THE VORTEX

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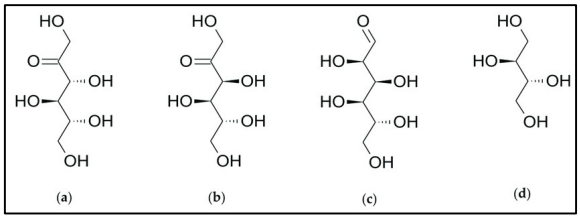

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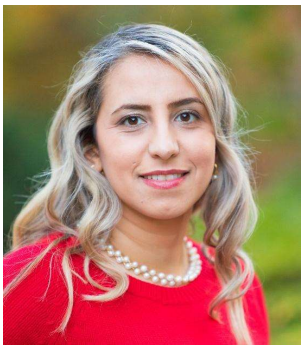
If you have material you think is worthy, submit it to donald.maclean.acs@gmail.com.

Chair Message



As the year winds down and we embrace the festive spirit of December, I pen my final message as your Chair in this edition of Vortex. My tenure as Chair may be ending, but the journey with this incredible community continues as I step into the role of Past Chair, ready to support the dynamic leadership of Patrick Lee and Alex Madonik in the coming year.

Reflecting on the year that was, I am overwhelmed with gratitude for your trust and engagement. Your active participation in our November elections, which also saw me elected as Councilor, exemplifies the vibrant democratic spirit of our section. It is an honor to represent our community at the national level.

The past year has been a remarkable period of resurgence and growth for our section. We made a strong comeback with an array of in-person and virtual events, catering to our members' diverse interests and needs.

The ACS National Meeting in San Francisco was a highlight, showcasing our commitment to collaboration and scientific excellence. Our active participation in various local scientific and outreach events has strengthened our presence in the scientific community.

Our collaboration with the Association of Women in Science East Bay Chapter has been particularly rewarding. This partnership, which we are eager to continue and strengthen in 2024, is a testament to our commitment to the empowerment of underrepresented voices in science.

This year, we also started new traditions that reflect our commitment to community and social responsibility. Our inaugural Juneteenth-Pride picnic celebration, symbolizing inclusivity and community, will be an annual event, bringing together members in celebration and solidarity. In addition, we proudly participated in the SF AIDS Walk this July. Our dedicated California ACS team walked 5k, raising funds and awareness for HIV programs and services in the Bay Area.

I am also thrilled to announce our successful bid for the Science Café mini-grant proposal. This achievement sets the stage for an engaging series of Science Café programs and seminars in the upcoming year, promising to make 2024 an even more intellectually stimulating and engaging year for our members.

As we celebrate these achievements and set our sights on future goals, I invite you all to join us at the end-of-year luncheon on December 16th. For more information, check page 4 of this Vortex edition or contact Julie at office@calacs.org.

In closing, I want to express my heartfelt thanks for the opportunity to serve as your Chair. I step down with a sense of accomplishment and immense pride in what we have achieved together. Here's to a festive holiday season, a joyful New Year, and an anticipation of great things to come in 2024.

With deepest gratitude and warm wishes,

Atefeh Taheri

Happy Holiday Season!

The California Section of ACS

Invites you to attend its

2023 Holiday Social (Lunch event)

On Saturday December 16th, 2023

At Lara's Fine Dining

1900 Esplanade Drive
Richmond CA

Time: *Social 11:30 am – 12:15 pm, Lunch 12:15 to 1:30 pm, Presentation: 1:30 – 2:00 pm*

COST: $65.00 per person (feel free to bring a guest, either a Cal. Section member or non-member)

Menu

Along with a Salad or Clam Chowder you have a

Choice of Entrée (Pick one):

- Grilled Atlantic Salmon
- Grilled Chicken
- Spinach Ravioli with ricotta and fresh tomato sauce

Followed by Dessert (Tiramisu or Cheescake), Coffee and Tea

Please RSVP by **Thursday, December 7th, 2023** by email office@calacs.org. When making your reservation, please indicate your choice of entrée, soup or salad and dessert (tiramisu or cheesecake. You may prepay by sending your check made payable to "California Section ACS" to the office at 2950 Merced Street, #225, San Leandro CA 94577 or pay with PayPal.
You may pay with cash or check at the event.

We hope you can attend!

2023 Section Election Results

By Michael Cheng

1. **Chair-elect (1 position)** - The Chair-Elect shall be Chair of the Program Committee and shall assist the Chair with the direction and management of the Section. - Alex Madonik

2. **Treasurer (1 position)** - The Treasurer shall have charge of the funds of the Section, including receiving all monies coming to the Section. - Paul Vartanian

3. **Councilors (3 positions)** - Representing CalACS members in the meeting of the Councils during ACS National meetings. - Sheila Kanodia, Patrick Lee, Atefeh Taheri; Alternate Councilors - Fanny Frausto, Neal Byington

4. **Director At Large (1 position)** - It is a member of the Board of Directors, and has full power to conduct, manage, and direct the business affairs of the Section. - Fanny Frausto

5. **Members At Large (3 positions)** - Assist the officers; bringing before the Executive Committee items of concern from members of the Section. - Mariana Alves, Charles Gluchowski, Dupeng Liu

Upcoming Events

By Donald MacLean

1. Berkeley Science Bowl Invitational, Sunday December 3, 2023. See calacs.org website for details.

How Sweet It Is!

Part 7

by

Bill Motzer

Introduction: In our quest to find a safe, effective, and satisfying low to no calorie natural sweetener, nutrition chemists continue experimenting and analyzing different substances. In Parts 5 and 6 of this series (June and September 2023 *The Vortex*), I reviewed the commercial sweetener *stevia* produced from the tropical plant. *Stevia rebaudiana bertoni.* Another, relatively new sweetener is *allulose* (aka: D-allulose, D-psicose, D-Ribo-2-hexulose, and pseudofructose. Allulose is a monosacharide C3 epimer of fructose ($C_6H_{12}O_6$), identified in the 1940s in wheat. It also occurs naturally in trace amounts in figs, raisins, maple syrup, and molasses. Allulose has similar physical properties to sucrose including bulk, mouthfeel, browning capability, and freeze point depression, making it a favorable sugar replacement in food products such as ice cream.

Safety Studies, Considerations, and Regulatory Requirements: tests on dogs and rats on the long-term effects of D-allulose ingestion have indicated that it's not harmful. Upon ingestion, it's partly absorbed in the small intestine, with slow release to the bloodstream. Small amounts transported to the large intestine, and in a rat's appendix are partially fermented; yet, in human intestinal studies, fermentation by bacteria occurs at a lesser extent with 70% absorbed in the small intestines and 30% excreted in feces. Studies have also shown that the commercial product is not absorbed and metabolized in the human body in the same manner as common sugars; therefore, it doesn't raise insulin levels. However, additional testing may be required to evaluate potential side effects. In 2020, the U.S. Food and Drug Administration (FDA) concluded that the maximum tolerable consumption for a 60 kg adult was 33 to 36 grams (g) per day. (For comparison, a 12 ounce can of Coca-Cola® Classic has 39 g of high fructose corn syrup.)

Because enzymes are employed to commercially extract and produce allulose from cane sugar and corn starch, the European Food Safety Authority (EFSA) investigated an enzyme manufactured by Matsutani Chemical Industry Company, Ltd. The enzyme used in production: d-psicose 3-epimerase, was researched for safety and allergenicity with findings that *E. coli* DNA was not present in the enzyme's preparation. Additionally, no match was found in the enzyme amino acid sequence with those of known allergens.

For allulose, the FDA's term *Generally Recognized As Safe* (GRAS) is now employed for various food categories where it is included as a sugar substitute. Because it's absorbed and metabolized differently from other sugars, the FDA has exempted allulose from the total and added sugar listings on *Nutrition and Supplement Facts* labels. Still, the FDA requires that its

weight be listed as a carbohydrate, with 0.4 kcal/g which is approximately 10 percent of the calories of ordinary carbohydrates (FDA, 2021).

History and Properties: In 1915 allulose was known to chemists as D-pseudofructose. In 1935, the German chemists Heinz Ohle and Felix Just determined its chemical structure, renaming it D-psicose. In 1942, it was isolated from commercial cane molasses by F. W. Zerban at New York City's Sugar Trade Laboratory and L. Sattler at New York's Brooklyn College. At the time, it was believed to be unfermentable and consequently of little practical value.

D-psicose's physical state is variously reported in the literature as a viscous liquid or a white crystalline solid with a melting point of 58 °C or 109 °C. Such temperature variabilities are likely due to the difficulty of crystallizing the compound. At approximately 1.0 kg/L, it's extremely soluble in water. In comparison glucose dissolves at about 0.90 kg/L and fructose at about 4 kg/L.). A brief summary is in **Table 1**; chemical structural comparisons with other sweeteners are shown in **Figure 1**.

D-Psicose has 70% sucrose's sweetness, but only about 10% of sucrose's nutritional energy or caloric value. Therefore, it's now used as a replacement for sucrose and artificial sweeteners (ACS, 2021).

In the next article, I'll review some of the allulose's uses and health benefits and risks.

Table 1: Some Allulose Chemical Properties

Property	Description
Molecular Formula	$C_6H_{12}O_6$
Chemical Abstract Service (CAS) No.	551-68-8
IUPAC Systematic name	(3*R*,4*R*,5*R*)-1,3,4,5,6-Pentahydroxyhexan-2-one
Molar Mass	180.063 g/mol
Physical state	White solid crystals
Crystallize	B-D-pyranose
Conformational isomerism	1C[^{1}C4(D)]
Melting point	96 ^{o}C (range: 58 ^{o}C to 109 ^{o}C)
Optical rotation (liquid)	Ca. -85 degdm^{-1} g^{-1} cm^3
Solubility	Dissolve 291 g/100 g water
Energy (caloric value)	0.007 kcal/g (rats);

Source: Xia, et al. (2021); PubChem (2023).

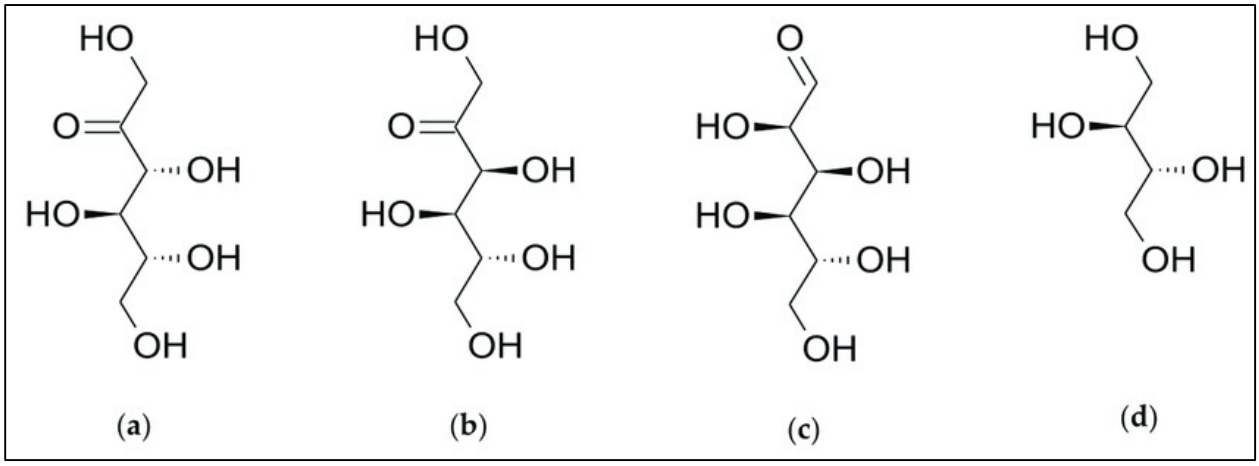


Figure 1: Chemical structure diagram comparisons of different sweeteners: (a) D-allulose, (b) D-fructose, (c) D-glucose, (d) d-erythritol. Source: *Maeng, et al. (2021).*

References:

American Chemical Society (ACS), Molecule of the Week Archive: D-Psicose (August 09, 2021): https://www.acs.org/molecule-of-the-week/archive/p/d-psicose.html.

FDA (Food and Drug Administration), GRAS Notice (GRN) No. 1029 with Amendments (2021), 69 p. with attachments; https://www.fda.gov/food/generally-recognized-safe-gras/gras-notice-inventory; https://www.fda.gov/media/159396/

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Xia, Y., et al., *Research Advances of d-allulose: An Overview of Physiological Functions, Enzymatic Biotransformation Technologies, and Production Processes*: Foods (2021), 10 (9), 2186; https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8467252/.

Armchair Explorer – Seeing California Geology

By Donald MacLean

Sometimes you see something that in retrospect you wished you recorded. That is the case with this month's armchair travel recommendation. I highly recommend Doug's Geology Journal, It's All My Fault, PBS Season 1 Episode 102. The episode uses locations along the San Andreas fault to explain not only the present-day geology, but also the environment, and the coastal shape that fault movement created.

Figure 1. Overlay of San Andreas Fault with California Geomorphic Provinces.[1]

First a background about California geology. California is divided into 11 geomorphic provinces: Basin and Range (3 noncontinuous areas, east of Sierra Nevada), Cascade Range (Mount Shasta), Coast Ranges (Cresent City to San Luis Obispo), Colorado Desert, Great Valley, Klamath Mountains, Modoc Plateau, Mojave Desert, Peninsular Ranges (Los Angeles, San Diego), Sierra Nevada, and Transverse Ranges (Santa Barbara, San Gabriel and San Bernardino mountain ranges) [Figure 1].[1]

There are more than 700 named faults in California that are recently active. Many other recently active faults are still unnamed. The longest fault in California is the San Andreas Fault system. It has a total known length of 1,600 kilometers (1,000 miles) and incorporates many parallel fault fractures and segments. The San Andreas Fault is a place where two tectonic plates touch, the North American and Pacific Plates. The Santa Cruz Mountains, west of the San Andreas Fault, grew 1.2 meters (47.2 inches) higher during the 1989 M6.9 Loma Prieta earthquake, evidence that the Coast Ranges are still rising today due to fault activity.[2] In the San Francisco Bay Area we know that the rumble that we get is not only from the San Andreas fault, but the Rogers Creek, Calaveras and Hayward Faults. In the San Cruz area, there is the San Gregorio fault.[3]

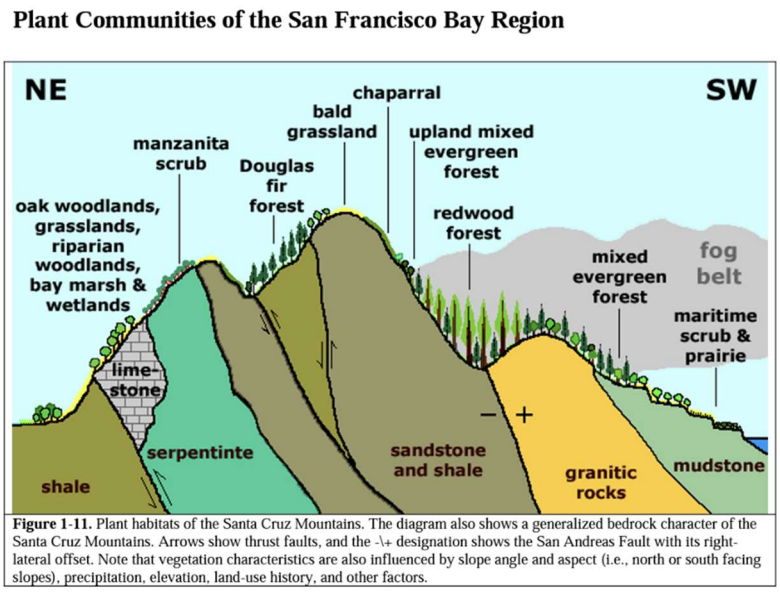

Figure 2. Plant Communities of the Santa Cruz Mountains Depend Upon Geology.[4]

An interesting area that the show visited was the bend at Santa Barbara. The fault has a northwest – southeast orientation, but at Santa Barbara the fault turns west. This is the reason the coastline faces south instead of west.

Another interesting observation is the Salinas River used to be part of the Colorado River. The deep canyon in Monterey Bay was cut by the Colorado River.

Looking at ecology, the fault is responsible for the redwood trees in Santa Cruz. See Figure 2. This is because the fault bends northward north of Santa Cruz and with the North American plate pushing southward, the land rises to form the Santa Cruz Mountains.

Geologically important places[6] featured in the video starting in the south and ending in the north:

Bombay Beach on the Salton Sea - created in 1905 when several floods inundated a bypass in irrigation canals and diverted the entire Colorado River for nearly two years.
Coachella Valley Preserve
Parkfield—Earthquake Capital of the World
Carrizo Plain San Gabriel Range – earth split image
Santa Barbara – bend west then north
Pinnacles National Park
Monterey Peninsula
Salinas River – former mouth Colorado River
Santa Cruz Mountains – redwood and fog
Santa Cruz
Golden Gate, San Francisco
San Andreas Lake
Stinson Beach
Point Reyes National Seashore
Tomales Bay
Alder Creek Beach (Manchester, Mendocino County) goes under the ocean if going north.

Many of these places are places that would be recommended for road trip stop.

Figure 3. screen image for PBS for Doug's Geology Journal.[5]

About the show. The show was on PBS starting in Dec 2022. Currently can be viewed by subscription to PBS.

In the new five-part series DOUG'S GEOLOGY JOURNAL, field geologist and host Doug Prose helps make sense of complicated geologic stories. By sharing his observations in places as diverse as Iceland and Death Valley, Doug explains big-picture geologic processes that shape the landscape. This series is sure to inspire interest in not only the geology around us, but the amazing stories that are shaped by planet Earth. There are only 5 episodes. Episodes with description are as provided by PBS:

Season 1	
Title	**Description**
A whole Lotta Lava	Doug explores Iceland's many geologic wonders, including an erupting volcano.
It's All My Fault	Doug travels the jagged length of California's restless San Andreas Fault.
An Army of Caterpillars	Doug rides the roller coaster terrain of America's Basin and Range Province.
Two Tasty Plates	Doug roams Sicily, an island of two crashing tectonic plates and one very active volcano.
Red Rock Rising	Doug winds his way through the sculpted red rock formations of Utah and Arizona.

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2. 150 Geologic Facts about California, 150 Geologic Facts about California, efaidnbmnnnibpcajpcglclefindmkaj/https://www.conservation.ca.gov/cgs/Documents/Melange/Geologic-Facts-about-California.pdf
3. Rock Record: The Faults that Shape Santa Cruz, Santa Cruz Museum of Natural History, By Graham Edwards and Gavin Piccione, https://www.santacruzmuseum.org/rock-record-the-faults-that-shape-santa-cruz/
4. Introduction San Andreas Fault: An Overview, United States Geological Survey, Chapter 1 efaidnbmnnnibpcajpcglclefindmkaj/https://pubs.usgs.gov/of/2005/1127/chapter1.pdf
5. Web site on PBS directed to the TV program. https://www.pbssocal.org/shows/dougs-geology-journal/episodes/it-s-my-fault

Exploring Health & Environment: Navigating Chemicals in Our Everyday Lives

By Atefeh Taheri

On Oct 11th, I had the honor of organizing a joint event between our section and the Association for Women in Science, East Bay chapter, that offered an insightful look into the prevalent chemicals in our daily lives. The enlightening presentation was delivered by Professor Sonya M. Schuh from the Department of Biology at Saint Mary's College of California.

Professor Schuh's talk highlighted the alarming rates of infertility and congenital defects in humans. With environmental toxins becoming ever pervasive, our exposure to toxic chemicals that disrupt our body's natural functions is a matter of great concern.

Bisphenol A (BPA) and phthalates, ubiquitous in plastics, household items, cosmetics, and personal care products, have been scrutinized. These compounds, suspected to be endocrine-disrupting chemicals (EDCs), have profound effects on hormone actions and pathways. Astonishingly, more than 93% of people show traces of bisphenols and phthalates in their system, prompting rigorous studies on their implications.

The research from Professor Schuh's lab, which predominantly comprises undergraduate students, used a mix of in vivo animal models and in vitro cell-based systems, notably adult mesenchymal stem cells. The results unveiled were indeed alarming. Many of these chemicals led to cell death, hindered development, stunted growth, and caused several other defects across species.

The event witnessed a robust turnout, with attendees hailing from various parts of the Bay Area, including the tech hub of Silicon Valley. Their diverse professional backgrounds enriched the Q&A session, leading to vibrant discussions.

Our gratitude extends to Katie Sullivan, chair of the Association for Women in Science East Bay, for her impeccable event facilitation in a splendid conference room. The post-talk networking session, enriched with wine and cheese, allowed attendees to foster connections and engage in informal but insightful discussions.

Bay Area Chemistry Symposium Report for Vortex,

C. Gluchowski

The award-winning Bay Area Chemistry Symposium (BACS) was held this year on November 3rd, 2023 at Robertson Auditorium on the UC San Francisco Mission Bay Campus. The weather was warm, the sun was shining and the science and networking opportunities were delightful!

This event, organized by the California and Silicon Valley ACS sections, and financially supported by established and start-up local industry sponsors, has grown significantly in the 4 years that it has been held. This year it brought together over 250 participants at all career stages from undergraduates to distinguished scientists to hear about new discoveries in chemistry and biochemistry coming from academic and industrial labs throughout the SF Bay Area and beyond.

The tag line for the symposium – "connecting industry + academia" – certainly was fulfilled at this event: the symposium featured an eclectic mix of oral presentations from both distinguished faculty such as Professors Kevan Shokat, UCSF and Carrie Partch, UCSC as well as talks from industrial scientists such as Michael O'Keefe from Gilead and Joseph Young from Novartis. In addition, 40 posters were presented by young scientists from all over the bay area.

With the weather at a balmy 72 degrees and sunny in downtown San Francisco, it was a beautiful day to mingle outside in the sunshine during coffee breaks and lunch. Blankets were provided for picnicking on the Koret Quad outside the auditorium. The symposium was capped off by a reception and poster session followed by awards being presented for the best posters. Each of the winners received a gift card. The following individuals won poster awards:

- 1st place: Di Gu, UC Berkeley, Wenjun Zhang Lab, "Discovery and biosynthesis of Salivabactin, a new antibiotic from oral bacteria"
- 2nd place: Logan Bartholomew, UC Berkeley, Richmond Sarpong Lab, "^{14}N to ^{15}N Isotopic Exchange of Nitrogen Heteroaromatics through Skeletal Editing"
- 3rd place: Clifford Leung, University of San Francisco, Herman Nikolayevskiy Lab, "Development and Mechanistic Analysis of Covalent Inhibitors Against Sortase A. Activity in Staphylococcus aureus Bacteria"

Speaking of awards, as a reminder, at the National ACS meeting held in San Francisco in August this year, the BACS and the California Section was recognized at the ChemLuminary Awards with the Outstanding Continuing Public Relations or Communications Program of a Local Section Award!

Special thanks to Caleb Karmel, Maze Therapeutics and Professor Ian Seiple, UCSF, co-chairs for the 2023 BACS, the rest of the organizing committee and particularly Julie Mason,

CalACS for her support. Check out the BACS website (https://www.bayareachemistrysymposium.com/) for updates on the plans for the 2024 event!

Photos:

Photo 1: BACS participants enjoying lunch al fresco. Photo by Natalie McClure, Silicon Valley ACS Section.

Photo 2: BACS participants waiting in anticipation for the next talk. Photo by Natalie McClure.

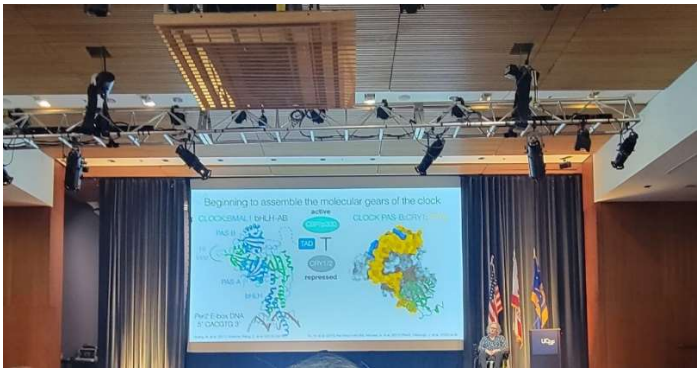

Photo 3: Professor Carrie Partch, UCSC, dazzling the audience with her presentation on molecular clocks and circadian rhythms. Photo by Charles Gluchowski, California Section.

CalACS at Lincoln Elementary School in Richmond, November 16, 2023

Charles Gluchowski

On November 16 CalACS participated in a STEAM outreach event at Lincoln Elementary in Richmond. It was a great success. The event was organized by Michael Cheng with some guidance from Alex Madonik from afar. Bryan Balazs opened the event and literally warmed up the crowd of students and parents with several explosive, colorful and educational experiments. Then the participants spread out and learned about various experiments sponsored by a number of groups including Chevron (Toni Miao was among the Chevron team). At our table, Michael prepped and organized the activity focused on the use of Anthocyanins (from red cabbage but also present in various fruits and vegetables) as a colorful pH indicator. Mariana Alves from Novartis and 7 of my Las Positas College Chem 30B students (Jennie Hamilton, Leila Hemdan, Chao Yu Hsu, Catherine Ip, Natalie Liebelt, Bola Raji and Lia Simon) did fabulous work interacting with both the students and parents while demonstrating the activity. Of course, safety came first with the CalACS team getting the participants to put on their safety glasses before handling the reagents. The evening was capped off with Michael making a delicious batch of liquid nitrogen frozen ice cream which we handed out to everyone who wanted it! Fun times in Richmond!

Photo 1: Bryan Balazs demonstrating the elephant's toothpaste reaction for the crowd.

Photo 2: Mariana Alves demonstrating the pH properties of Anthocyanin plant extracts.

Photo 3: CalACS team in blue ACS shirts: Facing camera: L-R: Lia Simon, Jennie Hamilton, Bola Raji, Leila Hemdan, Natalie Liebelt, Catherine Ip, Chao Hsu Yu (Chem 30B, Las Positas College). Facing away from camera: L-R: Mariana Alves, Michael Cheng.

Photo 4: Michael Cheng preparing the delicious ice cream mixture.

WCC Meeting Held on 11/04/2023: Speaker: Rachel Woods-Robinson, PhD
Shining light on solar cells and their material impacts

By: Abigail O. Gyamfi

Dr. Rachel Woods-Robinson is a scientist, science communicator, "sci-clist," and renewable energy advocate. Her research includes solar cells, sustainability analysis, materials science, and transparent conductors. She has a rich background in designing new crystals for solar energy by combining computational chemistry, thin film growth, and device fabrication. She received her Bachelor's in Physics with a minor in Environmental Systems and Society at UCLA. She completed doctoral studies in September 2021, specializing in Materials Physics under the tutelage of Prof. Kristin A. Persson at UC Berkeley. She then progressed as a Postdoctoral Scholar at the Lawrence Berkeley National Laboratory from October 2021-2022. Rachel is currently a Postdoctoral Fellow at University of Washington's Clean Energy Institute.

From her talk, she gave an overview into solar panel topics: designing new materials to convert solar energy into sustainable electricity. She discussed some big picture challenges in this field. She shared insights into the area of solar technology focusing on the power of the sun, zooming into a solar panel down to the nanoscale, designing new solar materials, solar sustainability, and society.

1. **The Power of the Sun**: It was pleasant to see a snapshot NASA video (https://youtu.be/6tmbeLTHC_0?si=rEznGK7VigvBfqQa) demonstrating the power of the sun which showed the beautiful imagery of the sun in various wavelengths. From the perspective of the earth to scale, the sun has enough energy to power a thousand earths if we were to harness it from where we are in the solar system. If we zoom into the earth right now, we face problems which include climate change, and we are up at the limits of a lot of our natural systems. She got interested in solar science in 2011. She showed a plot of the global electricity generation share. Electricity can be generated from other sources such as coal, hydro, nuclear, gas, oil, and wind. Over a decade ago, solar contribution was just 0.29%, a small fraction of the global electricity. In 2016, when she started her Ph.D., it was exciting to learn that global electricity share for solar had increased. Currently, solar is appreciably 4% of the share. However, it is crucial we harness the power of the sun for electricity generation in order to reach our climate goals of "net zero" by 2050. It is projected that we need between 60-75 terawatts (TW) of solar and approximately 16% of global electricity need to come from solar. There is a need for better materials in chemistry for solar in order to make progress in spite of political, societal, and economic challenges.

2. **Zooming into a solar panel**: She shared insights into Topaz Solar Farm in California [editor note this is a 550-megawatt (MW) power station on 4700 acres in San Luis Obispo County, California]**,** one of the largest solar farms in the world. This project consists of 9 million cadmium telluride (CdTe) solar panels. Zooming into an individual set of panels is the so-called solar array. A key step is to string a bunch of panels together into an array and then collect their charge and use different types of electronics like inverters to get the power to connect to the grid. Zooming further in is a photovoltaic solar panel or a module about the

size of a human. Inside of these panels are a bunch of crystals, but we haven't really seen where those crystals are yet and what they do, where the materials, chemical and physical challenges that are at work. Now, inside of a module is what is usually called a solar cell. The different layers of a solar panel can be separated into a frame, glass, encapsulation, a back sheet. The thickness of a solar cell is pretty small comparable to the size of a human hair for scale. In the crystal layers of the solar cell, there is a back contact that gets charged out of the solar panel with a thick layer which absorbs light, converting it to electricity. A transparent top contact material helps with the absorption of light, which is related to her research work. Her research involves making good contacts, which is a really important challenge. The technological challenge is growing high quality crystals with large enough grains to avoid losing energy to heat when electricity is moving through it. She also emphasized how a solar cell works. She talked about crystal "facets" and crystals "grains."

3. **Designing new solar materials**: Here she talked about CdTe, a type of solar panel. Silicon is one of the most common absorbers used on rooftops. There are also different types of solar materials such as gallium arsenide (GaAs). There are also a variety of contact materials and different metal layers that go into the solar panel. Common elements in solar panels can be grouped into *earth-abundant* (Al, Sn, Si, Zn, Cu, Se), *toxic* (Cd, Pb), *expensive* (Ag) and *critical* (Ga, Te, In, Ge, recently Cu has been added). The challenge is to make new crystals with earth-abundant elements. Currently, research is focused on developing the "next generation" solar materials which are cheaper, stable, and more sustainable. She applies computational chemistry to design and calculate properties of new crystals by using density functional theory (DFT) databases in addition to her experimental work of synthesizing crystals in the lab. Machine learning is an emerging field being explored by other researchers. In her Ph.D. work, she used screening processes to identify candidate contact materials, specifically, characterization of p-type transparent contact materials.

4. **Solar, sustainability & society**: She shared the comparison between the current solar capacity predicted to be ~1TW in 2023 and a projection of 60-75 TW of solar by 2050. The challenge is not only to make sure that there is enough installation of solar to mitigate some of severe impacts of the climate crisis but also do so in a way that minimizes impact during the installation. It is important we think about the full cycle of this technology from extraction, production, use and waste. Life cycle assessment (LCA) can be employed to assess the impacts to people and the planet. Some of the indicators include climate change, global emission, land use, resource depletion, ecotoxicity, water depletion, etc. A major concern is how to develop a cleaner and greener production process to reduce energy intensity during manufacturing so that our solar panels can lower embedded carbon. In aggregate, about 60-70% of emissions in industrial solar panels come from the production phase. About 5-20% of emissions come from waste; fortunately, we minimize that as we move forward. Renewable energy has higher material requirements than fossil fuels. For example, solar has more materials related emissions in comparison to coal. However, if we scale it based on absolute emissions, coal emits orders of magnitude more in total. There is an urgency to scale renewable energy efficiently, and we also need to pay attention to how life cycle impacts more "green sacrifice zones". In summary, material chemists can apply life cycle thinking in early stages of materials discovery and design to avoid "locking in" technology with significant negative impacts. Her goal is to help contribute to this process.

5. **Lessons from the field**: She has a big interest in community outreach. She is the co-founder of Cycle for Science, an adventure-based science education outreach organization that brings scientists to K-12 classrooms by bicycle tour to teach hands-on STEM lessons. She and her team create awareness about climate change, STEM engagement and diversity, epic bicycle adventure, and creative interactive science lessons. She shared her experiences from outreach engagement and teaching solar and climate-related lessons in California, New York, across the USA and even in the Netherlands. Some of their projects include 3D printed solar bicycle and the role of solar power, DIY blackberry solar cells, modeling the flow of glaciers and their climate impacts. She told an inspiring story of many of the kids sharing their experience of meeting scientists for the first time through their outreaches. Rachel is looking for adventurous scientists to join future trips. She spends her free time exploring the outdoors and envisioning a renewable-energy-powered future. She also shared her new found hobby developed during the pandemic; that is making different cakes in the shape of crystals she studies and demonstrating her research to her family. It was insightful to have a physicist share the power of the sun with 34 participants at this ACS meeting.

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Chair Message – Atefeh Taheri

January, February, March, April, May, June, November, December

2023 Meetings and Events		
Month	**Topic**	**Author (s) / Organizer / Presenter**
January	Editor Notes for the 2023 year Berkeley Science Bowl Invitational	Donald MacLean Raina Kasera, and Jordan Rasiah
February	Nonlinear Career Path: A New Normal and a Fun One	Atefeh Taheri Elaine Yamaguchi
March	Upcoming events 1. North Bay Science Discovery Day - Sonoma County Fairgrounds 2. YCC Networking "Chemistry on the Rocks" at Raleigh's Pub 3. Glorietta Elementary School in Orinda Science Fair 4. Fuel Your Career with Chevron: An insider's Look into University Recruiting 5. Earth Day Celebration- John Muir Birthday- John Muir Nat'l Historic Site 6. Chemistry Olympiad – Santa Clara University 7. Northern California ACS Undergraduate Research Symposium St. Mary's College	Julie Mason and Donald MacLean Alex Madonik Alex Bruefach Dan Calef Atefeh Taheri Sheila Kanodia Eileen Nottoli Steven Bachofer
April	Upcoming Events 1. Fuel Your Career with Chevron: An insider's Look into University 2. Recruiting 3. Berkeley Science Bowl Invitational - UC Berkeley 4. Earth Day Celebration- John Muir Birthday- John Muir Nat'l Historic Site 5. Chemistry Olympiad – Santa Clara University 6. Northern California ACS Undergraduate Research Symposium St. Mary's College	Donald MacLean and Julie Mason Mark Fields, and Brian Redmond Atefeh Taheri UC Berkeley Sushila Kanodia Steven Bachofer

2023 Meetings and Events		
Month	**Topic**	**Author (s) / Organizer / Presenter**
	California Section of ACS Celebrates Earth Day by Partnering with John Muir Association	Sushila Kanodia
	The Curious Chemistry of Amazing Algae	Sheila Kanodia
May	Upcoming Events 1. The 2023 ACS Northern California ACS Undergraduate Research Symposium 2. Building a competitive and multi-facetted research portfolio: an outsider's perspective 3. Biomedical scientists making their mark in clinical research: Experience on a journey without a map	Julie Mason Steve Bachofer Sudip Das Rajan Singh Elaine Yamaguchi
June	Upcoming Events 1. Cal ACS Picnic 2. Hands-on science at four Contra Costa County Library events 3. CalACS Day at the Oakland Coliseum A's vs Giants 4. Kids Zone Event at Children's Creative Museum at Yerba Buena Gardens 5. Solano Stroll - Albany / Berkeley	Donald MacLean Atefeh Taheri Fanny Frausto Vanessa Marx Atefeh Taheri Alex Madonik Michael Cheng
	Fentanyl Symposium at 2023 Fall ACS Meeting	Attila Pavlath
September	Upcoming Events 1. Solano Stroll - Albany / Berkeley 2. "The Physics and Chemistry of the Atomic Nucleus" 3. Distillery Tour & Spirit Tasting with Cal ACS - Delve into Distillation, St George Distillery, Alameda 4. Awards Luncheon 5. Exploring Health and Environment: Navigating Chemicals in Our Everyday Lives" 6. BACS 2023, UCSF Mission Bay	Donald MacLean Alex Madonik Michael Cheng Heather Crawford Elaine Yamaguchi Atefeh Taheri Julie Mason Atefeh Taheri Sonya Schuh Patrick Lee
	25th Annual ChemLuminary Awards Ceremony	Alex Madonik
October	Upcoming Events 1. Awards Luncheon 2. "Exploring Health and Environment: Navigating Chemicals in Our Everyday Lives" 3. BACS 2023, UCSF Mission Bay	Donald MacLean Julie Mason Atefeh Taheri Patrick Lee Elaine Yamaguchi Alex Madonik

2023 Meetings and Events		
Month	**Topic**	**Author (s) / Organizer / Presenter**
	4. "Shining Light on Solar Cells and Their Material Impacts" 5. Outreach Activities	
November	Up Coming Events 1. BACS 2023, UCSF Mission Bay 2. Shining Light on Solar Cells and Their Material Impacts" 3. Outreach Activities 4. Berkeley Science Bowl Invitational	Donald MacLean Patrick Lee Elaine Yamaguchi
December	Berkeley Science Bowl Invitational	Donald MacLean

2023 News		
Month	**Topic**	**Author (s) / Organizer / Presenter**
February	2023 Chemistry Olympiad Participation	Donald MacLean
	Summer Project SEED Applications	Donald MacLean
March	Summer Project SEED Applications	Donald MacLean
	2023 Chemistry Olympiad Participation	Donald MacLean
April	2023 Chemistry Olympiad Participation	Eileen Nottoli
	Summer Project SEED Application Deadline Extended	Donald MacLean
	2023 Lloyd Ryland Outstanding High School Chemistry Teacher Award	Eileen Nottoli
	In Memoriam: Gordon Moore	Donald MacLean
	2023 CalACS Chemistry Olympiad Report	Eileen Nottoli
October	ACS Younger Chemist Committee Leadership Institute Travel Award	ACS
	Section Elections	Michael Cheng
November	Atefeh Taheri wins Meridian Award from Association for Women in Science (AWIS)	Donald MacLean
	2023 CalACS Section Award Pictures	Donald MacLean

2023 Profiles and Obituary		
Month	**Topic**	**Author (s) / Organizer / Presenter**
January	Pavlath Legacy – 7: Edible and Biodegradable Films	Nicki Davis
April	In Memoriam: Gordon Moore	Donald MacLean
March	International Women's Day – Local Section Member Brief Profiles 1. Alexandra Bruefach 2. Sarah Bronner, Ph.D. 3. Fanny Frausto, Ph.D. 4. Sushila (Sheila) Kanodia, Ph.D. 5. Dr. Vanessa M. Marx, Ph.D. 6. Mina Mozafari, Ph.D. 7. Eileen Nottoli, J.D., Ph.D. 8. Margareta (Greti) Séquin, Ph.D. 9. Atefeh Taheri, Ph.D. 10. Alicia Taylor, Ph.D. 11. Elaine S. Yamaguchi, Ph.D.	Atefeh Taheri (Organizer) and Donald MacLean (Compilation and Presentation)
May	Uniformed Services 1. Donald MacLean 2. Lee Latimer	Donald MacLean

2023 Agriculture / Aquaculture and Pharmaceutical		
Month	**Topic**	**Author (s) / Organizer / Presenter**
January	Agriculture: 2022 Census	Donald MacLean
February	EP Proposes to Replace Rabbit Pyrogenicity Test with Protein Based Test	Donald MacLean
	Fish Hatcheries	Donald MacLean
April	Recommended Travel Location: Chicks Are In	Donald MacLean
May	USP Gray Zone Particulates Presentation is Available for Free	Donald MacLean
June	May Pharmacopeia Trip Experience Methemoglobin: Fighting Blue Skin with Methylene Blue	Donald MacLean
September	Agriculture Segment: Fire Hazard Tiers and Defensible Space	Donald MacLean
	Recommended Travel Location: The UC Davis Coastal and Marine Sciences Institute (Bodega Bay, Sonoma County)	Donald MacLean
October	USP New General Chapter for Talc Testing for Asbestos, From FTIR or XRD, and Optical Microscopy to XRD and Polarized	Donald MacLean

2023 Agriculture / Aquaculture and Pharmaceutical		
Month	**Topic**	**Author (s) / Organizer / Presenter**
	Light Microscopy, Part 1	
	Recommended Travel Location: Pumpkins and Corn Mazes	Donald MacLean
November	2023 Nobel Prizes 1. Chemistry – Quantum dots 2. Physics – Attosec light pulses 3. Physiology or Medicine – Nucleoside base modifications	Donald MacLean

2023 History and Education		
Month	**Topic**	**Author / Complier**
January	Pavlath Legacy – 7: Edible and Biodegradable Films	Nicki Davis
	Agriculture: 2022 Census	Donald MacLean
	Recommend Location: Mushroom Hunting	Donald MacLean
February	How Sweet It Is! Part 1	Bill Motzer
	EP Proposes to Replace Rabbit Pyrogenicity Test with Protein Based Test	Donald MacLean
	Fish Hatcheries	Donald MacLean
March	International Women's Day – Local Section Member Brief Profiles	Atefeh Taheri (Organizer) and Donald MacLean (Compilation and Presentation)
	Recommended Travel Location: Snow Country	Donald MacLean
April	How Sweet It Is! Part 2	Bill Motzer
	Recommended Travel Location: Chicks Are In	Donald MacLean
May	Uniformed Services	Donald MacLean
	How Sweet It Is! Part 3	Bill Motzer
	USP Gray Zone Particulates Presentation is Available for Free	Donald MacLean
	Recommend Activity – California Bloom and Waterfalls	Donald MacLean
June	How Sweet It Is! Part 4	Bill Motzer
	May Pharmacopeia Trip Experience Methemoglobin: Fighting Blue Skin with Methylene Blue	Donald MacLean
	Recommended Location: Aftel Archive of Curious Scents (Berkeley, Alameda County)	Donald MacLean
September	How Sweet It Is! Part 5	Bill Motzer
	Agriculture Segment: Fire Hazard Tiers and Defensible Space	Donald MacLean
	Recommended Travel Location: The UC Davis Coastal and Marine Sciences Institute (Bodega Bay, Sonoma County)	Donald MacLean
October	How Sweet It Is! Part 6	Bill Motzer
	Periodic Graphics – Side Effects – Colored Urine	Donald MacLean
	USP New General Chapter for Talc Testing for Asbestos, From FTIR or XRD, and Optical Microscopy to XRD and Polarized Light Microscopy, Part 1	Donald MacLean

2023 History and Education		
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	Recommended Travel Location: Pumpkins and Corn Mazes	Donald MacLean
November	2023 Nobel Prizes 1. Chemistry – Quantum dots 2. Physics – Attosec light pulses 3. Physiology or Medicine – Nucleoside base modifications	Donald MacLean
December	How Sweet It Is! Part 7	Bill Motzer

2023 Reviews		
Month	**Topic**	**Author (s) / Complier**
January	2022 The Vortex Index	Donald MacLean
February	"Meet Chemistry Superstars: Creating Tomorrow's Technologies" at Stanford University – A Successful Collaborative Event between ACS California and Silicon Valley Local Sections and the Chinese American Chemical Society Northern California Chapter	Dr. Lin Li
	Book Reviews 1. V2 by Robert Harris, published 2020 2. The Ragged Edge of Night by Olivia Hawker published 2018	Linda Wraxall
March	"Nonlinear Career Path: A New Normal and a Fun One"	Margareta Sequin
April	Chemistry on the Rocks Report	Romit Chakraborty
	Spring 2023 National Meeting Summary of Councilor and Other Committees Report	Jim Postma
June	Northern California ACS Undergraduate Research Symposium - May 6	Steve Bachofer
	Earth Day Celebration at The John Muir Historical Site In Martinez	Romit Chakraborty, Shelia Kanodia, and Alex Madonik
	California Section Women Chemists Support Sonoma County's Expanding Your Horizons Conference	Janet Schunk
September	WCC Meeting Held on 05/13/2023: Speaker: Dr. Sudip Das	Abigail Gyamfi
	WCC 5/20/23 Meeting: Experience on a Journey Without a Map	Linda Wraxall
	Contra Costa County Library – Exploration Stations – Summer 2023	Alex Madonik with contributors Michael Cheng, and Greti Séquin

2023 Reviews		
Month	**Topic**	**Author (s) / Complier**
	American Chemical Society ACS Fall 2023 Meeting San Francisco, California	Jim Postma, Bryan Balaz, Marinda Wu, Eileen Nottoli, Alex Madonik, Sheila Kanodia, Michael Cheng
October	Chemistry in Action: 1. Avocado's Number Guacamole to Go 2. CalACS at Giants Versus A's Game	Dan Calef
	Solano Stroll 2023	Alex Madonik
November	Chemistry in Action - Unicorn	Donald MacLean
December	Armchair Explorer – Seeing California Geology	Donald MacLean
	Exploring Health & Environment: Navigating Chemicals in Our Everyday Lives	Atefeh Taheri
	Bay Area Chemistry Symposium Report	C. Gluchowski
	CalACS at Lincoln Elementary School in Richmond, November 16, 2023	Charles Gluchowski
	Shining light on solar cells and their material impacts, 11/04/2023	Abigail O. Gyamfi
	2023 Volume 85 The Vortex Index	Donald MacLean