzies, in the Dordogne area. No wonder that Berthelot, not only a mean person but also in this case an envious and resentful bully, persecuted Le Bel by repeatedly preventing him from entering *Académie des Sciences!*

HIST 3994343

The tetrahedral carbon atom four years before van 't Hoff and Le Bel: The life of Emanuele Paternò (1921-1932)

Gregory S. Girolami, ggirolam@uiuc.edu. Chemistry, University of Illinois Urbana-Champaign, Urbana, Illinois, United States

Jacobus H. van 't Hoff (1852-1911) and Joseph Le Bel (1847-1930) deservedly get credit for recognizing many of the stereochemical implications of the hypothesis that the bonds of four-coordinate carbon atoms are directed toward the vertices (or faces) of a tetrahedron. Those familiar with the history of stereochemistry are aware, however, that van 't Hoff and Le Bel were not the first to discuss the tetrahedral carbon atom. In fact, the first person to apply the hypothesis to the isomerism of organic compounds was the Italian chemist Emanuele Paternò (1921-1932). Paternò discussed this topic in an article published in 1869, four years before van 't Hoff and Le Bel published their well-known papers. In this talk, I will review the life and work of Emanuele Paternò, a professor of chemistry from 1872 to 1892 at the University of Palermo, where he succeeded his teacher Stanislao Cannizzaro (1826-1910) and from 1892 to 1923 at the University of Rome. In addition to his work in organic chemistry, he published many papers on the cryoscopic determination of molecular masses, on colloids, and on photochemistry; he also co-founded the journal *Gazzetta Chimica Italiana*. Paternò was also rector of the University of Palermo (1885-1890), mayor of Palermo (1890-1892), senator of the Kingdom of Italy (from 1890, serving as Vice President of the Senate from 1904-1919), President of the Province of Palermo (1898-1914), President of the Advisory Commission on Explosives (1902-1907), President of the

Italian government's Superior Council of Health (1910-1923), and President of the Italian National Academy of Sciences (1921-1932). He died in Palermo in 1935, having left the specific provision of not wanting to be commemorated by the fascist Italian Senate.

HIST 3979750

"Missed it by that much!" How Butlerov almost proposed the tetrahedral carbon

David E. Lewis, lewisd@uwec.edu. University of Wisconsin-Eau Claire Chemistry and Biochemistry Department, Eau Claire, Wisconsin, United States

The Structural Theory of Organic Chemistry, first proposed by Archibald Scott Couper (1831-1892) and (Friedrich) August Kekulé (1829-1896) in 1858, and then clarified and extended by Aleksandr Mikhailovich Butlerov (1828-1886) in 1861, was a necessary prelude to the van't Hoff and Le Bel proposals of the tetrahedral carbon. At the time of Butlerov's proposal of his theory, he took pains to make it clear that his proposals were related to *chemical*, not *physical* atoms, making it more acceptable to those chemists for whom the concept of physical atoms was anathema. On the basis of his theory, Butlerov and his student, Vladimir Vasil'evich Markovnikov (1837-1904), predicted the numbers of isomers of organic compounds. The details about chemical bonding were to await the next century, but like his contemporaries, Butlerov used the concept of "affinities" in his explanations about isomerism in organic chemistry. As part of his theoretical considerations, Butlerov used a model to rationalize the number of equivalent equivalencies of the carbon atom, using a tetrahedron—an object with four identical faces—as an analogy. However, he did not propose anything more with the analogy. The key development needed to allow the advance by was the realization by van't Hoff and Le Bel that *physical* atoms existed and that their positions could be deduced, which was made easier by their realization that atoms that were *chemically* close to each other in the molecule might also be *physically* close to each other.

HIST 3979746

How sweet it is! Emil Fischer's stereochemical studies of glucose

David E. Lewis, lewisd@uwec.edu. University of Wisconsin-Eau Claire Chemistry and Biochemistry Department, Eau Claire, Wisconsin, United States

Oddly enough, the work of Emil Fischer (1852-1919) leading to the elucidation of the relative structures of the monosaccharides was only a part of his work that was recognized by the Nobel Prize in 1902. By 1889, Fischer had begun to consider that the monosaccharides were stereoisomers of each other, and he set out the sixteen isomers predicted by the van't Hoff model of the carbon atom. The arguments used by Fischer to derive a structure for glucose still stand, over 100 years later, as one of the most impressive feats of chemical logic in the history of the discipline. The whole structure of his logical

derivation of a structure for glucose appeared in two papers, published in 1891. These papers also contain the first publication of Fischer's new projection formulas for what we now term chiral centers. His arguments stand on three foundations: 1) the interrelationships between the monosaccharides, established by oxidation-reduction chemistry; 2) the molecular symmetry of the saccharic acids (and the alditols); and 3) the application of the Kiliani-Fischer homologation of aldopentoses, and the symmetry of those pentoses. The prelude to his work and Fischer's analysis will be presented.



HIST 3979769

René Just Haüy and the contribution of crystallography to 3-dimensional chemistry

Gary D. Patterson¹, gp9a@andrew.cmu.edu, Carmen Schmechel². (1) Chemistry, Carnegie Mellon University, Pittsburgh, Pennsylvania, United States (2) Philosophie, Freie Universität Berlin, Berlin, Berlin, Germany

Even before the advent of chemical atoms, natural philosophers intuited that atomic matter is inherently three-dimensional. René Descartes (1596-1650) was a master geometer who applied his novel insights to the structure of matter. While we do not employ his exact scheme for the description of matter today, it did contain all the mathematical sophistication needed to succeed in this effort. Descartes was fully aware of the unique shapes associated with macroscopic crystals and of the mathematics needed to describe them. Robert Hooke (1635-1703) observed the unique geometry of the faces of such crystals in his *Micrographia*. In 1784 René Just Haüy took these nascent ideas and constructed a full three-dimensional theory of the crystalline state. The geometric theory of matter requires a full tensor description of space. Many classes of crystals exhibit optical rotation. Such symmetries are called “chiral.” They lack a “center of symmetry,” and can be either dextrorotatory or levorotatory. A selection of chiral crystals taken from Haüy’s classic *Traité de Minéralogie* (1801) will be presented and discussed in terms of their symmetry. Haüy knew that, in addition to the macroscopic symmetry of the crystal, there was a microscopic “unit cell” with the same symmetry. Eventually chemists realized that molecules were subject to the same geometric analysis as unit cells.

HIST 3993696

Disseminating three-dimensional chemistry data and knowledge across generations

Ian Bruno, bruno@ccdc.cam.ac.uk. The Cambridge Crystallographic Data Centre, Cambridge, Cambridgeshire, United Kingdom

Crystallography provides unique and invaluable insights into the three-dimensional shape of molecules and how they arrange and interact within a crystal structure. When crystal structure determinations are aggregated together, they can be mined to reveal knowledge about molecular geometries, interactions and more. One of the pioneers of crystallography, J D Bernal, anticipated as early as the 1940s the opportunities for deriving knowledge from accumulated data. This vision motivated the formation of the Cambridge Structural Database (CSD) which was established by Olga Kennard in 1965. Today the CSD contains over 1.25 million crystal structure determinations and a sea of knowledge about 3D structure that can be channelled into applications for addressing real-world research problems in industry and academia. At this ACS meeting we are celebrating the life of Olga Kennard who passed away in 2023. This talk will offer a historical view on the development of the CSD and those who contributed to its success along the way. It will highlight how pioneers in structural chemistry research took advantage of emerging database technologies to bring Bernal's vision to life, and how Olga's commitment and drive created a legacy that continues to be built on today.

HIST 3989792

Alfred Werner: Coordination theory and the stereochemistry of metal complexes

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

In the early period of the theory of valency, much difficulty was felt in explaining what were often called "molecular compounds", which are formed by the addition of species to molecules in which the valence was completely saturated. Common examples of this were produced through the reaction of various metal salts with ammonia to give metal-ammine compounds. Attempts to understand such metal-ammines date back to the first half of the 19th century, with a leading theory introduced by Christian Blomstrand (1826 - 1897) in 1869. Blomstrand's chain theory was later extended and modified by Sophus Jorgensen (1837 - 1914) from 1878 onwards. Joining these efforts was then Alfred Werner (1866 - 1919), who after studying the stereoisomerism of trivalent nitrogen in his 1890 doctoral dissertation, presented his coordination theory in 1893, a radically departure from the previous Blomstrand-Jorgensen chain theory. Not only did coordination theory better correlate the properties of compounds based on their composition and configuration, but Werner's proposed structures also introduced the first understanding of stereoisomers in metal complexes. While initially disputed by Jorgensen, Werner's theory finally displaced the older chain theory by 1907 and resulted in the awarding of the Nobel Prize in Chemistry

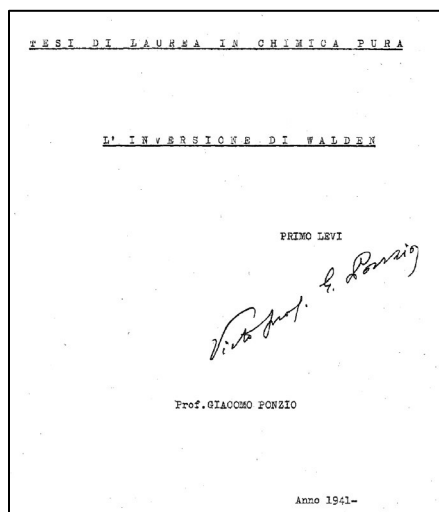
to Werner in 1913. The life and career of Werner will be presented with a focus on his coordination theory and its introduction of stereoisomers in metal complexes.

HIST 3985455

Primo Levi's undergraduate thesis on Walden inversion

Bart E. Kahr¹, bk66@nyu.edu, Miriam Rossi². (1) Chemistry and Molecular Design Institute, New York University, New York, New York, United States (2) Chemistry, Vassar College, Poughkeepsie, New York, United States

In 2015, WW Norton issued a three-volume set of *The Complete Works of Primo Levi* in English.[1] Many stories and essays were newly translated or retranslated. But *The Complete Works* was not absolutely complete; it did not include Levi's undergraduate thesis, *Inversione di Walden*. Levi, a student at the Politecnico di Torino, made a literature review of the concept, surprising at one time, that some atoms will turn themselves "inside-out", as if they had passed through a looking glass. The race laws in force in Italy at the time, prevented Levi from conducting laboratory research and consigned him to the library where he made an analysis of Walden inversion with the sources available to him. Molecular chirality remained a lifelong interest of Levi,[2] reappearing in his essay on the origin of life, *L'asimmetria e la vita*. [3] We received a copy of Levi's thesis from Professor Davide Viterbo (1939-2017) [4] of the Università del Piemonte Orientale 'A Avogadro' with whom we had previously collaborated about Levi's undergraduate chemistry.[5] Here, is an English translation of the thesis with some commentary on the its relation to Levi's otherwise complete *oeuvre*.



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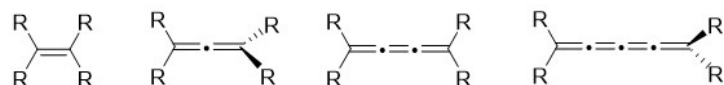
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HIST 3985040

Historical evolution, stereochemistry, and structural limitations for the C=C bond

Richard P. Johnson, richard.johnson@unh.edu. Chemistry, University of New Hampshire, Durham, New Hampshire, United States

Modern chemistry is anchored by a beautifully simple model for the electronic structure of carbon-carbon double bonds. This presentation will describe the historical evolution of structure and stereochemical concepts for C=C bonds in alkenes, allenes and higher cumulenes. The search for structural limitations has yielded many remarkable substances, some shelf-stable, others only fleeting intermediates, which demonstrate the tenacity of C=C bonds in bent, twisted and pyramidalized geometries.



HIST 3981499

Exploring variation in bonding and structure for tetravalent carbon: [1.1.1]propellane and inverted carbon

Kathleen M. Morgan¹, kmmorgan@xula.edu, Kenneth B. Wiberg². (1) Chemistry, Xavier University of Louisiana, New Orleans, Louisiana, United States(2) Chemistry, Yale University, New Haven, Connecticut, United States

In 1874, van't Hoff theorized that tetravalent carbon should have bonds oriented to the corners of a tetrahedron. While this is generally true, [1.1.1]propellane provides a notable exception. The synthesis and study of this remarkable compound, with comparisons to other unusual molecules including bicyclo[1.1.0]butane, will be discussed from an historical perspective.

HIST 3980523

Role of stereochemistry in the quantum chemical revolution

Jeffrey Seeman, jiseeman@yahoo.com. Department of Chemistry, University of Richmond, Richmond, Virginia, United States

Two revolutions in chemistry have been identified to have occurred in the 20th century: the Instrumental Revolution and the Quantum Chemical Revolution. The Quantum Chemical Revolution took place over a 40-year period, roughly from the middle 1920s until the middle 1960s. Stereochemistry and its partner conformational analysis played a central role in the tipping point that demarcated the beginning of a new era in chemistry. That era began with Derek H. R. Barton's discovery of conformational analysis in the early 1950s and R. B. Woodward and Roald Hoffmann's principle of conservation of orbital symmetry, more often referred to as the Woodward-Hoffmann rules, published in five communications in 1965.

HIST 3976660

Studies of chiral centers other than carbon: William Jackson Pope and Kurt Mislow, pioneers of stereochemistry

Arthur Greenberg, art.greenberg@unh.edu. Chemistry, University of New Hampshire, Durham, New Hampshire, United States

William Jackson Pope (1870-1939), Professor at Cambridge University, and Kurt Mislow (1923-2017), initially Professor at New York University followed by a long career at Princeton University, were both highly original thinkers who stretched the boundaries of stereochemistry. Although their careers were separated by half a century, there are striking parallels in their research subjects and approaches. A quarter century after van't Hoff's and Le Bel's independent papers disclosing the tetrahedral geometry of four coordinate carbon, Pope was studying the stereochemistry of nitrogen, sulfur, selenium, and tin. He was a pioneer in the application of X-ray crystallography to stereochemistry and the stereochemistry of spirocyclic molecules. Kurt Mislow pioneered static and dynamic studies of the stereochemistry of nitrogen, phosphorus, silicon, and sulfur, as well as hindered biphenyls and propeller-like molecules employing dynamic nmr spectroscopy and computational chemistry. Mislow played a major role in defining stereochemical relationships and developing nomenclature. Each exhibited a lighter side: Pope wrote about "Laevo Man", a fictitious person born with the wrong chirality. Mislow introduced the community of chemists to the "Coupe de Roi" parlor trick and then provided serious molecular analogies.

HIST 3977754

History of stereochemistry: Progress and prospects

Peter Ramberg, ramberg@truman.edu. Truman State University, Kirksville, Missouri, United States

It is now a little over twenty years since the publication of my book on the early history of stereochemistry, *Chemical structure, spatial arrangement: the early history of stereochemistry, 1874-1914*. Since its publication, new research has been published that bears on the conclusions I made in the book. Some of this is on the work of chemists J. H. van 't Hoff, Louis Pasteur, Emil Fischer, and Albert Ladenburg, while others have treated the more general development of the visual language of chemistry. In this talk, I will reflect on this literature for my understanding of the history of stereochemistry and sketch out prospects for more work to be done.

HIST 3995904

Generating and analyzing natural paints

Anna Lamm, annlamm12@gmail.com, Amy Millsap, amillsap@umhb.edu. Chemistry, University of Mary Hardin-Baylor College of Humanities and Sciences, Belton, Texas, United States

Painting is one of the oldest forms of art. From cave wall paintings to the great masters of the Renaissance, pigmented materials have been used throughout humanity's history for the pursuit of artistry and beauty. In the modern day, many commercial paints are made of synthetic pigments, which while vibrant and visually pleasing, can be toxic to the environment and expensive to produce in a cost-efficient manner. The goal of this research is to explore the effect of pH on the natural pigments present in local organic matter, and to extract those pigments via the process of laking, or of precipitation with a metallic salt mordant, and to then analyze and apply those extracted pigments into usable paint.

HIST 4000350

Energetics analysis of medieval black powder

Alecsander K. Imig, Vesa Ibrahimi, Blaine E. Dolin, Janez R. Orr, Sam V. Cowart, Justin C. Hunter, Dawn E. Riegner, dawn.riegner@westpoint.edu. Department of Chemistry and Life Science, U.S. Military Academy, West Point, New York, United States

Medieval black powder recipes were developed by trial and error of varying composition ratios and sometimes included interesting additives (such as vinegar, brandy, shellac) that modern historians and chemists have generally found puzzling or presumed to be

worthless. The purpose of this study is to analyze black powder recipes to aid historians in their interpretation of medieval texts and to determine if medieval artillery men empirically understood why certain additives and ratios of black powder increased performance. A combination of thermal techniques (bomb calorimetry, differential scanning calorimetry (DSC), simultaneous differential scanning calorimetry and thermogravimetry (SDT)) and computational fluid dynamics (CFD) were used to empirically determine the energy output of more than a dozen recipes. Using high speed imagery, we were able to capture the cannonball velocity during live-fire exercises from a replica medieval cannon. Pairing the laboratory data with the live-fire data enables qualitative and predictive analysis of black powder performance.

HIST 3986813

Early observations and studies of biological catalytic processes

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

Biocatalytic (enzymatic) reactions, e.g., the fermentation of sugars occurring in plants to alcohol, of alcohol to acetic acid, or of lactose in milk to lactic acid have been known and utilized for a very long time, with descriptions of the products (wine, beer) appearing in some of the oldest surviving documents. However, these processes were not scientifically studied until about the 17th century when in the works of “Basil Valentine” (published by Johann Thoenle), among other interesting observations, there appeared a description of the fermentation of wine to vinegar, which could not take place with the more concentrated spirit of wine (ethanol). Jan Baptist Van Helmont (1579-1644) carried out more extensive work on various types of fermentation and other enzymatic processes, such as digestion of proteins by gastric juice. He was probably the first to use the term “ferment” in a sense that is rather close to the terms “catalyst” and “enzyme” used today. Johann Kunckel (1630-1703) found that many substances, including strong acids or alcohol, suppress fermentation. The discovery and isolation from malt solution of the first enzyme, diastase, was reported in 1833 by Anselm Payen (1795-1871) and Jean-Francois Persoz (1805-1868), but the term “enzyme” (meaning “leavened”) was only introduced in 1877 by Wilhelm Kuehne (1837–1900). It would take several decades until the first scientific theories of enzymatic action were developed, notably, the “lock-and-key” concept proposed in 1894 by Emil Fischer (1852-1919) and the Michaelis-Menten kinetics reported in 1913. These and other impactful discoveries that shed light on enzymes and their function will be the subject of this talk.

HIST 3998583

Karl Ziegler and Giulio Natta and their impact on modern catalysis

Pete Villarreal, pete.villarreal@students.tamuk.edu, Christine Hahn. Department of Chemistry, Texas A&M University-Kingsville, Kingsville, Texas, United States

Karl Ziegler (1898-1973) and Giulio Natta (1903-1979) are two renowned chemists famous for their development and application of what is known as the Ziegler-Natta catalyst. Their pioneering work in titanium-based catalysts in the synthesis of 1-alkene polymers helped to revolutionize chemistry, industry, and commercial manufacturing. This talk aims to highlight their lives, achievements, and contributions to the field of chemistry and catalysis, as well as looking at the improvements that have been made to the modern world due to their work.

HIST 3998580

Catalysis research in the former German Democratic Republic

Christine Hahn, christine.hahn@tamuk.edu. Department of Chemistry, Texas A&M University-Kingsville, Kingsville, Texas, United States

This presentation will give a survey of the catalysis research in the former German Democratic Republic (1949-1989). Despite the situation after the WWII, the restrictions under the political system in East Germany, and the resulting economic shortcoming, the GDR was able to develop significant research in the variety of areas in catalysis. The catalysis research was closely connected with the state-owned chemical industry and directed by the government. The German Academy of Sciences founded in 1946 at Berlin has established the Institute for Catalysis Research at Rostock in 1951. In 1959 this Institute was split into two institutes, one for organic and one for inorganic catalysis research. Günther Rienäcker was the director of the Institute for Inorganic Catalysis Research with specialization in metal catalysts and molecular sieves for multifunctional heterogeneous catalytic systems. Another center for homogeneous and heterogeneous catalysis was established in 1970 at the Technical University Leuna-Merseburg under leadership of Rudolf Taube, Karl-Heinz Thiele, and Siegfried Engels. Highlights of the research include the stereospecific butadiene polymerizations, olefin metathesis, and hydroamination of olefins. Their research activities were directly linked to the industrial complexes Leuna Works and Buna Works Schkopau. The University of Leipzig collaborated closely with the former ORWO Filmfabrik Wolfen (an industry for photographic films) where Horst Hennig developed research on photocatalytic processes. At the University of Jena pioneering work was done by Dirk Walter in the area on CO₂ fixation at transition metals and the development of novel catalytic reactions with alkenes and alkynes for the generation of various heterocycles.

HIST 3985797

Asymmetric Catalysis: The beginnings with diazo compounds

Michael P. Doyle, michael.doyle@UTSA.edu. Chemistry, The University of Texas at San Antonio, San Antonio, Texas, United States

The first report that a homogeneous chiral catalyst could be used for asymmetric induction was published in 1966 by Nozaki and coworkers that included R. Noyori. Their target was the cyclopropanation of styrene, and although initial results with their copper-ligated chiral salicylaldimines showed low enantiomeric excesses, this and subsequent publications promoted extensive efforts in chiral ligand design. Directions were also taken in the use of alternative metal complexes, especially those of dirhodium(II), and in the synthesis of new diazo compounds. For many years, up to the present, diazo compounds were avoided because of the perception that they were toxic and/or explosive, yet commercial products from their use, especially those provided by asymmetric catalysis, continue to be produced. Applications of diazo compounds for carbene-based transformations continue to multiply and today include insertion, addition, and cycloaddition reactions. In recent years the use of proteins and nucleic acid structures as catalysts have further expanded understanding of asymmetric catalysis.

HIST 3982672

Selective catalytic routes for light hydrocarbon upgrading

Anne M. Gaffney, anne.gaffney@inl.gov. University of South Carolina, Columbia, South Carolina, United States

This talk will review progress made over the past 43 years on the selective catalytic upgrading of light hydrocarbons as experienced during my industrial career at major chemical manufacturing companies and also during my recent appointments at Idaho National Laboratory and University of South Carolina. An overview of the discovery, R&D and commercialization of four new technologies, namely AlkyClean™, OCT™, Superflex™ and 1,4-Butanediol™ will be provided along with the initial groundbreaking work OCM, Direct PO, C2 ODH, ChemPren and new routes to polymers.

HIST 3994396

Metal-catalyzed reductions of amides to amines using silanes: Learning more than chemistry from a historical analysis of such a specific "Green" transformation

Keith H. Pannell, kpannell@utep.edu. Chemistry, University of Texas at El Paso, El Paso, Texas, United States

One of the major targets for the transformation of standard chemical reactions to green alternatives has focused upon the amide to amine reduction, i.e. without using reactive metal hydrides. A multitude of catalysts, with systems ranging from old-fashioned zinc salts to organometallic iridium complexes, have been demonstrated to be useful. Organosilanes, R_nSiH_{4-n} , have been also studied extensively for this specific purpose. In our laboratory we have used the earth abundant (cheap) Fe and Mo metal systems and, by so-doing managed to definitively clarify the mechanism for the process, at least for the Mo catalyzed process. However, as interesting as the chemistry itself are the lessons regarding the conduct of chemistry as noted from a historical study of the field. The ethical responsibilities of current researchers (and editors/reviewers) to the literature will be discussed as will be the "rush to patent" aspects of our trade.