American Chemical Society

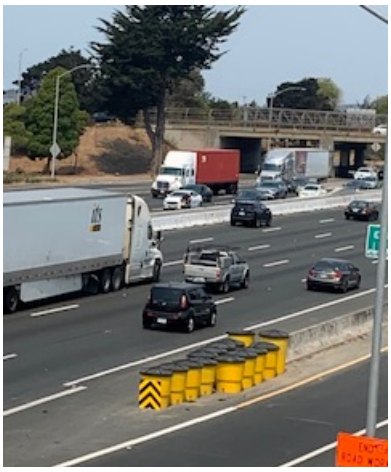
California Section

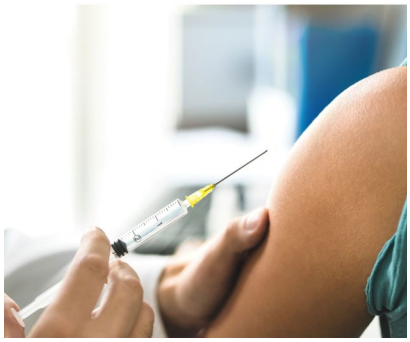
# THE VORTEX

Volume LXXXIII Number 7

September 2021 Newsletter


Back to Normal.





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### ANNOUNCEMENTS



### EDUCATION, EMPLOYMENT, CAREERS

Photos: Cover: Welcome Back Message with a Blue Face Mask – Canva
TOC – Top: Interstate 80 in Berkeley California – Donald MacLean; Middle: Mark Frishberg - ACS; Bottom: Doctor giving vaccine, flu or influenza shot to patient with injection needle. – Canva; next page: Raptor (taken elsewhere) – Caroline Bothroyd

## New Newsletter Editor Starting September 2021

The September 2021 *The Vortex* is the first issue where I am *The Vortex* newsletter editor. Having been involved in the section since 2003, I know that this responsibility has its challenges; I will never please everyone. Over 84 years, there has only been 5 Vortex editors which shows the editors' stamina. Since *The Vortex's* inception there has been changes:

1. converting the paper copy to electronic format;
2. placing *The Vortex* on the section web page;
3. declining and aging membership;
4. increase in late event notices and reliance on Zoom meetings;
5. less technical and industrial topics, more public outreach topics.

I will change the newsletter format to reflect changes such as not mailing, and adding a midmonth supplement as needed. I will ask for photos and written items from the public to incorporate into the newsletter. The newsletter will not have a fixed page length. The original goal was to maintain the pamphlet size (5.5" x 8.5") but am now I think 8.5" x 11" format is more appropriate. *The Vortex* is designed to be the official section record, therefore archiving binding ability will be at the design forefront.

I will divide the issue into 3 sections: Announcements, Education, Employment, and Careers, and Review.

**Announcements (input by)**
Each issue will have a Chair Message (current Chair), planned section activities (Executive Committee), Member spotlight (All), and shout out (All), new members and milestone years (Section Office), and In Memoriam (All).

**Education, Employment, and Careers (input by)**
Variable topics include Students (All), general article (screened), A Teaching Moment (All), industry news, professional development and hobbies (All), work arounds and issues (All), and a blog (Selected).

**Review (input by)**
Variable topics include a section for kids and grannies to experience science (All), Science in Action (All), Past event summary, and TV / Movie / Book Review (All).

My reference will be my experience until I can obtain enough outside contribution, meaning you the reader. The topic emphasis will be more biological, industrial centered, and teen year science experience focused. I also will point out some of the quirky things where science and the real world work together, especially agriculture. I also like to point to differences in how things are done around the world.
I also plan to underline each person‘s name mentioned the first time in any section or article. I plan on mentioning milestone membership years and new members.

I like to include industrial events like product release and withdraws, but I am not well versed in deciding what to include and what to leave out. I leave that to C&EN.

So this is what I would like from all members to provide:

1. Events held locally by other professional organizations. I like a flyer or some details.
2. Shout outs for awards and retirements after a long career. I like a picture, one that includes others if possible, but not required.
3. Pictures of chemistry (or other science) in action, especially your vacation.
4. Places to go, especially free ones related to science.
5. Obituary
6. Review of tv / movie / book that is topic appropriate.

Starting in August 2021, send any topics and messages to my email just for *The Vortex*, donald.maclean.acs@gmail.com and copy office@calacs.org .

## October / November Topic Contribution Needed:

For October / November Topic, I want to include

1. Covid 19 life / work changes from some members. How did you at home life and work life change?
2. Environmental topic such as glyphosphate (Round Up) experience.
3. Wildfire update.
4. Nuclear – Xe-135 equilibrium from nuclear reactor burn up and I-135 decay from fission.

Please sent a draft to us.

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## Chair's Message – Alicia Taylor

We would like to welcome everyone back after summer vacation! Hopefully our readers were able to take some time off and enjoy the great summer weather. Some summer highlights – Cal ACS hosted numerous events this summer, with many focusing on young professionals and leadership development. Our Younger Chemist Committee, or YCC, is very active and you can sign up for their event newsletter here. We had a zoom event with Silicon Valley ACS and the Redwood City Library on water quality kits that Cal ACS and SV ACS created and distributed in early summer. The Redwood City Library hosted a kit opening event where we helped 5 – 8th graders conduct their water quality experiments. The event was a big success! We plan to roll out a classroom version of the water quality kits this Fall.

In addition, our last issue of *The Vortex* in June had a message from Lou Rigali, our editor, on his stepping down from the role. We'd like to thank Lou for his many years of service to *The Vortex* and to Cal ACS. Lou has had a pivotal role in keeping our section members updated about Cal ACS news through *The Vortex*. Hopefully we'll still hear from him occasionally through articles he submits to *The Vortex*. You are welcome to say thanks to Lou as well, by emailing office@calacs.org. At this time, I'd like to welcome our new editor, Don MacLean! This issue is Don's first as our new editor, and we'll be trying out some different things with *The Vortex*. Stay tuned for interesting content coming your way!

We're also initiating our third iteration of the CalACS College Application and Professional Success (CAPS) Program. This program strives to assist high school students in the Bay Area by providing career preparation and assistance with college applications. We're very excited to work with our local and national mentors who have joined the program, to bring important professional development skills such as practicing mock interviews and reviewing college essays for high school students. Our mentors are all volunteers, and most are university students, recent graduates, and graduate students. A big shout out to their help with making the program so successful!

We're continuing to strengthen our ACS relationships with activities planned with Silicon Valley ACS and other local organizations, such as East Bay AWIS (Association for Women in Science). In addition, stay tuned for upcoming international organization collaborations we are hoping to kick off this Fall.

We have halted plans on our Fall awards luncheon due to the Delta Covid variant. We have many awards to present to our members, and look forward to doing so when we are sure that we can do so safely. Please watch out for upcoming announcements on our awards luncheon.

In August, the National ACS meeting was held as a hybrid event with in-person events in Atlanta and online events. For those of you who attended, please feel free to share your thoughts on the hybrid model and ideas for both local and national hybrid events moving forward. Cal ACS would like to resume in-person events in the future, hopefully soon, but will also continue to host online events after the pandemic ends. We've had a lot of success with high attendance and online engagement, so we look forward to engaging with our members in different venues.

This Fall the ChemLuminary awards will be presented at a virtual event during National Chemistry Week. We hope you can attend and cheer on CalACS as one of the finalists. More information will be coming from National ACS in the weeks ahead on how you can attend the awards event.

Also, stay tuned for updates on our Fall elections for various officer positions within Cal ACS. If you are interested in running for an officer position, please reach out to office@calacs.org to learn more about our executive committee.

## California Section
## American Chemical Society

## All are welcome

### Saturday, Sept. 18, 2021

### Title

Air Pollution in High Definition:

Building Low-Cost Sensor Networks & Community Partnerships

### Time

10:30 – 11:00 a.m.
Chatting

11:00 a.m.
Talk and Discussion

### Reservation

Please visit the CalACS website www.calacs.org to register for this meeting or use the Brown paper Ticket Link for the registration:

https://www.brownpapertickets.com/event/5159757

Please register no later than Friday, Sept. 17, 2021 before 10:30 am, as we need your email address to send you the Zoom link.

Zoom meeting will be shared with attendees on or before the day of the event via Brown Paper Ticket.

**Cost :** Free

**Question contact:**

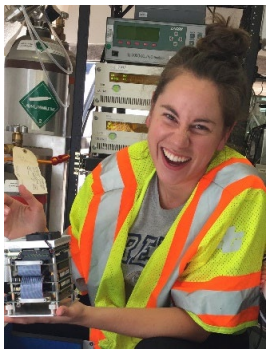
Elaine Yamaguchi
<eyamaguchi08@gmail.com>

# Meeting and Events

## About the Speakers

Dr. Alexis Shusterman

Dr. Alexis Shusterman completed her PhD in atmospheric chemistry at the University of California, Berkeley while working with Prof. Ronald Cohen. Her graduate work centered around the construction of BEACO2N, a high-density network of more than three dozen low-cost sensors capable of providing community-level air quality reports throughout the San Francisco Bay Area. During graduate school, Alexis worked with science communication and outreach organizations nationwide to spread climate change and environmental justice awareness, winning recognition in the UC Berkeley Grad Slam, the University of California Carbon Slam, and the American Chemical Society Chemistry Champions competitions. Now a lecturer in the UC Berkeley College of Chemistry, Alexis (or "Dr. S" to her students) now dedicates herself to delivering high quality chemical education full time.



Dr. Chelsea Preble

Dr.Chelsea Preble earned her PhD in Environmental Engineering from UC Berkeley in 2017, and is now an Assistant Research Engineer in the Department of Civil and Environmental Engineering at UC Berkeley and affiliate of the Energy Technologies Area at Berkeley Lab. In her work, she seeks to better understand air pollution trends, sources, and controls in impacted communities and to evaluate the real-world emissions impacts of new regulations and alternative energy technologies. Her research includes characterizing in-use emissions from heavy-duty diesel trucks and commercial harbor craft, developing community-based air quality sensor networks, and quantifying emissions from organic waste diversion systems.

## Abstract

Measuring atmospheric pollutants at high spatiotemporal resolution has the potential to help identify problematic sources as well as pinpoint communities facing disproportionate risks. Most traditional air quality monitoring campaigns, however, have been necessarily sparse in their resolution owing to the significant upfront and operational costs of high-precision and high-accuracy instrumentation. We explore the intersection of this measurement challenge with the issue of environmental justice in the United States and make an argument for the benefits of tracking air pollution at the neighborhood scale using low-cost monitoring techniques. We also present initial results from community air quality studies in West Oakland and Richmond, two San Francisco Bay Area communities that are burdened by diesel particulate matter pollution. In these studies, we deployed custom-built, low-cost black carbon (BC)—or soot—sensors outside of community members' homes and businesses. These dense networks captured seasonal trends in ambient BC on a block-by-block basis and found that the spatiotemporal patterns in BC concentrations were driven by truck activity. Through meaningful partnerships between researchers and key community stakeholders, these collaborations created actionable datasets that advance both science and advocacy goals as part of broader Community Air Protection Program monitoring efforts (AB 617).

## National Chemistry Week 2021 – Fast or Slow, Chemistry Make It Go

As students return for the fall semester (in-person or online), California Section is gearing up for public outreach activities. National Chemistry Week is the centerpiece of ACS fall public outreach, with this year's celebration featuring the theme, "Fast or Slow, Chemistry Make It Go." Visit the NCW resource page

https://www.acs.org/content/acs/en/education/outreach/ncw/educational-resources.html

for fun, safe, hands-on activities that you can try at home or with your students. Contact your NCW Coordinator if your school or community group would like free copies of the NCW 2021 edition of Celebrating Chemistry – we'll get them to you (ncw-coordinator@sonic.net).


## Solano Sidewalk a-Faire (Albany – Berkeley)

It's not yet clear whether we can return to in-school events. The Bay Area Science Festival has been postponed to the Spring, but we'll start the outreach season with hands-on chemistry at the Solano Sidewalk a-Faire on Sunday, September 12th. We will have our own outdoor booth space. COVID is still a serious concern for many of us, but the case rate remains quite low locally, and we're all vaccinated, right? We'll be masked and we will take other precautions as appropriate, while presenting simple hands-on activities such as UV-color-changing beads. Your NCW Coordinator, Alex Madonik, intends to demonstrate reactions rates with the Iodine Clock Reaction and Elephant's Toothpaste. Please let me know if you can help out that day as we engage with future scientists, hand out NCW souvenirs, and encourage public support of STEM education.

## NCW 2021 Illustrated Poem Contest

We invite all K-12 students to participate in the NCW 2021 Illustrated Poem Contest – please share this link with your friends and colleagues, especially any K-12 teachers. The California Section will award prizes to the best entries in each of four categories (grades K-2, 3-5, 6-8, and 9-12), and the winning entries will be forwarded to the ACS National Illustrate Poem Contest. The winning entries will also be featured on the Cal ACS web site. Find the rules and entry form on the Cal ACS NCW 2021 web page:

https://calacs.org/outreach/national-chemistry-week/ncw-2021-fast-or-slow-chemistry-makes-it-go/

## NCW-Themed Videos

Even if we can't gather in person, we hope you'll try some hands-on activities at home, and even record a video of your favorite reaction. Be sure to follow the safety instructions, and wear safety goggles! Then, upload your video using the link on the Cal ACS NCW 2021 web page. Please contact your NCW Coordinator (ncw-coordinator@sonic.net) if you have questions.

## Bay Area Science Festival Postponed to Spring

The Bay Area Science Festival has been postponed to the Spring.

## Younger Chemist Committee (YCC) Newsletter

YCC has their own newsletter that comes out every 2-4 weeks (depending on how many announcements they have). Readers can opt to sign up for their newsletter too (it's mostly professional development events for early career scientists). The YCC page on the Cal ACS website has the sign up info. See https://calacs.org/committees/ycc/

Member Spotlight

# Attila Pavlath Legacy – Part 2

By Nicki Davis

This is the second installment in a series of articles about the life, career, and legacy of Attila Pavlath. Many of you know Attila through his service to the ACS, but know little of his life or his scientific career. The information in these articles will help fill that gap.

In this installment, we learn about Attila's pioneering work in fluorine chemistry for his PhD. As with his previous studies at the university, Attila faced additional difficulties, both scientific and political.

## How are fluorine compounds special?

While working on developing various fluorine compounds for possible application in fighting cancer, Attila learned why fluorine compounds are so different from other halogen compounds. Because the fluorine atom is about the same size as a hydrogen atom, substituting fluorine for hydrogen generally does not change the steric properties of the compound. For biologically active compounds, this means that when a hydrogen is replaced by fluorine, the fluorinated compound may bind to enzymes in metabolic pathways. The high electronegativity of the fluorine atom, however, may prevent the metabolic reaction from proceeding further and inactivate the enzyme. In cases where fluorinated compounds are used as medicines, this property can halt harmful biological processes. On the other hand, fluoroacetic acid ($CH_2FCOOH$) is effective as a pesticide because it can bind to the same enzymes as acetic acid. The latter is a component of a key metabolic pathway by which cells extract energy from glucose (Krebs cycle), so this life-giving cycle is halted if enough $CH_2FCOOH$ is ingested.

The similarity of fluorine and hydrogen atoms can cause changes in the physical properties of a compound. Substituting a single hydrogen with fluorine generally does not change the boiling point of a compound, but adding more fluorines changes the surface tension, as illustrated by the different properties of polyethylene and polytetrafluoroethylene (Teflon®).

## Fluorine reacts differently from other halogens

It is evident that fluorinated compounds have many advantages; however, their preparation does not follow general organic chemistry methods used for the creation of other halogen compounds. For example, elemental chlorine reacts with hydrocarbons moderately, but elemental fluorine reacts explosively. For his doctoral dissertation, Attila decided to explore the reasons for this and to develop methods for preparing fluorine compounds.

For example, benzene reacts with chlorine in the presence of an iron catalyst, $FeCl_3$, to replace a hydrogen atom with a chlorine atom. The $FeCl_3$, a Lewis acid, heterolyzes the chlorine molecule ($Cl_2$) to generate $Cl^+FeCl_4^-$. The $Cl^+$ atom then reacts with the nucleophilic benzene ring to produce chlorobenzene.

This reaction does not work for fluorine, however. Fluorine is the most electronegative element, so more energy is required to heterolyze the fluorine molecule to $F^+F^-$. Instead, even without a catalyst, the reaction results in the formation of a fluorine radical (F•), which requires much less energy. The fluorine radical not only reacts with organic compounds, but also triggers a chain reaction that creates other fluorine radicals, resulting in an explosion. Attila reasoned that if both a Lewis acid (LA) and a Lewis base (LB) are present they will pull apart the fluorine molecule from both sides, forming a complex fluorocation:

$$LB + F–F + LA \rightarrow LBF^+LAF^-$$

The fluorocation $LBF^+$ can react with benzene without causing an explosion. Attila's dissertation work using $C_6H_5IF_2$ was the first to create a complex fluorocation, $C_6H_5IF^+BF_4^-$.

Simultaneously with his work on aromatic fluorine compounds, Attila developed a method of creating aliphatic fluorine compounds by using inorganic fluorides to replace chlorine atoms in organic chlorine compounds. While such methods were known using anhydrous hydrogen fluorides and metal polyfluorides such antimony trifluoride, he successfully used KF with some monochloro organic compounds such as chloroacetic acid and chloroethanol. He prepared these fluorocompounds for use in pesticides.

## Resonance theory, Linus Pauling, and Marxist philosophy

By 1955 Attila had completed his thesis work, had published over twenty papers, and was ready to defend his thesis and obtain his PhD. However, the Communist government required PhD candidates to meet two additional requirements: to demonstrate fluency in the Russian language and to pass oral and written exams in Marxist philosophy.

At first you might think these requirements were simply a nuisance, but not so. In fact, science was highly politicized in Communist countries. A series of books were created in which many scientific theories were declared to be in conflict with Marxist philosophy. Resonance theory was on the list of unacceptable ideas. For example, in June 1951, the Soviet Academy of Sciences convened a conference on the chemical structure of organic compounds, where "the pseudo-scientific essence of the theory of resonance was exposed and unmasked"[1].

Attila's thesis project involved research on aromatic compounds, which have unusual stability because of resonance delocalization of π-electrons. Would a chemist who worked with aromatic compounds be forced to deny the existence of aromaticity?

Resonance theory had been developed by the American scientist Linus Pauling as part of his work on the nature of the chemical bond, for which he won the Nobel Prize in chemistry in 1954. At first Pauling was denounced as a lackey of capitalism. Later, however, he became known for his peace activism, which eventually led to being awarded the Nobel Peace Prize in 1962. His activism improved his reputation in the Soviet Union to the point where the Soviets awarded him the Lenin Peace Prize in 1970 -- apparently forgetting about his role in resonance theory.

Fortunately, Attila's thesis research took place at a time when Pauling's reputation in the USSR was transitioning from villain (for resonance) to hero (for peace activism). Other things in the political landscape were also in transition. After Stalin died in 1953, the political situation in the USSR was in flux as Stalin's successors fought each other for power. By 1955, people were questioning whether resonance theory was in conflict with Marxist philosophy. The professors in the Marxist Philosophy Department were afraid to take a position on the issue, because the "correct" ideological position on many issues changed almost daily. None of the professors wanted to risk being branded as a reactionary if he made the wrong choice.

To prepare for the exam in Marxist philosophy, Attila met with associate professors of the Marxist Philosophy department, who would determine whether he knew enough Marxist philosophy to be allowed to take the exam with the professor. Attila dealt with the issue of resonance by questioning one of his tutors:

"Comrade Professor, what's the present situation on resonance theory? Stalin had said that Pauling's resonance theory is a device by the capitalist system against materialism. But now Pauling is being praised, so what am I going to say when the professor asks a question about this?"

---

[1] Moore, Barrington Jr. (1954). *Terror and Progress USSR: Some Sources of Change and Stability in the Soviet Dictatorship*. pp. 142–143.

The professor hemmed and hawed, because he didn't know what to say. Finally, Attila took pity on the professor and asked,

"You think, Comrade, that I won't get a question about this?"

The professor replied, "Yes, we are still trying to figure out the exact nature of resonance theory and whether it is in conflict with Marxist philosophy."

Attila didn't get a question about resonance when he took the exam, so he passed. After he passed the exam in Russian, he was finally able to defend his thesis and get his PhD. Attila was now ready to continue his research on fluorine chemistry at the university.

Article Installment History:
Installment 1 in April 2021 *The Vortex*.

## Shout Out – Awards and Announcements

### Jonathan C Fong is 2021 California Section Lloyd Ryland Outstanding Chemistry Teacher

The 2021 California Section Lloyd Ryland Outstanding Chemistry Teacher goes to Jonathan C Fong from Lowell High School's Chemistry Department (San Francisco, Cal.). Jonathan mentors other chemistry teachers and participates in courses to further engage students. A $500 award was presented in June to Jonathan Fong along with a $500 check to the Lowell High School Chemistry Department, and a subscription to the American Association of Chemistry Teachers.

### Chemistry Olympiad Virtual in 2021

This year's Chemistry Olympiad was virtual for the second year due to Covid 19. Over 200 students took the virtually monitored Local exam by 15 proctors. The top 17 students were allowed to take Part 1 of the National exam and ten were allowed to continue to Part 2 of the National exam.

We began a tutoring program focused on the Olympiad with UC Berkeley chemistry and chemical engineering students and plan to expand that program this next year.

### Wally Yokohama Becomes ACS Fellow

ACS announced the 2021 ACS Fellows. Our own Wally Yokohama is now a Fellow of the ACS. More information can be found at:
Announcing the 2021 ACS Fellows - C&EN Digital Magazine

### New Member and Milestone Years

23 new section members joined the local section in July.

## Can't Get Enough Science, Try These

**Sacramento Local Section ACS**
http://www.acs-sacramento.org/

**Santa Clara Valley Section Local Section ACS**
http://svacs.org/
Bay Area Chemistry Symposium – November 9, 2021

**Bay Area Discussion Group AAPS**
https://www.aaps-badg.org/

**Bay Area Mass Spectrometry (BAMS)**
inactive status

**CASSS**
https://www.casss.org/

**Electrochemical Society – San Francisco Section**
https://www.electrochem.org/upcoming-meetings/

**American Nuclear Society – Norcal section**
http://local.ans.org/norcal/

**Science Cafés (PBS Nova)**
https://scienceatcal.berkeley.edu/all-programs/
https://www.sciencecafes.org (locations Albany, Arcata, Belmont, Davis, Lodi, Los Altos Hill, Menlo Park, Merced, Palo Alto, Sacramento, San Francisco, San Rafael, Santa Cruz, Santa Rosa, Sebastopol)

## Senior Chemist – Son Nguyen

Son Nguyen has an article in ACS Senior Chemist Committee July 2021 newsletter article titled "How COVID-19 Has Changed My Retirement Plan". To read this newsletter go to this link:

http://app.connect.discoveracs.org/e/es?s=341921710&e=348700&elqTrackId=efd74c1a1b7a40299e524d6e5aa03bea&elq=715a583cb8b84c49a8c0d06c7e5d7e0b&elqaid=3731&elqat=1

For the Senior Chemist Committee link:
https://www.acs.org/content/acs/en/membership-and-networks/senior-chemists.html

# In Memoriam

Helen Free 1923- 2021

Helen Free, 98, died Saturday, May 1, 2021. Her obituary can be found at: https://www.legacy.com/obituaries/elkharttruth/obituary.aspx?n=helen-free&pid=198539904&fhid=8850

After graduating in 1945 from College of Wooster, she moved to Elkhart, Indiana, and took a job as a quality control chemist at Miles Laboratories (creators of Alka-Seltzer, Bactine, and One-a-Day vitamins). However, she aspired to be researcher as opposed to working in quality control. When Dr. Alfred Free had a position open up in his newly formed biochemistry research group, she interviewed and got the position. In 1947, they married. Al and Helen worked together for over 35 years.


Initially, they researched different antibiotics before they moved on to dry reagent systems. Later, Free worked with her husband to move the tests from tablets to test strips. In 1956, they introduced Clinistix, the first dip-and-read tests, followed by Uristix, Ketostix, Dextrostix, Labstix, and a still-current product, Multistix. These tests were the first to allow diabetics to easily and accurately monitor their own blood glucose levels.

In 1969, Helen moved into the Growth and Development Department and eventually became the director of the Specialty Test Systems in 1976. She was Director of Marketing Services for the Research Products Division when Bayer Diagnostics acquired Miles in 1978.

She also earned an MA in Management Health Care Administration from Central Michigan University (1978) and was an adjunct professor of management at Indiana University at South Bend.

By 1975, Helen had earned seven patents for her improvements in medical and clinical urinalysis testing. Also, in '75 she and her husband co-authored their second book, "Urinalysis in Laboratory Practice," which is still a standard work in the field.

- 1980 received the ACS's Garvan Medal (honoring distinguished service to chemistry by a woman)

-1982 retired but worked as a consultant to Bayer Diagnostics until 1995 (acs.org has 2007).

Following her retirement, she became an active promoter of science education. She devoted special attention to educating both female and underprivileged students through such programs as "Kids and Chemistry" and "Expanding Your Horizons." She personally gave hundreds of children tours through the remaining Miles/Bayer facilities.

In 1993 she was elected as president (third woman to do so) of the American Chemical Society (ACS), where her top priority was raising the public's awareness and positive role chemistry has played in people's lives. The ACS named an award in her honor, the Helen M. Free Award in Public Outreach.

Portion Taken and rewritten from https://www.acs.org/content/acs/en/education/whatishemistry/landmarks/diagnostictesttrips.html

https://www.acs.org/content/acs/en/education/whatischemistry/women-scientists/helen-m-free.html

## Dr. Evaldo Luis Kothny
## (October 6, 1925 - May 24, 2021)

Dr. Evaldo Luis Kothny passed away in Walnut Creek, California, on May 24, 2021 at the age of 95. Evaldo was born on October 6, 1925 in Buenos Aires, Argentina, to Luis Kothny and Frida Roth Kothny.

He married Monica Albertz in 1960 and raised two daughters, Cecily and Lilian. He earned his PhD in Chemistry from the Universidad de Buenos Aires and was a Research Chemist at the California Department of Health for many years.

In his youth, Evaldo developed a lifelong fascination and curiosity about science, especially Chemistry. After earning his PhD, he came to California where he continued his career in air and water research and took pride in the part he played in helping improve California's air quality.

His passion for chemistry extended beyond work, and he became an active gold mining enthusiast, assaying samples for amateur miners and even staking his own claim near Weaverville. Evaldo remained a lifelong member of the American Chemical Society, contributing actively to their local newsletter, *The Vortex*, well into his retirement.

Evaldo and Monica lived in Lafayette and Orinda for many years where they raised their family, later moving to Walnut Creek during retirement. Throughout his life, he enjoyed taking his family on trips to explore California, going on long walks, and spending time with his family and friends.

He is survived by his wife, Monica, his daughters Cecily Person (Greer), Lilian McGlothlen (Brian), his sister Terese Kuhne and grandchildren Katherine, Henry, Ashley, Sophie, Carter, and William. Donations may be made to the American Chemical Society.

Source: Published by East Bay Times on Jun. 11, 2021.

## Reflections
By: Lou Rigali

Regrettably, we seldom get to know the many facets or rich lives lived by our colleagues and associates with whom we work over many years. And so, it was with Evaldo Kothny and me.

Evaldo and I met when I first became editor of *The Vortex.* In those days each article or photograph was literality cut and pasted to a tacky, lined form that would later be photographed and printed as a page in *The Vortex*. Evaldo was part of the team that put the Vortex together each month along with the previous editor Bob Grinsted. I think I attended one or two of the cut-and-paste session before the process went digital. Evaldo continued contributing to *The Vortex* with technical articles and proofreading that continued for more than a decade. Evaldo, Linda Wraxall and I met for a few months to proofread *The Vortex* at the Section office in the Post Office building in downtown Berkeley. We continued that routine at the new office in San Lorenzo. We sat around a table making and comparing corrections, each person finding changes that others did not. Lots of discussions on the use of commas or why quotation marks are outside the period at the end of the sentence. Thanks to Linda, we found out why the British use a different convention.

There was a sense of comradeship; we were all interested in publishing a quality newsletter for the section. We, like most of the world, went remote and digital for efficiency, making the corrections at our homes and using email for communicating the changes. Are we happier with all the accumulated efficiency?


Evaldo's scope of knowledge always amazed me, he knew the names, formulas of minerals where they were found and how to extract and purify them. He also knew which minerals were biologically necessary. Often, he would report or confirm results from experiments he performed at the laboratory in his garage. His articles are all available in bound, but unindexed copies of *The Vortex* at the Section office. The Section could hire a student or have a section member volunteer to index the contents for easy access.


We talked chemistry and science, but I knew very little of his other interests. Thanks to his daughters Lilian, and Cecily, and his wife Monica who shared their remembrances at the church services celebrating his life, I learned more about Evaldo. He was an attentive father including his daughters in his activities and instilling a sense of wonder, exploration and curiosity to his daughters about nature and life as he explored back country trails and old mines and miners.

I regret not getting to know Evaldo better.

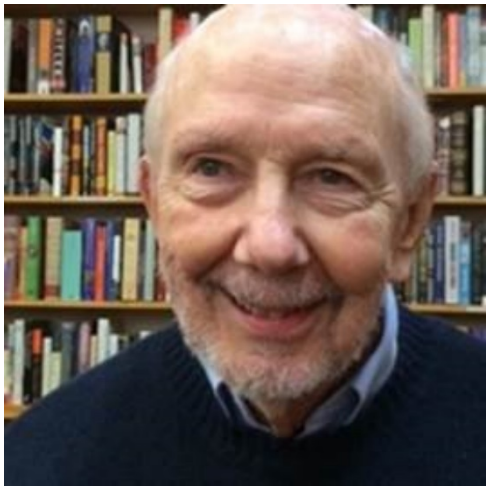
Pictures: The California Section honored Evaldo with Fifty Year Service award in 2014 and a Salute to Excellence in 2011.

**Mark Frishberg**

Mark Frishberg passed away this July 8, 2021. A remembrance article written by a team of local section members who worked with him will be coming in a future issue, targeted for October.

Picture from: Industry Matters Newsletter, November 14, 2019
https://www.acs.org/content/acs/en/industry/industry-matters/what-i-learned/mark-frishberg.html

## Dr. Donald D. Kasarda



It is with great sadness that I share the passing of longtime WRRC research scientist and collaborator, Dr. Donald D. (Don) Kasarda, on February 12, 2021. Dr. Kasarda was a dedicated scientist for more than 50 years and a recognized expert in wheat gluten proteins and celiac disease. He will also be remembered as a gracious and kind person.

Dr. Kasarda received his Ph.D. in physical chemistry from Princeton University in 1961. Following appointments at Bell Laboratories and the University of California San Francisco, he joined the USDA-ARS Western Regional Research Center (WRRC) in 1964 to study wheat protein structure in relation to breadmaking quality. He served as Research Leader of the Food Proteins Research Unit from 1972 to 1985 and was responsible for establishing the wheat molecular biology program at WRRC. In addition, he was an Associate in the Experiment Station at the University of California Davis and collaborated extensively with faculty members and students from the Department of Plant Sciences. Over the years, he mentored visiting scientists from many other countries who came to his lab to study the genetic basis of wheat quality. He also collaborated with medical groups to define the basis for the activity of the wheat proteins in celiac disease and served on the Medical Advisory Board of the Celiac Disease Foundation and as an advisor to celiac patient support groups. Following his retirement in 1999, he continued on as a collaborator at WRRC and remained passionate about science, wheat gluten proteins and celiac disease.

Dr. Kasarda is the author of more than 100 research publications and review chapters and received numerous awards for excellence in research during his career. He was awarded the Thomas Burr Osbourne Medal for distinguished contributions in the field of Cereal Chemistry in 1993. In 2002, Dr. Kasarda, along with Dr. Peter Shewry of the UK, was honored with the Rank Prize in recognition of his work on the molecular characterization of cereal seed storage proteins.

Please consider donations to the Celiac Disease Foundation in Dr. Kasarda's memory: https://celiac.org/donate/.

## All That Glitters…? Part 5[2]

By: Bill Motzer

### Review of Previous Series Articles

In Part 1 (March 2021 *The Vortex*), I discussed California's Gold Rush (1848-1849) history. Part 2 (April 2021 *The Vortex*) focused on some fundamental physical and chemical characteristics of elemental gold and its geochemistry. In Part 3 (May 2021 *The Vortex*) we reviewed gold's formation in the Universe by stellar nucleosynthesis (SN) in evolving and exploding stars or supernova. Part 4 (June 2021 *The Vortex*) described the geology and geochemistry of the Mother Lode gold placer and vein deposits.
Although the discovery and subsequent mining of California's placer and lode gold deposits created an enormous amount of wealth and led to California becoming the 31st State, it also created profound human and environmental problems that persist to this day.

### The Discovery and Placer Mining

In January 1848, James Marshall and his work crew were camped on the American River at Coloma near present-day Auburn, building a sawmill for John Sutter. On January 24, Marshall and Elizabeth Jane (Jenny) Cloud Wimmer (see *California's First Analytical Chemist?*, November 2011 *The Vortex*) discovered and identified several gold nuggets in the river's gravel; the subsequent announcement published in San Francisco's one-page newspaper *The Californian*, was not at first widely believed, but eventually resulted in one of the largest historical human migrations with a reported 300,000 and perhaps 500,000 people world-wide descending on California with the desire to reap instant wealth. Placer gold was subsequently discovered in the Feather River and Trinity River drainages. By August 1848, news had reached the east coast and by December, President Polk informed Congress setting off the Great California 1849 Gold Rush with thousands of solitary or itinerant miners descending on the rich surface and near surface placer deposits of the western Sierra Nevada. Although the solitary miner (Figure 1) disturbed only surface sand and gravel, as the placers were depleted they resorted using liquid mercury to recover the fine gold (also known as dust or flower gold (see *Amalgamating Mercury*, September 2007 *The Vortex*). This gold recovery method led to mercury contamination of many of California's rivers and the San Francisco Bay's, where it remains to this day. Co-incidentally, mercury deposits occur in California's Coast Ranges and mining of these deposits also contributed to mercury contamination of inland waters [see *Methylating Mercury*, December 2006 *The Vortex* and *Methylating Mercury (Revisited)* - Parts 1 and 2, respectively in the February and December 2014 *The Vortex*].

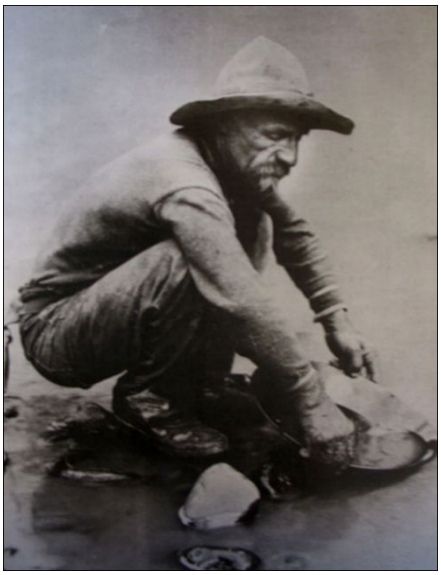


**Figure 1:** Forty-Niner panning for gold in the American River (1850). Photo from D. Brinkley, *History of the United States*: Viking Penguin Books, p. 151.

### Removal of the Indigenous Peoples

The Ohlone (San Francisco and South Bay, Coast and Bay Miwok (Marin County and East Bay, respectively) populations were in decline before the Gold Rush because of the early Spanish Missions (1770s) and subsequent Mexican settlements (1820s) into what became *Alta California*. Introduced diseases (smallpox, malaria, etc.), forced labor, religious, agricultural, and cultural impacts caused significant indigenous population declines. However, the 1848-1852 Gold Rush literally swept these

[2] Dr Evaldo Kothny passed away on May 24, 2021. Evaldo was a co-contributing editor with me for many years. He was also an avid gold mining hobbyist, taking his two daughters on many of his gold exploration trips. Therefore, this series is dedicated to his memory.

peoples aside with Ohlone populations declining from an estimated 10,000-20,000 in 1700 to 864 - 1,000 by 1852.

**Industrialization**

**Underground Mining:** The *Forty-Niners* also followed the placers back to their quartz vein origins – *The Mother Lode* (ML) –where underground mining began at the Mariposa mine in Mariposa County. On September 9, 1850, California became a state with its border moved eastward to include the entire Sierra Nevada (because it was believed that the ML extended into the Sierra Nevada). Also, in that year, gold-bearing quartz veins were discovered at Gold Hill in Grass Valley, leading to development of large underground mines such as the Empire and Idaho-Maryland mines. In 1853, the first extensive underground mining of buried alluvial river channels (drift mining) commenced at Foresthill in Placer County.

**Hydraulic Mining:** began in 1852 at American Hill just north of Nevada City and at Yankee Jims in Placer County. It rapidly replaced the solitary prospector's panning methods and by 1864 was conducted on a large-scale industrial process (Figure 2). Miners dammed and diverted streams in a vast canal systems (called *ditches*) so that they could wash down auriferous gravel hillsides with high-pressure water jets (aka: *water cannons* or *monitors*). Washed gravels were processed through long wooden sluice boxes to extract placer gold with the fine gold recovered by amalgamation. Gravels and fine sediment—called *slickens*—were then discharged back into the streams, subsequently washing down into the lower Sacramento Valley. From about 1850 to 1884, an estimated 250 million cubic yards (Myds$^3$) (191.14 Mm$^3$) of gravel produced 12 million ounces (Moz) (~373,242 kg) of gold. The large influx of hydraulic mine tailings (up to 685 Mft$^3$ (~19.4 Mm$^3$) of debris were deposited in the lower Yuba River, raising the river bed as much as 45 feet (13.7 m) in places, resulting in flooding of Central Valley agriculture. In 1884, hydraulic mining was prohibited by the now famous Judge Lorenzo Sawyer Decision. However, this injunction was for the northern Sierra Nevada only and did not include the Kalamath-Trinity area where hydraulic mining contiued into the 1950s.

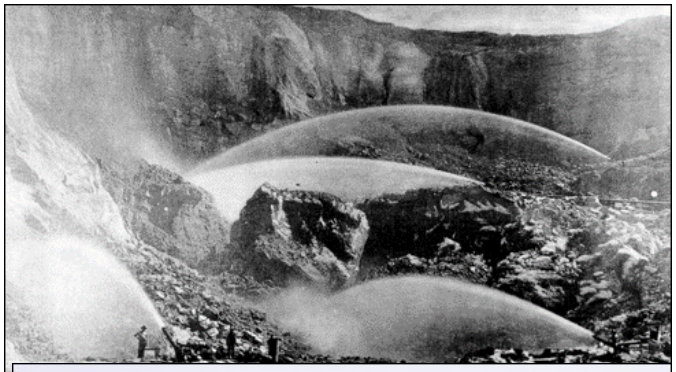


**Figure 2:** Hydraulic mining at Malakoff Diggins, CA (1890). Watkins Photo, Bancroft Library Neg.#8111. Unknown Author

**Dredging** in California river alluvium began in 1850, when a small boat fitted as a dredge attempted gravel mining on the Yuba River above Marysville. In 1893, the California Debris Commission also began dredging the Yuba River near Marysville to mitigate environmental damage caused by the earlier hydraulic mining. Gold production commenced with construction of larger dredges. In 1898, the first successful gold dredge was introduced on the lower Feather River near Oroville. In 1904, the Yuba Consolidated Gold Fields Company was founded becoming a large, profitable placer dredging operation on the Yuba River. By 1911, California had 62 operating bucket-elevator dredges. Of those, only a single dredge (Yuba No. 17) mined gold until it was recently discontinued in the 2000s (Figure 3).

Figure 3: Yuba Gold Dredge No. 17, last of the dredges. Constructed in May 1918, refurbished 1934 and 2006. Operated until 2012. Photo by W.E. Motzer (March 2011).

## Cal ACS and Silicon Valley ACS Launch a Citizen Science Water Quality Kit.

By Alex Madonik

Cal ACS has been working with Silicon Valley ACS to create a Citizen Science Water Quality Kit.

Cal ACS and Silicon Valley ACS have created a science kit for 4 – 9th graders. With the help of a local library, kits were distributed in May 2021 to students as part of a pilot roll out program. Students with the kit can use the video and guide at the links shown below. The objective of the kit is to help students learn more about water quality in the Bay Area.

If you are interested in a kit for your child, a relative, or a classroom, please email Alicia Taylor (office@calacs.org) to be part of our Fall 2021 roll out for the kit. See https://calacs.org/2021/05/cal-acs-and-silicon-valley-acs-launch-a-citizen-science-water-quality-kit/

## Review of "Future Prospects and Opportunities for Chemistry with H.N. Cheng ACS President 2021"

By Alex Bruefach

In collaboration with the Southeastern Louisiana University (SELU) ACS student chapter, CalACS hosted ACS President H.N. Cheng for an intimate online discussion following a talk about the accomplished chemist's views on the future of chemistry. Dr. Cheng revisited his journey through chemistry from a young age and highlighted opportunities for young chemists to be excited about in the coming years. New ACS programs developed by Dr. Cheng were presented, highlighting opportunities for young chemists to grow in the areas of entrepreneurship and government-industry collaborations. Ultimately, Dr. Cheng painted a wonderful picture of how the job title "chemist" is changing, which underpins his presidential theme of, "Growth, Collaboration, and Advocacy".

**Summer Experiences for the Economically Disadvantaged (SEED): Virtual Summer Camp (VSC) 2021**

By Elaine Yamaguchi

The California Section is a leader in the ACS High School SEED Summer Internships. The program focuses on providing research experiences for socio- and economically disadvantaged high school Juniors and Seniors. The SEED program has some prerequisites such as excellent grades in chemistry classes and upper income limits. After being chosen, students are assigned a location to perform their summer internship with an expectation that written and oral reports are given at the end of the 9-week program. Due to Covid 19 restrictions the in-person experience has been changed to a virtual summer camp. This is the second summer of the VSC due to the pandemic. The selected students are divided into camps. Elaine Yamaguchi volunteered as the Camp Manager of Camp Omicron, with about 30 students who came from CA, NV, OR, and WA. There are a total of about 375 VSC SEED students nationwide, and the National ACS has provided a large variety of speakers on different topics, such as financial aid, academic integrity, mutations in DNA, pharmaceutical development, etc. Since the students are receiving a stipend, they are expected to attend these National Sessions, and yes, attendance is recorded. In addition, Camp Managers meet with their campers once a week for a meeting on topics they choose.

Elaine Yamaguchi has led the California section SEED effort for many years. She wanted to expose the students to an array of scientists from private industry, government labs, and academia. This summer, three members of the local CA Section gave talks on some aspect of their volunteer work with SEED students. Representing the government researchers, Dr. Billy Hart-Cooper spoke on studies aimed at making the non-edible parts of plants serve as substitutes for plastic, as an example. Dr. Michael Cheng spoke on his analytical studies in the petroleum field when he worked for Chevron. Finally, Dr. Patricia LiWang from the University of California at Merced talked about how SEED students contributed to her work on AIDS, especially affecting young females in Sub-Saharan Africa. So, even with the pandemic, CA Section chemists are volunteering for the SEED VSC and encouraging students toward their future studies.

For more information on ACS Seed Program see:
https://www.acs.org/content/acs/en/education/students/highschool/seed.html

A teaching moment is planned to show a life experience relating to a chemistry principle.

## It is the Wrong Vial - Parenteral Osmolality Lesson

By Donald MacLean

The card reads "fill the syringe with 0.5 cc 0.9% NaCl and administer IM". I pick up a vial from the stainless steel bowl that contains many vials. The vial label says "sterile water". Wrong one. I tell the instructor the vial says "sterile water". He says "Continue". I know it is the wrong vial, but I do not reselect a correct vial from the bowl. Instead I continued by filling the proper size syringe with the material I picked. I set the syringe aside. Now my shots unit partner reads his card, selects a vial out the bowl and fills his syringe. He does not notice anything. He sets his filled syringe on the table. I take his syringe and administered it to him as the card instructed. I pass the administration test. My partner then takes the syringe I filled and administered it to me. Pain, pain, and more pain. This is the teaching moment, Osmolality and Pain on injection, or is it when you notice something wrong stop and fix it?

Turns out osmolality is a critical part of a parenteral drug. Osmolality (Osmol / kg) is just as important as pH, and sterility. Osmolality sounds like molality, and molarity but with a tweak. Osmolarity cannot be measured but is calculated theoretically from the experimentally measured osmolality value. The discrepancy between theoretical (osmolarity) and experimental (osmolality) results is, in part, due to the fact that the real solution osmotic pressure is less than that of an ideal solution because of interactions between solute molecules or between solute and solvent molecules in a solution.

Why is osmolality important and how is it determined? The body works on osmotic pressure differences caused by dissolved ions / species such sodium, chloride, calcium, etc.. Cells selectively restrict the in and out ion movement resulting in osmotic pressure difference between the inside and outside the cell. There are several molecules that travel freely through the cell membrane such as water, urea, ammonium chloride, and alcohol.

Isotonic solutions cause no swelling or tissue contraction when then they come contact with tissue. Best examples are 0.9% sodium chloride and 5% dextrose (D5W). Isotonicity is between 285 to 310 mOsmol /kg in blood. Hypotonic solutions cause cells to swell and maybe burst; hypertonic solutions cause outward water flows causing cell to shrink and scribble. Both can cause pain.

Osmotic pressure follows the form described using the Van't Hoff equation, $\pi V=nRT$ , which is similar in form to the ideal gas equation, $PV = nRT$. However, it is not as simple as it first appears as the equation is limited to dilute solutions. Further improvement came with Morse equation $\pi = RTm$ , where the molarity is replaced by molality.

$\pi = RTm$ where RT = 22.4 at 25 °C, or 22.4 at 0 °C.

$\pi$ = osmotic pressure
V = volume
n = number of moles
R = ideal gas equation
T = temperature
m = osmolality
g = osmotic coefficient

Osmolality is measured using freezing point (FP) depression or boiling point (BP) elevation (dew point). The USP (United States Pharmacopeia) states both methods as acceptable but EP (European Pharmacopeia) states FP only. The methods are designed for small molecules. Caution has to be taken with large biomolecules as an antifreeze effect has been demonstrated using FP and vapor pressure methods, resulting in higher osmolality readings, especially notable with FP. The dew point method would seem to a better alternative, but this method suffers from cleaning and environmental issues.

In general chemistry these two equations were taught that are very close to what is used for Osmolality calculation.

$\Delta T_f = K_f m$ where $K_f = 1.86$
$\Delta T_b = K_b m$ where $K_b = 0.51$

However, the van't Hoff factor ("I") and dissociation constant ("g") must be put into the equation. The dissociation constant is concentration and molecule dependent. The van't Hoff factor is the number of dissociate pieces. For example, unionized material has I = 1, sodium chloride (NaCl) has I =2 and $CaCl_2$ dissociates has I = 3.

$\Delta T_f = gIK_f m$

A quick and dirty calculation of the expected osmolality can be done using the summing each species concentration times the ions that each generated when dissolved in water.

Dissociation constant must be imputed as dissociation is not 100% and is concentration, identity, and temperature dependent and must be looked up.

For 0.9% NaCl rough estimate:
0.9% NaCl = 0. 9 g/100 mL = 9.0 g/L = 0.154 M, I = 2, g ~0.93 at 150 mM
$\Delta T_f = gIK_f m$ = ~0.93 (2) (1.86) (154) = 0.53 C

However, the real interesting part is looking at a product with multiple components. For rough formulation estimation perform the sum of the individual molecule contribution.
i.e., 6% sucrose, 10 mM L-histidine + 50 mM sodium chloride

6% sucrose = 60 g/L = 0.175 M, I = 1, g ~1.01
10 mM L-histidine = 0.010 M, I = 1, g ~ 1
50 mM NaCl = 50 mM, I = 2, g ~0.93
π = 175 mM (1.01) (1) + 10 mM (1) (1) + 50 mM (2) (0.93) = 279.8 mOsm / kg

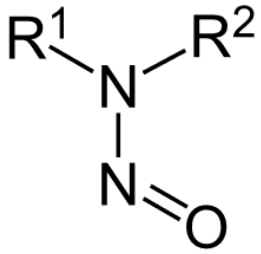
What did I learn from my Shots Unit? Wrong osmolality injections hurt is obvious, but more importantly "continue" does not mean carry on with what you are doing. If something is wrong, stop, and correct the misstep.

References:


1. Physical Pharmacy, fourth edition, Alfred Martin, editor, Lea and Febiger Publishers, Philadelphia, 1993.
2. Sahin et al., "Osmolality Measurements for High Concentration Protein-Polymer Solutions: Variation Based on Working Principles of Osmometers", Bioprocess International, 2016
3. USP ⟨785⟩ Osmolality and Osmolarity
4. USP ⟨1⟩ Injections and Implanted Drug Products (Parenterals)—Product Quality Tests
5. EP 10.5 – 2.2.35 Osmolality
6. JP 17 - 2.47 Osmolarity Determination

## Selected Industry News

Nitrosamine Assessment for Pharmaceutics
Summary by Donald MacLean




A new general chapter regarding nitrosamine has been implemented by USP and Pharm Eur (EP) based on ICH M7 (regulates mutagenic impurities in API). FDA and EMA is extending this to other classes of medicines and medicinal products. Previously, limits were listed in individual monographs, which now has been deleted and replaced by the general chapter.

Nitrosamines are formed by chemical reaction of secondary or tertiary amines with nitrites. Nitroso compounds are among the structural groups of high potency mutagenic carcinogens in several animal species, and some are classified as probable or possible human carcinogens. Exposure comes from smoking and preserved foods containing nitrites, but protein (food) is a prime source.

What needs to be done?

1. A risk assessment should be conducted to determine the materials that contribute to the potential for inclusion of nitrosamines in the drug product (identify mutagenic impurities, establish safe limits, evaluate exposure, characterize risk).
2. Development of a control strategy.
3. Upon completion of the risk assessment, exploratory testing may need to be performed to confirm the conclusions of the risk assessment and proposed control strategy.

Where to find more information?

1. EP 10.6 (to be effective starting 2022-01-01), general chapter 2.5.42. N-Nitrosamines in active substances.
2. USPNF 2021 (to be Official on 1-Dec-2021) <1469> Nitrosamines Impurities, can be found at https://www.usp.org/, but requires registration to access and a subscription.
3. Pharmacopeial Forum: Volume No. 46(5), can be found at https://www.usp.org/, but requires registration and is free. This is not the official version but can give an idea of what is in the official version with commentary.

Pharmacopeia Elemental Impurities Limits Determined by Dosage not Concentration

Summary by Donald MacLean

Background – Drug excipients and drug product must comply with regional / national pharmacopeia (s), if one is present. Pharm. Eur. (known as EP) is a multinational compendium that covers the European Union. The British Pharmacopeia (BP) is the national standard for UK, Canada, and Australia. BP incorporates all EP monographs and text and adds specific items for UK pharmaceuticals (human and veterinary). United States Pharmacopeia (USP) covers the US with many other countries adopting it as legally binding or accepted compendia. The third major drug compendium is the Japanese Compendia (JP). EP, USP, and JP are known as the major pharmaceutical compendia. There are other compendia, the most significant is the Chinese Pharmacopeia (ChP).

In the past the major pharmacopeias (USP, Pharm Eur, JP) used a color reaction or precipitation as the upper limit for the generic heavy metals test. The reaction was compared to 1, 10, 100 ppm lead standards where thioacetamide was added to form precipitates. In addition to the limits general chapter, individual drug substance and drug product monographs would have their own specific element concentration limit tests.

On February 1, 2013 USP officialized but did not implement limit tests <232> Elemental Impurities Limits and <233> Elemental Impurities Procedures with the intent to replace <231> Heavy Metals (with the latest effective date August 1, 2013) [EP 2.4.8 Heavy Metals is the EP version, effective date July 2010]. The new test method used ICP-OES or ICP-MS and changed the limits from concentration to Permitted Daily Exposures (PDE). This created problems as manufacturers could not meet the new requirements by December 1, 2015 official effective date. USP then had to allows for both general chapters to be valid simultaneously. This led to a period where you could do either <231> or <232> limits (notification June 2015) / ⟨2232⟩ Elemental Contaminants in Dietary Supplements (effective date December 1, 2014). <231> Heavy Metals remained official until January 1, 2018, thereafter, is not required. This is the implementation date for USP <232>. This dual limit testing requirement problem also plagued EP. EP method 2.4.20. Determination of Elemental Impurities (effective date July 2018), states ICP-AES, ICP-OES, and ICP-MS, while EP method 5.20 Elemental Impurities refers the limits to ICH Q3D guideline (effective date Jan 2018).

During this period, JP 17 kept the <1.07> Heavy Metal Limit Test (effective date April 1, 2016) using color and precipitation methods. With JP 17 S2 implementation <2.66> Elemental Impurities—Procedures (Effective date June 28, 2019) using one of 2 prep procedures and quantified by ICP-AES / -OES, or ICP-MS became the dual method that was seen with USP and EP. In JP 18 General Information "Control of Elemental Impurities in Drug Products" has been integrated into <2.66> and the chapter renamed as <2.66> Elemental Impurities (effective date 2021-06-07, 18 month normal implementation grace period would be by December 2022, but in this case 36 month June 2024).

Note 1: JP General Notice 34, omitting heavy metal and arsenic testing if do risk assessment.

Note 2: JP elemental impurities test required for prescription drugs not for over the counter medicines. This is a JP quirk.

Going forward, all three major compendia will use PDE limits and instrument test method instead of precipitate and color. With the PDE limit, there is no fixed concentration value, rather this must be determined based upon the dose and the administration route. Note the elemental impurities mean the element is not meant to be present in the final product. The element can be added on purpose during manufacturing such as a catalyst, but subsequently removed, would mean if present, the catalyst is an impurity. On the other hand, cobalt coming from B12 vitamin product would mean that the cobalt PDE would not apply since it was intentionally added, not an impurity. The species and oxidation state are not considered, only the element amount. The elements are divided into 3 classes (1, 2A, 2B, 3), class 1 composed of mercury, arsenic, lead, and cadmium.

Table. Portion of USP <232> Table 1 Drug Product Permitted Daily Exposure

| Element | Class | Oral PDE (µg/day) | Parenteral PDE (µg/day) | Inhalation PDE (µg/day) |
|---|---|---|---|---|
| Cadmium | 1 | 5 | 2 | 3 |
| Lead | 1 | 5 | 5 | 5 |
| Arsenic | 1 | 15 | 15 | 2 |
| Mercury | 1 | 30 | 3 | 1 |
| Cobalt | 2A | 50 | 5 | 3 |
| Vanadium | 2A | 100 | 10 | 1 |
| Nickel | 2A | 200 | 20 | 5 |

USP and EP chapters – EP does not state the elemental impurity limits but refers to ICH (International Council for Harmonization) Q3D Guideline for Elemental Impurities. To see the PDE for drug product and drug substances / excipients see USP-NF <232> Elemental Impurities Limits.

Class 2A is high likelihood of occurrence. There are other elements that may have limits stated within monographs, such Al (renal), Mn and Zinc (hepatic) due to health concerns.

There are many products that are not included in this requirement including gene and cell therapy. Elemental Impurities levels above the PDE limits may be allowed for intermittent dosing, short term dosing, and specific indications (rare disease, life threatening, unmet medical needs).

Note USP uses the concept of flexible monographs. Flexible monographs are monographs which may contain different alternate methods and specifications than the general chapters. During transition periods monographs may be in revision process and may conflict with General Notices and General / Informational Chapters. Check General Notices and Notices of Intent to Revise.

References:


1. For USPNF 2021 go to https://www.USP.org
2. For EP 10.6 go to https://pheur.edqm.eu/home
3. For JP 18, the English version expected availability is December 2021, only the Japanese version is available as of this printing.

## Real Life Workarounds

Remember when L-tryptophan for inducing sleep could be found at the drug store? How about Mecuricome for cuts? Some things seem to disappear and just become memory for real or perceived good reasons. Some things are bewildering why they become hard to get. Good examples are water for injection, thermometers, or medicines. This section is dedicated to work arounds, some of which are humorous way to obtain them or just outright stupid.

### It Is for My Dog
By Donald MacLean

A year ago my wife bought a ram to replace the one that died from pneumonia. When we looked at its left eye, the eye appeared opaque blue. The seller offered us another ram, but we said he will do. Upon investigation the opaqueness was caused by grass. The seller removed the grass seed from the eye, and applied an antibiotic ophthalmic ointment. We took it home and isolated it for 1.5 months. The eye healed and is now transparent clear. This was a good lesson, so I tried to buy this ointment. The problem was I could not just buy it. The only thing I found on the store shelf was hypochlorous acid (HOCl) for $28, and it was a small bottle which is used as an irrigation. I ask the salesperson for help. She had antibiotic for the eye behind the counter but she could not sell it to me without prescription as I mentioned sheep. However, if it was for my cat or dog, she could sell it to me. This bewildered me. So I looked this up. Sure enough she was correct, in California this product is restricted, yet in Oregon I can buy it without prescription. So the solution is to tell them it is for my dog, wink wink.

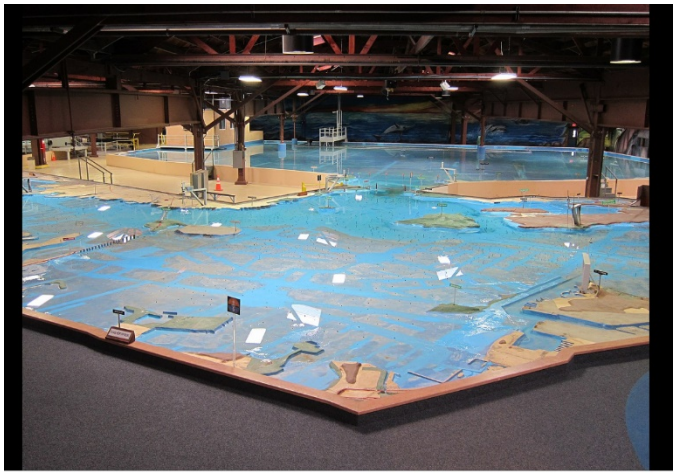
## Science in Action Vacation Photos


This is one of my favorite goofs. The Nevada State Capitol Building in Carson City, Nevada has a banner with the elements listed in the hallway. I could not figure out the logic of the order, but the odd element Borax caught my attention. What is worse they had boron. – Donald MacLean

# Bay Model – Sausalito

By Donald MacLean

The U.S. Army Corps of Engineers Bay Model is a working hydraulic scale model of the San Francisco Bay and Sacramento-San Joaquin River Delta System. The Model is capable of simulating tides and currents throughout the Bay and Delta. It occupies 1.5 acres and represents an area from the Pacific Ocean to Sacramento and Stockton, including: the San Francisco, San Pablo and Suisun Bays and a portion of the Sacramento - San Joaquin Delta.



"The model was constructed in 1957 and operated from 1958 to 2000. The main purpose was to assess circulation and flow characteristics 100 times faster than real time for such activities as dredging and oil spills. According to Wikipedia the original use was to model the damming feasibility of SF Bay. The model is used to reproduce (to the proper scale) the rise and fall of tides, flows, and currents of water, mixing of salt and fresh water, and trends in sediment movement. The model is approximately 320 feet long in the north-south direction and about 400 feet long in the east-west direction. It is constructed out of 286 five ton concrete slabs joined together like a jigsaw puzzle. Features that affect the water flow of the San Francisco Bay and Sacramento-San Joaquin Delta are reproduced, including ship channels, rivers, creeks, sloughs, the canals in the Delta, fills, major wharfs, piers, slips, dikes, bridges, and breakwaters. "

For those of us who visited in the 1980's, the experience and focus has changed. The physical model has been replaced by computer simulation in 2000. Today the model is used as a teaching tool. Along each section are informational plaques and interactive stations focusing on water policy and environmental issues relevant to the Bay and Delta regions.

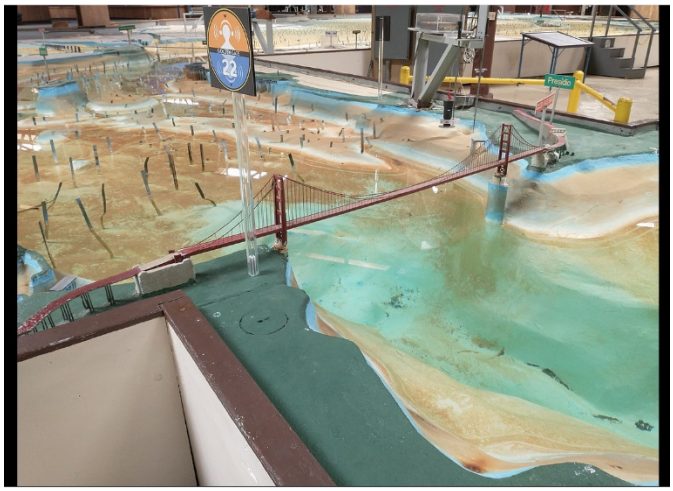


Image from Wikipedia web site. The horizonal 1/1000 and vertical scale is 1/100. The pins and foils in the water are adjustments to the model to mimic real life flow. The area around the Golden Gate Bridge is really deep.

Address: 2100 Bridgeway, Sausalito, CA 94965
Phone: (415) 289-3007
https://www.spn.usace.army.mil/Missions/Recreation/Bay-Model-Visitor-Center/
Cost: Free
Parking: Free

Lindsay Wildlife Experience- Walnut Creek
Love those Birds

Lindsay Wildlife Experience, formerly known as Lindsay Wildlife Museum, is a family museum and wildlife rehabilitation center in Walnut Creek, California. Lindsay is the first wildlife hospital established in the United States.

The wildlife center is renowned for their raptors (birds that kill using their feet). This is a place where wildlife, especially birds, are placed for rehabilitation, and sanctuary care is provided for local animals. There are interior and exterior displays with birds taking center stage, with a lot of other small animals. The birds are the real prize.


They have the following:
Volunteer Rehabilitation - 16+ years
Volunteer Animal Husbandry - 18+ years
Volunteer Wildlife Educator - 18+ years
Non paid internship - 18+ years
Keepers in Training - Sep to Aug Teen Program - your cost $625 – 13 - 17 years

Address: 1931 1st Ave, Walnut Creek, CA 94597
Phone: (925) 935-1978

https://lindsaywildlife.org
cost $12 adults, $10 children
parking free

Image Source: Lindsay Wildlife Experience web site.

## Meeting Reviews

Section Meetings During Summer

The section held the following activities during the summer months:

| Date | Topic | Presenter | Meeting Type |
|---|---|---|---|
| June 14, 2021 | Structural and biophysical characterization of function and aggregation in the extremely long-lived proteins of the eye lens | Professor Rachel Martin University of California, Irvine | Online Zoom |
| June 25, 2021 | CO2 Capture and Conversion to Carbon-Neutral Chemicals and Fuels | Professor Chunshan Song | Online Zoom |
| July 7, 2021 | Speak up and Stand Out With Courage and Confidence | Dr. Lois P. Frankel | Online Zoom |
| July 13, 2021 | Choosing a PhD Program & an Advisor | Prof. Darren J. Lipomi | Online Zoom |
| August 4, 2021 | Intentional Leadership: A Conversation with Claudia Graham & Matthew Lynch | Claudia Graham & Matthew Lynch | Online Zoom |
| August 23 to 25 | Celebrating the “40th Anniversary of CACS” Symposium during ACS 2021 Fall National Meeting | Chinese American Chemistry Society | Online Zoom |

Information can be found at https://calacs.org/calendar/

# From Water to Human Dynamics: Taking a Non-Traditional Path to Make Chemistry More Inclusive

By Nicki Davis and Elaine Yamaguchi

After 20 years of trying to increase diversity in the chemical field, the major approaches deserve a critical analysis. On May 15, 2021, Dr. Chrissy Stachl offered a perceptive critique of the methods currently being used and their shortcomings. She also described a solution she devised for graduate students at the UC Berkeley Chemistry of Department that addressed these issues.

Over the past quarter-century, efforts to increase diversity in science, technology, engineering, and mathematics (STEM) fields have made little progress. To date, only 7.6% of students at research universities self-identify as Black, Hispanic, Native American, Alaskan Native, or Pacific Islander. While the number of women relative to men in STEM fields has increased, they continue to be underrepresented in these fields. The underrepresentation of minorities and women is especially acute at senior levels. White, non Hispanic individuals make up the majority of people earning chemistry PhDs and getting professorships at the top 50 Grade I schools.

Past efforts to address this problem focused on outreach to recruit students from historically disadvantaged groups. The thinking was that simply increasing the numbers of women and minorities would fix the problem. Pipeline programs were designed to better prepare minority students to enter STEM. There is a word for this called deficit thinking, which basically starts with the assumption that there is something "wrong" with diverse individuals and concentrates on making them fit into the existing system, rather than looking for ways to change the system to make diverse individuals feel more welcome.

Dr. Stachl described how these issues played out in her own career. As an undergraduate pre-med student at the University of Washington, she participated in undergraduate research using ion mobility mass spectrometry, "fell in love" with chemistry, and eventually opted out of pre-med to earn a bachelor's degree in chemistry and neuroscience. Colombian by descent, and born and raised in Miami, she discovered that as a Hispanic in Seattle she didn't fit in. For example, few spoke Spanish.

Prior to graduate school, Dr. Stachl worked in labs abroad in Germany, the U.K., and Scotland, where she experienced collaborative environments and was first introduced to mass spectrometry. However, her initial period at UCB, though productive research-wise using cyclotron resonance mass spectrometry, left her feeling isolated. She joined the Chem Graduate Life Committee and found her fellow graduate students had similar issues and felt that the non-technical side of research group dynamics was hindering thriving at their highest potential. So, along with her grad student colleagues and faculty support inside and outside the Department of Chemistry, she led a rigorous community driven approach to identify problems (power dynamics, as an example), implement solutions, and track changes from 2018-2020. This is reported in 'Grassroot Efforts to Quantify and Improve the Academic Climate of an R1 STEM Department: Using Evidence Based Discussions to Foster Community' (1) and in 'Improving the Academic Climate of an R1 STEM Department: Quantified Positive Shifts in Perception' (2). The data set was large, since there are roughly 400 graduate students in the department; thus, meaningful conclusions could be made. Since all departments are different, a one-size fits all approach cannot be taken, but the methodology has been developed.

Chrissy earned her Ph.D. in Chemistry in 2020 from UC Berkeley and is now the Director of Education, Outreach, and Diversity at the National Science Foundation Center for Genetically Encoded Materials (C-GEM). She recently also contributed to a Women in STEM all-ages coloring book, created by ColorMePhD (download it here: http://bit.ly/colormephdvol2 for free!)


(1) C.N. Stachl, M.B. Francis et al., J. of Chem. Educ., 96 (10) 2019: 2149-2157.

(2) C.N. Stachl, A.M. Baranger et al., *ACS Omega*, 6 (22) 2021: 14410–14419. https://doi.org/10.1021/acsomega.1c01305

# Review of Earth Week April 2021

By Alex Madonik

After an entire year of COVID lock-downs, the California Section was determined to celebrate Earth Week with some hands-on chemistry fun. Earth Week coordinator Sheila Kanodia proposed an online celebration, to take place on Saturday, April 24th, close to the 51st anniversary of the original Earth Day on April 22nd, 1970. Zoom technology allowed a collaborative program with presenters from the California and Puget Sound Local Sections.

**Visitors joined us live for two sessions, at 11 AM and 1 PM.** Our theme was "Reducing Our Footprint with Chemistry." UC Berkeley student Raina Kasera acted as our MC. The Zoom sessions were recorded and the links are located on the Cal ACS Earth Week page, along with a photo album and links to instructions for each of the demonstrations. Here's the program:

https://calacs.org/outreach/earth-week/hands-on-chemistry-for-earth-week/

**Chemistry Rainbow Demonstration with Purple Mizuna Extract presented by Alex Madonik**

**Insulation Keeps Us Cool presented by Alex Madonik (California Section)**

**Protein Structure - Preparing Casein from Milk presented by Garima Thakur (Puget Sound Section)**

**Moving Colors in Milk presented by Chimara Stancill (California Section)**


**Plant Smells and Molecules presented by Margareta Séquin (California Section)**