

THE VORTEX

AMERICAN CHEMICAL SOCIETY
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CALIFORNIA SECTION
SEPTEMBER 2016



Elaine Yamguchi, Chair of the California Section Project Seed, accepting the ChemLuminary Award for Outstanding Project SEED Program, 2015



Alex Madonik, Coordinator of National Chemistry Week for the California Section, accepting the ChemLuminary Award for the Most Creative NCW Event Using the Yearly Theme, 2015

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California Section
American Chemical Society
September Section Program

Speaker: Stefan Koenig Co-chair of the American Chemical Society (ACS) Green Chemistry Institute

Topic: Making Medicines More Sustainably: Efforts of the Green Chemistry Institute Pharma Roundtable (GCIPR)

Date: Thursday September 22, 2016. 5:30 – 6:45 PM Social Hour, 7:00-8:00 PM Presentation.

Place: USDA, 800 Buchanan St., Albany, CA 94706

Cost: \$10.00 members and guests. No charge Students and retired members., Light snacks, sandwiches, and drinks

Reservations: Please register by Monday, September 19, for meal or for talk only, by email to office@calacs.org, or by phone 510.351.9922. If mailing a check in advance, please make payable to “California Section ACS” and send to CalACS Office, 2950 Merced Street #225, San Leandro, CA 94577.

Directions: •From Oakland: Take I-80 North, exit Buchanan Street, turn right onto Buchanan Street, continue east one block, turn right into USDA driveway.

•From Vallejo: Take I-80 South, exit Albany, turn left onto Cleveland Avenue (S), left on Solano Avenue (E), right on Taylor Street (S), cross Buchanan into USDA driveway.

Biography:

Stefan Koenig is Co-chair of the American Chemical Society (ACS) Green Chemistry Institute Pharma Roundtable (GCIPR) as well as a member of the International Consortium for Innovation & Quality in Pharmaceutical Development (IQ Consortium) and ACS. He is a Process Chemist at Genentech, where he has contributed to both early and late research & development projects. Stefan received his Ph.D. from Yale University and was a post-doc at the ETH Zurich prior to embarking on his career in industry.

Abstract: The ACS Green Chemistry Institute Pharma Roundtable (GCIPR) was founded in 2005 to bring committed pharma companies together to help the industry become more efficient and reduce its environmental footprint. The presentation will provide an introduction to the GCIPR as well as an overview of ongoing activities in making the discovery and development of medicines a more sustainable enterprise.



California Section 2016 Election

The California Section, ACS, will hold an election this fall for the following positions: Chair-elect, Secretary, Director, three Councilors, three Alternate Councilors, and two Members-at-Large. All these positions are members of the Section's Executive Committee, and the first three positions are members of the Section's Board of Directors. If you have an interest in being a candidate for one of these positions or would like more information, please contact Michael Cheng, Secretary, [(510) 242-2588, mitch@chevron.com], Paul Vartanian [(510) 763-0195, pfvartanian@gmail.com], a member of the Nominations and Election Committee,

or Charles Gluchowski [(925) 640-0550, charles.gluchowski@gmail.com], the chair of the committee, by September 12, 2016.

While the first five elected positions may be filled only by full members of the ACS, the positions of Member-at-large are open to both members and student members of the Society.

The 2016 election will be conducted electronically via SurveyMonkey; instruction will be sent to you, as well as in future *Vortex* issues. If you wish to cast your vote on a paper ballot, please call the California Section of ACS office at 510-391-9922, and a paper ballot will be mailed to you.

THE VORTEX

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Chair's Message

The Future of Chemistry

Lou Rigali

What is the future of chemistry? Asked another way... what challenges lie ahead for chemists and chemistry? The question was prompted by reflecting on the many changes seen in the field over a single generation and even within the last decade.

Changes can be good. The carriage makers of the 19th century who saw themselves as being in the transportation business did well, the buggy whip people not so well. As members of the American Chemical Society and the California Section we need to know how chemistry is changing and how it will affect us.

One of the things a professional society like the ACS does is to publish information and opinions from respected leaders in the field on important topics. The article by Professor Ronald Breslow, "Back to the Future of Chemistry", C&EN News, May 2, 2016, touches on some aspects of the coming changes. His admonition to chemists "... the field must remain the creative and useful science and not become the narrow science." He further described some challenging projects, confirming that there is indeed a lot to discover and invent. Among some of the challenges are:

1. Cures not just treatments for viral diseases like Ebola and Zika.
2. Development of new materials to utilize solar power.

3. Focus on how different substances interact and, in organized life systems, how this would lead to being able to mimic bacteria.
4. Be mindful of the environmental impact for all projects.

In an earlier publication, "The future of chemistry", Nature Chemistry, Vol 1 April 2009, there were similar discussions of the opportunities and chemistry challenges for the future.

Rypji Noyori, at Nagoya University, emphasized research and development on function in place of structure, the interaction between large biopolymer and small organic molecules as found in living organisms.

Harry C. Gray, at California Institute of Technology, also pointed to developing solar fuel to power the planet using "dirt" cheap catalysts.

Mark A. Johnson at Yale predicts that interdisciplinary effort will be the foundation for the molecular sciences, and traditional dividing lines will become obscure or obsolete.

Barbara Imperiali at MIT speaks of the infinite opportunities for chemists at the biology interface. The challenge is to develop those chemically-driven strategies to help navigate the fundamental processes of life.

Gary M. Hieftje at University of Indiana at Bloomington discusses the importance of developing new tools, techniques, and

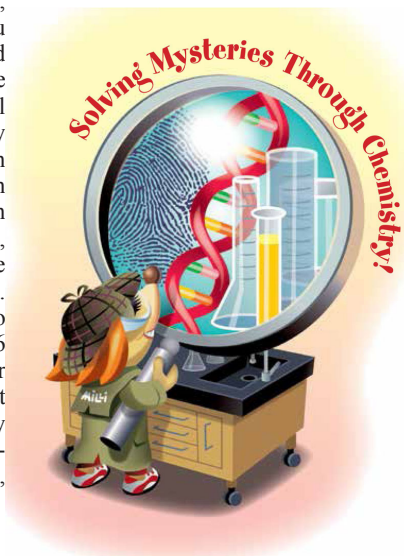
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Family Science Night

We're off to an early start with public outreach in the California Section this fall and you Can Help!

Family Science Night is coming -- on Wednesday, September 7th, 5 PM to 7 PM at César Chávez Middle School in Hayward, CA. We need to hear from you ASAP if you can participate. The Scientific Jam band and Bryan Balazs will be there to open the show with music and some thrilling chemical demonstrations. The National Chemistry Week theme is «Solving Mysteries with Chemistry» and we will have an entire room dedicated to a crime scene investigation (fingerprints, fibers, perfumes, paint chips, DNA sequencing, etc.), with half a dozen more classrooms devoted to other hands-on activities.

The California Section returns to the Solano Stroll on Sunday, September 11th, 10 AM to 6 PM, and we need volunteers to take two-hour shifts at our booth opposite Andronico's Market in Berkeley. There will be hands-on chemistry fun, colorful displays, and souvenirs for visitors. Come join the fun at this annual event, which attracts over 200,000 visitors!



East Bay Mini Maker Faire

We are invited to participate in the East Bay Mini Maker Faire in Oakland on Sunday, October 23rd, 10 AM to 5 PM (Mole Day!) at Park Day School, 360 42nd Street, Oakland, CA and Studio One Art Center, 365 45th Street, Oakland, CA 94609 -- a perfect finale for National Chemistry Week. The Chemistry of Latent Fingerprint Visualization will be our

(Continued on the next page)

The logo features a stylized atom with three orbiting spheres in blue, green, and orange, connected by colorful lines. To the right, the text "Bay Area SCIENCE FESTIVAL" is displayed in a sans-serif font, with "SCIENCE" in blue and "FESTIVAL" in grey.

Bay Area SCIENCE FESTIVAL



primary activity – everyone has fingerprints, right? Thousands of visitors are expected, so this will be a great opportunity to reach out to the Oakland community and to everyone who is into Do-It-Yourself science.

Last, but not least, join us for Discovery Days at AT&T Park in San Francisco as the Bay Area Science Festival celebrates its finale on Saturday, November 5th, 10 AM to 4 PM. Our booth will feature plant/perfume aroma identification and the construction of molecular models – this activity never fails to please, and it fits well with this year’s NCW theme. Tens of thousands of visitors will throng the field, and this is your chance to see the cream of Bay Area science and technology in action.

Please contact the Cal ACS Office office@calacs.org or (510) 351-9922 for more information or to volunteer. You can also contact Alex Madonik, National Chemistry Week Coordinator, at alexmadonik@sonic.net or 510-872-0528.



Congratulations to Elaine Yamaguchi and Alex Madonik for their leadership in Project Seed, and National Chemistry Week, respectively, resulting in ChemLuminary Awards in each category. Elaine and Alex both join the California Section in thanking the many other volunteers whose efforts and donations contributed to these programs.



Only at Oklo? (Part 1)

Bill Motzer

On December 2, 1942, the world's first self-sustained nuclear chain reaction occurred in what was then designated as the Chicago Pile-1 or CP-1. Its construction was part of the work conducted under the auspices of the then top secret Manhattan Project's Metallurgical Laboratory ("Met Lab") at the University of Chicago. CP-1 was actually assembled under the western stands of the abandoned Stagg Field football stadium, in a space formerly used as a squash ball court (Fig. 1). The reactor was built of neutron-producing uranium pellets separated by graphite blocks, without radiation shielding or a cooling system typical of modern reactors. The graphite served as a neutron moderator, slowing the neutrons, thereby increasing the chance they'd be absorbed by other uranium atoms resulting in sustained nuclear fission. The pile also contained control rods made of cadmium, indium, and silver. Cadmium and indium are neutron absorbers used to control the chain reaction and also prevent a runaway chain reaction. At that time, CP-1 required huge quantities of graphite and uranium: about 40,000 graphite blocks (~400 tons) enclosing 19,000 pieces of uranium metal and uranium oxide fuel (~6 tons of uranium metal and 34 tons of uranium oxide). The graphite blocks were arranged in layers within a 24 square foot wooden framework shrouded on all sides by a large gray square balloon supplied by Goodyear. Today, the site is a noted Chicago and a National Historic Landmark.

CP-1 was assembled under supervision of the eminent physicist Enrico Fermi, with collaboration of Leó Szilárd, discoverer of the nuclear chain reaction, with assistance of Martin Whittaker, Walter Zinn, and George Weil. It was the culmination of discoveries in chemistry and physics spanning several thousand years – from the philosophies and writings of ancient Greeks who coined the word "atom" to the 1789 discovery of uranium in pitchblende ore by Martin Heinrich Klaproth, to radioactivity (in 1896)

by the French scientist Henri Becquerel, to Marie and Curie's 1898 discovery and isolation of polonium and radium, to Otto Hahn's 1938 experiment, where he directed neutrons onto uranium atoms expecting to find transuranium elements but instead found barium as a product. In 1939, Lise Meitner and her nephew Otto Frisch verified that Hahn's results were the first experimental confirmation of nuclear fission.

On the first try, Fermi's group did not achieve a chain reaction. They built and rebuilt the uranium, uranium oxide, and graphite block stacks at least 30 times before conducting a valid test. Finally, on December 2nd, CP-1 was ready for a demonstration. At 9:54 A.M., before a group of on-looking dignitaries, Fermi ordered removal of the electrically-operated control rods. George Weil extracted the final control rod with Fermi monitoring neutron activity from nearby instruments. The pile obtained a self-sustaining reaction ("went critical") and Fermi confirmed this with additional calculations, finally shutting it down after 28 minutes. At 3:25 P.M. he announced that: "the reaction is self-sustaining," and for the first time on Earth a self-sustaining nuclear reaction had occurred and it was humans that had unleashed and controlled atomic power, although the reactor only generated about half a watt of power, just enough to illuminate a small light bulb. Or was it?

In May 1972, at the French Pierrelatte Uranium Enrichment Facility, a routine mass spectrometry analysis of uranium hexafluoride (UF₆) showed a discrepancy in the amount of uranium-235 (235U) isotope contained in the analyzed samples. The original uranium source was ore obtained from the Oklo Mine, in Gabon, Central Africa. Normally, uranium ore's 235U concentration is 0.7202%; however, these samples contained only 0.6000%. This significant discrepancy required immediate explanations, because all fissionable isotopes at civilian uranium handling facilities must be accounted for, assuring that they are not diverted for nuclear weapons. Therefore, the French Commissariat à l'Energie Atomique

(continued on page 7)

(Motzer continued from page 6)

(CEA) began an immediate investigation, conducting a series of measurements into uranium and other elemental isotope relative abundances from Oklo when compared to other uranium deposits. Results showed several anomalies when Oklo ores were compared to uranium ores from other mines.

Further studies of Oklo determined that some uranium ores had ^{235}U concentrations as low as 0.440%. This type of ^{235}U loss only occurs in nuclear reactors and it was subsequently concluded that Oklo had

operated for a time as a natural fission reactor. Analyses of other elemental isotopes including neodymium and ruthenium showed similar anomalies and on September 25, 1972, the CEA announced that self-sustaining nuclear chain reactions had occurred on Earth about 1.8 billion years ago.

So Gaia beat us to it! How and why this occurred is a fascinating story of geological (e.g., plate tectonics), hydrogeological, chemical, geochemical, biogeochemical, and nuclear chemical and physical processes (although not necessarily in this order) and we'll explore these in future parts.



Figure 1: 1957 painting by Gary Sheahan of the audience and operators gathered under the University of Chicago's Stagg Field Stadium squash court witnessing the first nuclear chain reaction in history. Painting based on participant written reports, interviews, drawings and descriptions because no photographs were taken of this event. Painting at the Chicago Historical Society Museum. From Forest Preserves of Cook County-Red Gate Woods iSite A1 at: <http://fpdcc.com/site-a/> and <http://www.atomicarchive.com/History/sites/Metlab.shtml>.



Nominations for Esselen Award

The Northeastern Section is requesting nominations for the 2017 Esselen Award for Chemistry in the Public Interest. Deadline is October 15, 2016. Further information is available www.nesacs.org/awards_esselen.html

(Continued from page 3)

instrumentation that will be needed to advance chemistry.

James H. Clark at the University of York speaks to both the depletion of resources and elimination of wasteful processes and where chemists will work with biologists and engineers to make greater use of biomass. The challenge for Green Chemistry is not just to replace undesirable chemicals but to replace them with sustainable and environmentally benign products.

J. Fraser Stoddart at Northwestern University reminds us that chemistry today is like a two year old child learning to speak; the chemist is just now learning to construct sentences. The story is yet to be told.

These powerful and inspiring topics from the above brief paraphrased summaries are worthwhile reading from the original papers and are easily accessible on-line.

Throughout the last two years, the Section has had programs on some aspect of all the topics with the exception of solar energy. I would welcome a recommendation for a speaker on solar energy or any of the subjects covered in the above publications.

Insightful as these articles maybe, there

are additional questions that can also be addressed, such as: what changes may be necessary in K-12 education to meet the demands of the future? Will the role of the university need to change to address the interdisciplinary nature of science. How about graduate students and Postdocs? How many would be interested in participating in an on-line forum that would discuss these and other future chemistry related issues? Send an email to LR101898@aol.com

It is hard to believe that school has started and the fall season is around the corner. The Section has a very full program as you can see from the announcements in this issue. There are even more; so check the calendar on the website, www.calacs.org

Just a couple of reminders...watch for the email announcing the Section elections.

We need more volunteers to spend a couple of hours or more in our booth or at the table at Family Science Night, Solano Stroll, Bay Area Science Festival, Mini Makers Faire in Oakland. You can be an inspiration to the youngsters that visit the booth to learn about Chemistry. We expect 20-30,000 students for these four events. Your contribution will be important.



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Gifts & Donations

As noted in the report from Eileen Nottoli and Alex Madonik, the Section has many outreach programs to help support science and chemistry in our community schools. You can help support the programs including the work with the High School Chemistry Teachers programs through your donations. Call or email and find out how your valued contribution can be used.

Lou Rigali, LR101898@aol.com

Field Trip to “Walking in the Woods with Chemistry” Exhibit at the UC Davis Arboretum, June 12, 2016

A group of about thirty members of the California and Sacramento ACS sections, including guests and family, spent a sunny Sunday morning at the Arboretum of UC Davis, to visit the temporary exhibit “Walking in the Woods with Chemistry”. The exhibit had been developed and prepared by UC Davis Chemistry Professor Dean Tantillo, Plant Biology Professor Philipp Zerbe, and Chemistry Ph.D. candidate Nhu Nguyen and was mentioned in a C&EN article (5/9/2016) that had captured our interest.

Our group was fortunate to obtain an in depth tour of part of the large outdoor exhibit at the arboretum by two of the organizers. Prof. Philip Zerbe and Nhu Nguyen gave us a lively introduction to their research and described their special interest in making chemistry understandable and accessible for the general public. They then led us to visit select plants in the exhibit, mostly of plants with pharmaceutical applications, and addressed the chemistry of their key compounds. Colorful, descriptive signs,

adorned with 3D molecular models of crucial compounds, were displayed next to the plants. A 3D molecular model of the terpene carnosol, a medicinal compound found in the herb rosemary, was attached to the plaque that described the compound and its applications. The public thus was invited to touch and examine the models. Another terpene, 1,8-cineole, and its 3D molecular model illustrated a further medicinal compound from rosemary as well as from eucalyptus. The common weedy plant horehound (Marrubium vulgare) contains the terpene marrubiin among other pharmaceutically active components whose activities are being studied by the Zerbe group. Again, an attractive sign, with its 3D molecular model attached, made the chemistry of these plant compounds inviting and interesting. Our tour guides were glad to answer our many questions and discuss ideas for further outreach exhibits.

The scenery of the landscaping and plantings of the Arboretum, combined with this special exhibit, made for an enjoyable and informative summer field trip.

Greti Sequin



Honoring the Section's Senior Members

On Saturday, May 14, 2016 at the annual awards meeting the Section presented awards recognizing both community and Section members for their contributions to Chemistry and Science. The May and June issues of the *Vortex* published the recipients of the Lloyd Ryland, P3 and Petersen awards. We also recognized those members with 50,60, and 70 years of ACS membership. We apologize for not matching pictures with names



Awardees and Section Officers at the May Awards Meeting

50 Years

Donald B. Alger
David Boyd Ball
Ronald Barany
Richard H. Fish
Russell George Frost
Kenneth Almeron Frost
Norman Leigh Hill
Michael Joseph Holman
Roy Allen Johnson
Jean Philippe Lassegues
William A. Lester
Glory B. Merrill
William James Michaely
George William Mutch
Gregory Victor Nelson
Donald Emil Schmidt
Charles S. Sodano
Robert L. Tucker

50 Years

John Cord Van Heertum
Afaf K. Wensky
David Leon White
William F. Wood
Anthony Wu
Sigmund M. Csicsery
George Francis Field
Curtis Donavon Fromke
Henry Hermann Kramer
Bernard Frank Mulaskey
Danute E. Nitecki
Gerd Matthew Rosenblatt
J. F. Thomas
Barney Rubin
Howard Kapnek
Schachman
Irving Leibson

60 Years

Sigmund M. Csicsery
George Francis Field
Curtis Donavon Fromke
Henry Hermann Kramer
Bernard Frank Mulaskey
Danute E. Nitecki
Gerd Matthew Rosenblatt
J. F. Thomas
Barney Rubin
Howard Kapnek Schachman
Irving Leibson

70 years

Barney Rubin
Howard Kapnek Schachman
Irving Leibson

BUSINESS DIRECTORY

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There are many companies and organizations searching for chemical and biochemical personnel to fill important jobs in their organizations.

- Companies for laboratory and management positions
- Universities & Colleges for teaching positions and laboratory personnel
- Hospitals for technical and research personnel

There are several web sites that may help you search for these open positions.

- www.mboservices.net
- <http://www.calacs.org/page.asp?id=22>

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