American Chemical Society
Division of the History of Chemistry

Program and Abstracts

231st ACS National Meeting
Atlanta, GA
March 26-30, 2006

J. S. Jeffers, Program Chair

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DIVISION OF THE HISTORY OF CHEMISTRY

Final Program, 231st ACS National Meeting, Atlanta, GA, March 26-30, 2006

J. S. Jeffers, *Program Chair*

Business Meeting, 1:30 p.m.: Tuesday, GWCC, Building A, Room 408

SOCIAL EVENT:
CHF-Sponsored Chemist-Composers Reception, 4:30 p.m.:
Tuesday, GWCC, Building A, Room 409

SUNDAY MORNING

Georgia World Congress Center, Building A, Room 408

Science History and Its Applications to Chemical Education

Cosponsored with CHED
D. E. Lewis, *Organizer*
S. C. Rasmussen, *Organizer, Presiding*

8:30 — Introductory Remarks.
8:40 —1. Project Inclusion: Faces and facts, some tools for encouraging student success. **J. M. Hayes**, P. L. Perez
9:10 —2. Some techniques of teaching chemical history outside the classroom. **L. May**
9:40 —3. Teaching the history of chemistry as a study abroad course in Great Britain. **K. A. Walters**
10:10 — Intermission.
10:25 —4. Organic name reactions: Useful teaching tool or obstructive jargon? **D. E. Lewis**
10:55 —5. Smith's *Introduction to General Inorganic Chemistry*, 1906 - 2006. **D. Cotter**
11:25 —6. History of the African American Women Chemist Project. **J. Brown**

Archaeological Chemistry: Analytical Techniques and Archaeological Interpretation

Sponsored by NUCL, Cosponsored with HIST

Implications of Sugar Ring Conformations in Drug Design: A Symposium in Memory of Muttaiya Sundaralingam

Sponsored by CARB, Cosponsored with HIST, MEDI, and ORGN

SUNDAY AFTERNOON

Georgia World Congress Center, Building A, Room 408

Science History and Its Applications to Chemical Education

Cosponsored with CHED
S. C. Rasmussen, *Organizer*
D. E. Lewis, *Organizer, Presiding*

1:30 —7. Science as experienced through lives in science: The Percy Julian story. **M. Michalovic**
2:00 —8. World Year of Physics 2005: Lessons for chemistry educators? **C. J. Giunta**
2:30 —9. Using the history of science as a tool to identify and confront pseudoscience. **S. C. Rasmussen**

General Papers

J. S. Jeffers, *Organizer, Presiding*

3:15 —10. Patriots, immigrants and chemical patentees in the National Inventors Hall of Fame. IV. **H. M. Peters**, S. B. Peters
3:40 —11. History of the Chemistry Department at Dickinson College. **J. Robinson**
4:05 —12. Associates of Frederick Sanger: John Walker, Nobel Laureate 1997. **J. S. Jeffers**

Georgia World Congress Center, Building A, Room 409

4:30 —HIST Executive Committee Meeting

Archaeological Chemistry: Analytical Techniques and Archaeological Interpretation

Sponsored by NUCL, Cosponsored with HIST

MONDAY MORNING

Georgia World Congress Center, Building A, Room 408

Pharmaceutical Research and Development over the Past 25 Years: Investment in Basic Research Leading to Benefits for Society

Cosponsored with PRES
M. V. Orna and J. I. Seeman, *Organizers*
J. I. Seeman, *Presiding*

9:00 — Welcome, Mary Virginia Orna.
9:10 — Introductory Remarks. **A. Nalley**.
9:20 —13. Trajectories in pharmaceutical R&D, markets, and regulation. **A. Daemmrich**
9:50 —14. A retrospective look at drug discovery. **P. Anderson**
10:20 — Intermission.

10:35 —15. Long-term investments in research can benefit society. **R. Vagelos**
11:05 —16. The emerging impact of research universities on drug discovery. **D. C. Liotta**
11:35 —17. Pharmaceutical manufacturing practices in the 21st century: A focus on safety. **C. A. Maryanoff**

Archaeological Chemistry: Analytical Techniques and Archaeological Interpretation

Sponsored by NUCL, Cosponsored with HIST

MONDAY AFTERNOON

Georgia World Congress Center, Building A, Room 408

Chinese American Chemical Society 25th Anniversary Symposium: Sustainable Contributions by Chemical Professionals

Cosponsored with Chinese American Chemical Society
Y. Hsieh, *Organizer*
W. S. W. Ho, *Organizer, Presiding*

1:30 — Introductory Remarks. **W.S.W. Ho, T. Y. Hsieh** .
1:40 —18. VIP presentation: President of Chinese-American Chemical Society. **Y. H. E. Ma**
1:50 —19. VIP presentation: President of American Chemical Society. **A. Nalley**
2:00 —20. VIP presentation: President of American Institute of Chemical Engineers. **J. C. Chen**
2:10 —21. VIP presentation: President of Chemical Heritage Foundation. **A. Thackray**
2:20 — Intermission.
2:35 —22. Keynote Address. Water treatment and reuse by membrane technology. **N. N. Li**
3:10 —23. Keynote Address. New tools for carbohydrate-based drug discovery. **C -H. Wong**
3:45 —24. Keynote Address. Science education, research, and society: Perspectives of an immigrant research scientist and teacher. **H -L. Dai**
4:20 —25. Keynote Address. On the clean fossil energy conversion systems. **L. S. Fan**

Archaeological Chemistry: Analytical Techniques and Archaeological Interpretation

Sponsored by NUCL, Cosponsored with HIST

MONDAY EVENING

Georgia World Congress Center Hall B4

Sci-Mix

8:00 - 10:00

8-9. See previous listings.

26. History and evolution of the Gordon Research Conferences: 75 Years at the frontiers of science. **A. Daemmrich**

TUESDAY AFTERNOON

Georgia World Congress Center, Building A, Room 408

1:30 —HIST Business Meeting

Chemist-Composers: Their Chemistry and Music

L. May, *Organizer, Presiding*

1:55 — Introductory Remarks.
2:00 —27. Alexander Borodin: Chemist, composer, and champion of women's rights. **V. M. Bragin**
2:30 —28. Lejaren A. Hiller, Jr.: Computer composition. **C. C. Wamser**, C. A. Wamser
3:00 —29. Music and mind. **E. L. Bearer**
3:30 —30. Other chemist-composers: Edward William Elgar, Georges Urbain, and Emil Votoček. **L. May**
4:00 —31. Music and chemistry. **R. S. Root-Bernstein**

Georgia World Congress Center, Building A, Room 409

4:30-6:00 —Chemist-Composers Reception (Sponsored by Chemical Heritage Foundation)

Abstracts

HIST 1 Project Inclusion: Faces and facts, some tools for encouraging student success
Janan M. Hayes, Science Division, Merced College, 3600 M Street, Merced, CA 95348, Fax: 209-384-6362, hayes.j@mccd.edu, and Patricia L. Perez, Chemistry Department, Mt. San Antonio College

As a result of over a decade of Project Inclusion activities, we have come to the conclusion that the inclusion of chemical history in the chemistry curriculum at all levels (high school through university) is a key to student success. It is important and necessary for today's students and absolutely must be done! Why? Briefly, because the variety of persons and accomplishments cited, particularly at the introductory level, makes the content more relevant. It connects chemistry to our students, to their fields of interest, and to their daily lives. The result is increased student retention and success. How can this be done? Variety is key in the selection of the examples in terms of gender, geography, ethnic group and historical period. We chemical educators must look carefully at our students and hook them into the exploration of the discipline through faces and facts of history related to them. Throughout this paper examples will be given of this approach in lecture, laboratory, discussion session, exams, homework, and other course activities. These are Project Inclusion's tools for student success.

HIST 2 Some techniques of teaching chemical history outside the classroom
Leopold May, Department of Chemistry, The Catholic University of America, Washington, DC 20064, Fax: 202-319-5381, may@cua.edu

In the early part of the twentieth century, the study of chemical history was important in the chemical curriculum. Since the nineteen forties, courses in chemical history have been rarely offered. Many teachers have found the presentation of historical events to be useful in their courses. Calendars, such as Milestones in Chemistry Calendar, provide a list of daily events. With the advent of the Internet and e-mail, new approaches make historical materials readily available to students. Two such approaches will be described: the History Corner, a monthly biography of a prominent chemist; and the Hall of Chemical History.

HIST 3 Teaching the history of chemistry as a study abroad course in Great Britain
Keith A Walters, Department of Chemistry, Northern Kentucky University, Nunn Drive, Highland Heights, KY 41099, Fax: 859-572-5162, walterske@nku.edu

In the fall of 2005, a history of chemistry course was added to the curriculum at Northern Kentucky University. The course was offered as a two-week intersession course taught in London as part of the Cooperative Center for Study Abroad (CCSA). This presentation documents the course content and field trips for the initial offering of the course in the 2005-2006 winter intersession term. Ten students joined the instructor on a "tour de force" of the big names of chemistry that passed through Great Britain and how their contributions shaped how we study and understand chemistry today.

HIST 4 Organic name reactions: Useful teaching tool or obstructive jargon?
David E. Lewis, Department of Chemistry, U. of Wisconsin - Eau Claire, Eau Claire, WI 54702, Fax: 715-836-4979, lewisd@uwec.edu

The use of name reactions as a teaching tool in organic chemistry is well illustrated by the undergraduate organic chemistry curriculum, where the great names of organic chemistry abound. Thus, we find name reactions (e.g. the Grignard addition, the Claisen condensation, the Kolbe carbonation) and rules (e.g Markovnikov's rule for addition, Zaitsev's Rule for elimination) that have been known for many years. In contrast, one finds that the same situation does not occur at the graduate level, where the latest name reaction frequently appears to be more a means for determining whether the listener or reader is in "the club." The history of organic name reactions is well illustrated by the story of the Chichibabin amination of pyridines and by the much more recent series of coupling reactions of aryl halides and sulfonates. The two named rules of sophomore organic chemistry will be discussed to show how the history of an observation may add a dimension to the study of organic chemistry, and the two examples above will be discussed as illustrating the use and abuse of reaction names.

HIST 5 Smith's *Introduction to General Inorganic Chemistry*, 1906-2006
Donald Cotter, Department of Chemistry, Mount Holyoke College, 50 College Street, South Hadley, MA 01075, wdcotter@mtholyoke.edu

The seminal instructional text in American collegiate chemistry celebrates its centennial in the almost complete obscurity it now shares with its author, Alexander Smith (1864 - 1922). Smith's 1906 *Introduction to General Inorganic Chemistry* inaugurated a sea change in educational practice, made possible by the unique niche its author occupied in the pre-war American chemical community. The peculiar fit between the perceived needs of that group and Smith's own expertise and passions resulted in the establishment of a form of education that was both revolutionary and robust. This presentation will examine the text's relationship with its predecessors and progeny, with its author and his professional ideals and aspirations, and with the community of teachers who ultimately incorporated its aims as the core of their professional practice.

HIST 6 History of the African American Women Chemist Project
Jeannette Brown, Education Consultant, 122 Brookside Lane, Hillsborough, NJ 08844-4816, Fax: 908-874-6177, jebrown@infionline.net

African American women in science have always labored under the "double bind" of being a woman and a minority in science. To date, limited knowledge exists on the educational experiences of African American Women Chemists. We will discuss the establishment of a project to extend the current knowledge base about African American women in chemistry. Dr. Marie Daly was the first African American woman to receive a PhD in chemistry in 1948. She is noted for her research that preceded the discovery of DNA. If one is interested in women chemists one will find out that white women were receiving PhD degrees in the late 19th century, not the middle of the 20th century like African American women. This is the motivation for establishing this History of African American Women Chemists Project. This will be a multi-media approach for materials for students aged 9-14. We realize that this information should be available in forms other than a book because students at this age are best reached through use of multiple media. We are developing a multimedia program, web site, links to chemistry sites, activities geared toward the science of women chemists and workshops where students, especially girls, can interact with contemporary African American women chemists either in person or via the web by e-mail and chat rooms. This paper will detail our progress to date

HIST 7 Science as experienced through lives in science: The Percy Julian story
Mark Michalovic, Chemical Heritage Foundation, 315 Chestnut Street, Philadelphia, PA 19106-2702, Fax: (215) 925-1954, markm@chemheritage.org

Students can gain insight into what it means to be a scientist and do science by studying the lives of practicing scientists. This presentation introduces the Chemical Heritage Foundation's new educational initiative, Science Alive!, which follows

the life of the African-American chemist Percy Julian (1899-1975), who is notable for his synthesis of physostigmine and his work with steroids. It also introduces central concepts in chemistry by relating them to the issues Julian dealt with in his own unfolding career. Julian's achievements in chemistry both contributed to and were the products of the changing face of science and history. His story will underscore the value of historical biography in demonstrating the connections between science history and chemical education.

HIST 8 World Year of Physics 2005: Lessons for chemistry educators?
Carmen J. Giunta, Department of Chemistry and Physics, Le Moyne College, 1419 Salt Springs Rd, Syracuse, NY 13214-1399, Fax: 315-445-4540, giunta@lemoyne.edu

Albert Einstein's "Miracle Year" of 1905 was the occasion of a World Year of Physics proclaimed and observed by institutions all over the world throughout 2005. World Year of Physics activities used the achievements of an outstanding figure from the history of physics to highlight the field of physics to students and the general public. Can chemistry educators replicate some of the successes of the World Year of Physics? Selected events associated with the World Year of Physics will be described, with an eye toward identifying possible parallels for chemistry.

HIST 9 Using the history of science as a tool to identify and confront pseudoscience
Seth C. Rasmussen, Department of Chemistry and Molecular Biology, North Dakota State University, Fargo, ND 58105, Fax: 701-231-8831, seth.rasmussen@ndsu.edu

Many are concerned by the popularity pseudoscience has achieved in modern society. While it is easy to dismiss such beliefs as belonging to the uneducated, studies have shown that these beliefs are not reduced by a university education, even for students completing science degrees. This illustrates the extent to which even a successful science education has failed to transform students' intellectual outlook and should raise concern as to the deficiencies in our present science curriculum. Over the years authors have given sound justification for the inclusion of a historical component in science programs. I would like to add to these arguments the fact that knowledge of science history allows one to more easily identify and confront pseudoscience and that rectifying the current deficiency of historical context in our science education may be an effective way to change the way that students view claims and ideas presented to them.

HIST 10 Patriots, immigrants and chemical patentees in the National Inventors Hall of Fame. IV
Howard M. Peters, Peters, Verny, Jones Schmitt & Aston, LLP, 425 Sherman Avenue, Suite 230, Palo Alto, CA 94306, Fax: 650-324-1678, peters4pa@aol.com, and Sally B. Peters, PARC Inc

The U.S. patent system is over 200 years old. See www.uspto.gov. The National Inventors Hall of Fame (NIHF) in Akron, Ohio is over 30 years old. See www.invent.org. Using available resources including immigration records, genealogy records, the Sons of the American Revolution (SAR, see www.sar.org) and the Daughters of the American Revolution (DAR-www.dar.org), this paper continues an examination of the NIHF inductees for chemical innovation for their and/or their families' origins. New NIHF inductees examined include but are not limited to: George Washington Carver, Percy L. Julian, Elijah McCoy, Arnold Beckman, Helen & Al Free, etc. Some archival information in this series is found at the first author's web site www.howardpeters.net.

HIST 11 History of the Chemistry Department at Dickinson College
Jeanne Robinson, Department of Chemistry, Dickinson College, Carlisle, PA 17013, robinsje@dickinson.edu

Dickinson College was founded in 1783 by Benjamin Rush, signer of the Declaration of Independence and first chemistry chair in America (Penn, 1769); the experimental sciences were thus an important concern of the college since its beginning. This presentation traces the history of Dickinson's chemistry department from its founding to the present. It notes the early arguments over the role of the sciences in a liberal education, shows buildings and laboratories that held the chemistry department in its formative years, describes courses offered and texts used, illustrates available equipment (including some donated by Joseph Priestley), and traces the beginnings of women in the laboratories. The presentation ends with the current chemistry building, dedicated in 1958, and plans for the new chemistry wing of Tome Science Building, with ground-breaking scheduled for this spring.

HIST 12 Associates of Frederick Sanger: John Walker, Nobel Laureate 1997
Joe S. Jeffers, Department of Chemistry, Ouachita Baptist University, 410 Ouachita Street, Box 3786, Arkadelphia, AR 71998-0001, Fax: 870-245-5241, jeffers@obu.edu

John Walker received a Ph.D. from Oxford University in 1969, working with E. P Abraham on peptide antibiotics. He then received NATO and EMBO fellowships to work at the University of Wisconsin and in France at the CNRS at Gif-sur-Yvette

and at the Institute Pasteur. Following a dinner conversation with Frederick Sanger during an EMBO workshop in Cambridge, he joined the Medical Research Council Laboratory of Molecular Biology, working with Ieuan Harris, for a three-month trial. Sanger gave him several extensions until finally he was invited to join the regular research staff . Walker used protein sequencing methods to study bacteriophages and bovine and human mitochondria. In 1978, he decided to apply these techniques to membrane proteins, studying ATP synthase from bovine mitochondria. He eventually obtained the atomic resolution structure of the F catalytic domain of the enzyme. John Walker shared the 1997 Nobel Prize in Chemistry with Jens Skou and Paul Boyer for their elucidation of the enzymatic mechanism underlying the synthesis of ATP.

HIST 13 Trajectories in pharmaceutical R&D, markets, and regulation
Arthur Daemmrich, Center for Contemporary History and Policy, Chemical Heritage Foundation, 315 Chestnut Street, Philadelphia, PA 19106, Fax: 215-925-1954, arthurd@chemheritage.org

Since 1980, the pharmaceutical industry has invented and brought to market over 500 new therapies, including several entirely new classes of drugs. Firms in this sector have been among the top economic performers, with the top ten global companies averaging 10 to 12 percent growth per year. Investments in R&D also have increased significantly, from an average of 6 percent of sales in 1980 to 14 percent today. Employment of chemists and other scientists by the industry has likewise grown. Yet the industry is beset by difficulties: high profile drug withdrawals, a marked decline in public opinion and trust, competition from previously small biotechnology firms, and international challenges to intellectual property positions. This talk provides an overview of pharmaceutical R&D since 1980 in the context of a challenging economic, political, and social climate and offers a prognosis for the near-term future and some informed speculation concerning the next 25 years.

HIST 14 A retrospective look at drug discovery
Paul Anderson, 1233 Buttonwood Drive, Lansdale, PA 19446

Early practitioners of medicine used preparations of naturally occurring materials to achieve therapeutic benefit with little knowledge of the material's chemical composition or information about how the benefit was achieved. Over time these endeavors evolved into a formal process for drug discovery in which medicinal chemistry has played a key role. Understanding molecular structure and its relationship to biological activity was central to this evolutionary process. Today, targets for drug discovery are selected based on unmet or under met medical needs. These objectives are pursued through specific biochemical mechanisms for drug action that link the target to the experimental biology. Active molecules are discovered and designed with the mechanism of drug action in mind. Often the discovery process is facilitated by knowledge of the target's molecular structure. Molecules are optimized for fit to the target as well as for other drug-like properties by exploring a full range of ADMET parameters. While remarkable advances in scientific knowledge have enabled this process, the power of a good idea in the mind of a medicinal chemist and/or biologist frequently determines whether or not the discovery effort will be successful.

HIST 15 Long-term investments in research can benefit society
Roy Vagelos, To follow, To follow, To follow, NJ 00000

The “cholesterol hypothesis” was based on observations of cholesterol in plaques of occluded coronary arteries after a heart attack and epidemiological studies relating high blood cholesterol to death from heart attacks. An understanding of the biosynthesis of cholesterol as well as its control led many laboratories to focus on one enzyme, HMG CoA reductase. The discovery of lovastatin and simvastatin at Merck led to the pivotal studies that proved that lowering blood cholesterol can bring about a major reduction in death from heart attacks. These and other statins have caused a revolution in treatment of cardiovascular diseases. University studies of pseudohermaphrodites, patients who lack the enzyme that converts testosterone to dihydrotestosterone, provided the clue that inhibition of this enzyme might result in a beneficial effect in people who have benign prostate enlargement. Merck researchers designed a potent inhibitor, finasteride, which was shown to shrink benign enlarged prostates and benefit people with male pattern hair loss. Ivermectin, a potent antiparasitic agent discovered at Merck, was used for treatment of parasites in domestic animals. Studies beginning in 1981 demonstrated its ability to kill the microfilariae of Onchocerca volvulus, a parasite that infects 18 million people, largely in Subsaharan Africa. In 1987 the company faced a dilemma: the drug was able to prevent blindness caused by this parasite but the people who were infected or at risk of infection were too poor to afford it – at any price.

HIST 16 The emerging impact of research universities on drug discovery
Dennis C. Liotta, Department of Chemistry, Emory University, 1515 Dickey Drive, Atlanta, GA 30322

The passage of the Bayh-Dole Act in 1980 enabled universities to own intellectual property developed within and thereby catalyzed the creation of an alternative pathway for drug discovery. This presentation will attempt to define the role of drug

discovery in research universities and place it in its proper perspective vis-à-vis the pharmaceutical and biotechnology industries. It will also highlight the discovery of several therapeutics by academic laboratories, including our own.

HIST 17 Pharmaceutical manufacturing practices in the 21st century: A focus on safety
Cynthia A. Maryanoff, Cordis Corporation, a Johnson & Johnson Company, Welsh & McKean Roads, Spring House, PA 19477

State-of-the-art pharmaceutical development in the 21st century must focus on safety. In the past 10 years, the risk-benefit assessment for certain marketed drugs has resulted in their removal from general therapeutic use. A similar fate has befallen development compounds with certain molecular mechanisms of action. Given that a drug exhibits appropriate efficacy, the safety of patients becomes a paramount issue, which impacts the design of clinical and toxicological development studies. Beyond this aspect, we have concern for the safety of employees in planning the chemistry for drug synthesis, in pharmaceutical formulation, and in the design of manufacturing processes. Moreover, the safety of the environment becomes critical as we emphasize green chemical routes for the manufacture of drug substances and drug products. Examples from across the industry will be highlighted. As a new frontier, the marriage of drugs and devices will be addressed. Drug-eluting devices provide local drug delivery, which can afford a different type of safety improvement for active molecules.

HIST 18 VIP presentation: President of Chinese-American Chemical Society
Yi Hua Ed Ma, Department of Chemical Engineering, Worcester Polytechnic Institute, Worcester, MA 01609, Fax: 508-831-5867

VIP Presentation by President of Chinese-American Chemical Society for the Chinese-American Chemical Society 25th Anniversary Symposium/Celebration with a theme of “Sustainable Contributions by Chemical Professionals”.

HIST 19 VIP presentation: President of American Chemical Society
Ann Nalley, Department of Physical Sciences, Cameron University, 2800 Gore Blvd., Lawton, OK 73505, Fax: 580-591-8011

VIP Presentation by President of American Chemical Society for the Chinese-American Chemical Society 25th Anniversary Symposium/Celebration with a theme of “Sustainable Contributions by Chemical Professionals”.

HIST 20 VIP presentation: President of American Institute of Chemical Engineers
John C. Chen, Department of Chemical Engineering, Lehigh University, 111 Research Drive, B-316, Bethlehem, PA 18015-4791

VIP Presentation by President of American Institute of Chemical Engineers for the Chinese-American Chemical Society 25th Anniversary Symposium/Celebration with a theme of “Sustainable Contributions by Chemical Professionals”.

HIST 21 VIP presentation: President of Chemical Heritage Foundation
Arnold Thackray, Chemical Heritage Foundation, 315 Chestnut Street, Philadelphia, PA 19106, Fax: 215-925-1954

VIP Presentation by President of Chemical Heritage Foundation for the Chinese-American Chemical Society 25th Anniversary Symposium/Celebration with a theme of “Sustainable Contributions by Chemical Professionals”.

HIST 22 Keynote Address. Water treatment and reuse by membrane technology
Norman N. Li, NL Chemical Technology, Inc, 479 Bus Ctr Dr. 100, Mount Prospect, IL 60056

The lack of clean water is a serious problem in many parts of the world. Membrane technology is effective in removing impurities and pollutants from water. There are basically two broad types of membranes for water treatment and reuse. One is solid polymeric membranes and the other is facilitated transport membranes. Within each broad type, there are several specific types of membranes. This paper will discuss the various specific types of membranes and their roles in water treatment and reuse processes. The discussion will include not only the present membranes and membrane processes, but also the future developments of new membranes and processes. Also, the use of Six Sigma management and quality program in membrane R&D and manufacturing will be described.

HIST 23 Keynote Address. New tools for carbohydrate-based drug discovery
Chi-Huey Wong, Ernest W. Hahn Chair in Chemistry, Department of Chemistry, The Scripps Research Institute, 10550 North Torrey Pines Road, La Jolla, CA 92037, Fax: 858-784-2409, wong@scripps.edu

This lecture will present recent advances in the development of new tools for use in the study of carbohydrate-mediated biological recognitions and drug discovery.

HIST 24 Keynote Address. Science education, research, and society: Perspectives of an immigrant research scientist and teacher
Hai-Lung Dai, Department of Chemistry, University of Pennsylvania, 231 S. 34th Street, Philadelphia, PA 19104, Fax: 21-898-2037, dai@sas.upenn.edu

In a recent National Academies Committee on Prospering in Global Economy of the 21st Century report to Congress, “Rising above the storm: Energizing and Employing America for a Brighter Economic Future”, several areas critical to the economic competitiveness of the US have been identified for improvement: talent pool and education in science, basic research support, commercializing and investing in innovation, and intellectual right protection. This report illustrates the impact that a research scientist, whether working in academia or industry, may exert on the economic well being of a modern society. As an immigrant who had benefited from the education systems both abroad and in the US and who has had ample opportunities to observe and compare the trends in education and research in the US and abroad, I will provide personal perspectives on the strength and current problems encountered in science education, from K-college, and research here in the US. I will also discuss how an immigrant scientist can contribute to the betterment of science education and research in the US.

HIST 25 Keynote Address. On the clean fossil energy conversion systems
L. S. Fan, Department of Chemical and Biomolecular Engineering, The Ohio State University, 140 West 19th Avenue, Columbus, OH 43210-1180, Fax: 614-292-3769, fan@chbmeng.ohio-state.edu

Absolute and per-capita energy consumption is bound to increase globally, leading to a projected increase in energy requirements of 50% by 2020. The primary source for providing a majority of the energy will continue to be fossil fuels. The use of alternative sources of energy such as solar, wind, hydroelectric, nuclear, and biomass remains either uneconomical or less socially acceptable, despite the rapid technology advances made in their use. Therefore, an array of enabling technologies needs to be proven for the realization of a zero emission power plant in the near future. Opportunities to develop new processes, driven by the regulatory requirements for the reduction or elimination of gaseous and particulate pollutants, abound. This presentation describes the overall energy outlook in the context of the chemistry, mechanisms, process engineering, economics, and regulations that surround the development of the new clean coal technologies. The presentation will cover the salient features of the fundamental and process aspects of the technologies conceived and developed in the author's laboratory. These technologies include commercially demonstrated OSCAR and CARBONOX processes, CO_2 sorbent separation and mineral sequestration processes, and high temperature H_2S sorbents. New combustion and gasification processes based on the chemical looping concepts will also be discussed. The cornerstone of the energy conversion systems for cogeneration of fuels, chemicals, and electricity is fluidized bed technology. The state-of-the-art research in fluidization including the discrete computation of gas-liquid-solid fluidized beds and the 3-D imaging of the dynamics of the choking transition in gas-solid fluidized beds using the electrical capacitance volume-tomography (ECVT) will be highlighted.

HIST 26 History and evolution of the Gordon Research Conferences: 75 Years at the frontiers of science
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This poster visually displays the history of the Gordon Research Conferences, a series of scientific meetings first held in 1931 that have expanded since to over 350 week-long conferences attracting over 20,000 scientists annually. A unique conference formula encourages debate among scientists (ranging from leading figures to doctoral candidates) and kindles life-long friendships that further scientific communication well beyond any one conference itself. On the poster, graphs are integrated with a timeline and world map to illustrate the geographic, quantitative, and qualitative growth of GRC over seventy-five years, as well as key demographic trends including attendance from academia, industry, and government; participants' gender; and attendance by scientists from outside the United States. The poster also presents specific case examples of outcomes in five categories: theoretical knowledge, experimental techniques, collaborations, structural aspects of science and technology, and real-world products.

HIST 27 Alexander Borodin: Chemist, composer, and champion of women's rights
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Although better known as a composer than as a chemist, Alexander Borodin was, first and foremost, a chemist. He considered his musical activities to be second only to his duties as a chemist. This paper will discuss the various facets of Borodin's fascinating life, including his work in support of academic freedom for Russian women.

HIST 28 Lejaren A. Hiller, Jr.: Computer composition
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Lejaren Hiller (1924 - 1994) was trained in chemistry but maintained a lifelong love of music and eventually made music his primary career. His early work on the chemistry of polymers with Fred Wall at the University of Illinois introduced him to the Illiac computer, with which he did Monte Carlo calculations of polymer conformations. He promptly collaborated with Leonard Isaacson, a graduate student also associated with the Wall group, to teach the Illiac to compose music. Using a modified Monte Carlo technique to select the notes and other aspects of the music, they applied increasingly complex rules to define what constituted acceptable music. The result was their String Quartet #4, produced in 1957, often called the Illiac Suite. It is generally acknowledged as the first piece of music composed by a computer. Hiller remained a pioneer in the field of computer composition during his distinguished career at the University of Illinois and the State University of New York at Buffalo. This paper traces Hiller's careers in chemistry and music and examines the connections between the two.

HIST 29 Music and mind
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The Greeks discovered that mathematical (quantitative) relationships exist between the harmonics of sound and distances between the planets. This led to today's concept of physical laws applicable universally. Mathematics, arising from the human ability to quantize, pervades both music and science, linking them in the realm of conceptualization. As a chemist-composer, I entered science after intensive studies and professional activities in music. Initially, my science focused on the biochemical mechanics of musical perception. Now I am exploring relationships between quantal conceptualization in music and in biological sciences. This process is fundamental to human perception and analysis of the physical world, from atomic and molecular structures to neuronal connections and their modifications during learning and memory. In this talk accompanied by musical examples, I will describe findings from my laboratory on the mechanisms of acoustic perception and on neuronal activity that leads to experience and musical creativity.

HIST 30 Other chemist-composers: Edward William Elgar, Georges Urbain, and Emil Votoček
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The most prominent among the other chemist-composers is the amateur chemist-composer, Sir Edward William Elgar (1857-1934), who is best known for his five Pomp and Circumstance marches. Elgar enjoyed chemistry as a hobby in a shed in his garden that he called "The Ark". Georges Urbain (1872-1938) was an inorganic chemist-composer who was the co-discoverer of lutetium with K. Auer von Welsbach. In addition to composing music, he was a painter and sculptor. Emil Votoček (1872- 1950) was a Czech organic chemist-composer whose chemical work was concerned with sugar chemistry. He introduced the concept of epimerism and was a co-founder of the chemical journal Collection of Czechoslovak Chemical Communications in addition to composing 29 songs and 26 other compositions.

HIST 31 Music and chemistry
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Nobel prizewinning chemists tend to be polymaths with significantly higher rates of adult participation in arts such as music than the average scientist. Possible reasons range from unusually broad talents or educations to trans-disciplinary tools for thinking and synergy between creativity activities. Music certainly plays many chemical roles: analysis (e.g., musical urinalysis and genes); communication (musical biochemistry); source of analogies (Eigen and fast reactions, NMR theory); aesthetic guide (e.g., Gerhard Herzberg on boron research); social function (e.g., Martin Kamen); technical training (making instruments); or simply fruitful relaxation (e.g., Wilhelm Ostwald).Oddly, eminent scientists report working less hours and playing more often than the average scientist, suggesting that avocations promote scientific creativity. (Root-Bernstein RS.

“Sensual Chemistry,” HYLE, 2003; 9: 33-50; “Music, Creativity, and Scientific Thinking,” LEONARDO 2001; 34: 63-68; “Harmony and Beauty in Medical Research”, J Mol Cell Cardiol 1987; 19: 1043-1051.