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Karina K. Sand, PhD.

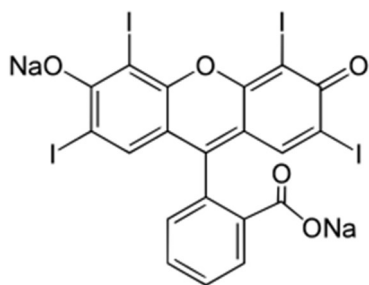
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Upper Right: Chemistry of Beer, Cheese, and Wine poster

Upper Center: GWB poster

Lower Left: Red Dye Number 3 Chemical Structure, Wikipedia

Lower Center: Pine Tree, Event poster

Lower Right: Plasma Ball at WOW Museum, Donald MacLean



Cal ACS Chair's Message

Alex Madonik



We have an action-packed month ahead in the California Section, starting off with two events on Saturday, February 8th: in the morning, the WCC will host a virtual presentation by Danish chemist Karina Krarup Sand, who will examine the interactions of DNA with minerals and the implications for DNA stability and transfer in sediment. That same afternoon, our Chico Subsection will host the Chemistry of Beer, Cheese, and Wine, an in-person event that will feature presentations by experts from UC Davis and tasting of distinctive examples of these classic products of fermentation.

The very next week, the WCC will be back as we host a virtual networking event on February 11th, "Accelerating Equity in Science," help in conjunction with the IUPAC's worldwide event, the [Women's Global Breakfast](#). This event has brought together tens of thousands of participants annually since 2019, and we look forward to hearing from Cal ACS members and friends across the U.S. at 5:00 PM on Zoom, followed by in-person networking at the Emeryville Public Market at 6:30 PM. The ACS remains committed to [DEIR](#) (Diversity, Equity, Inclusion, and Respect) at all levels, because we know that diversity insures the most talented technical workforce possible, and we want every chemical scientist and technical professional to know they have a home in the ACS, and in its Local Sections and Divisions.

With the return of in-person events, Family Science Nights are back! Following last year's successful event at Willard Middle School in Berkeley, Cal ACS will return to Bancroft Middle School in San Leandro on Wednesday, February 26th. [Mariana Alves](#) will present the ever-popular

chemistry show, the [Chevron Slime Team](#) will be there, and our volunteers will present a variety of hands-on activities, capped off with Liquid Nitrogen Ice Cream! Please contact me or [Chimara Stancill](#) if you're able to help out that evening.

Finally, we are invited to join the CACS (Chinese American Chemical Society) in celebrating the Year of the Snake with a tour of the JBEI/LBNL facility in Emeryville and a presentation by Staff Scientist [Dr. Ning Sun](#), "Trash to Treasure: Upgrading organic & plastic wastes via chemical and biological conversion." Space is limited [for Thursday February 27, 2025], so be sure to reserve your place for the dinner reception, talk, and tour.

Looking ahead, Cal ACS outreach volunteers will return to North Bay Science Discovery Day in Santa Rosa on Saturday, March 8th, 10 AM to 4 PM. I'll be there, and I'm sure some of our North Bay members will want to join us as we introduce this year's [Chemists Celebrating Earth Week](#) theme, "Glaciers: Hot Topic, Cool Chemistry."

As you doubtless know, Cal ACS and the Silicon Valley Section will cohost the 2025 Western Regional Meeting in San Jose, October 25th to 28th. The program is rapidly taking shape and the invitation for symposium proposals is open on the [WRM 2025 web site](#). This is the chance for you, your colleagues, and your students to shine on the local stage, and to enjoy opportunities to socialize, network, and hear about the latest innovations in the Bay Area and beyond.

There are opportunities for every member of our Section to suggest new activities and to help plan future events. I look forward to hearing from more of you, and I will be reaching out to encourage both recent and long-time members to join in our continuing work to strengthen our Society and communicate the importance of our work to the public.

2024 Cal ACS Election Results

Data Provide by Michael Cheng

Shall the amended Bylaws of CalACS be adopted?		
	Responses	Percent
Yes	221	92.5
No	18	7.5
Total Respondents	239	

The following people were selected for various positions

Chair – James Postma

Secretary – Michael Cheng

Director-at-Large – Atefeh Taheri

Councilors (Select 2)		
	Responses	Percentage
Mariana Alves *	206	86.19
Fanny Frausto *	193	80.75
James Postma	75	31.38
Write-in candidate	4	1.67
Total Respondents	239	

Members-at-Large (Select 3)		
	Responses	Percentage
Greti Sequin *	206	86.19
Fiona Fotherby *	184	76.99
Linda Wraxall *	174	72.80
Sagar Bhattacharya	149	62.34
Write-in Candidate	4	1.67
Total Respondents	239	

Upcoming Events

- **Topic:** DNA-mineral interactions at the molecular level: implications for bacterial evolution and ecological inference
Date: Saturday February 8, 2025
Time: 10:30 – 12:00
Location: Zoom
Cost: Free
- **Topic:** Chemistry of Beer, Cheese, and Wine
Date: Saturday February 8, 2025
Time: 14:00 to 16:00
Location: Cal State University Chico, Colusa Hall 100 A/B
Cost: Free
- **Topic:** “CALACS Partners Networking Event on February 11, 2025”
Date: Tuesday February 11, 2025
Time: 17:00 – 20:00
Location: Zoom, followed by Emeryville Public Market
Cost: Free
- **Topic:** Family Science Night at Bancroft Middle School
Date: Wednesday February 26, 2025
Time: 5:00 pm – 7:30 pm
Location: 1150 Bancroft Avenue, San Leandro, CA 94577
Cost: NA
- **Topic:** CACS 2025 New Year Seminar and Tour — JBEI/LBNL
Date: Thursday February 27, 2025
Time: 5:30 pm – 8:30 pm
Location: JBEI/Lawrence Berkeley Nat'l Lab, 5885 Hollis St, Emeryville, CA
Cost: Free



All are welcome
Saturday, February 8, 2025

Title
**DNA-mineral interactions
at the molecular level:
implications for bacterial
evolution and ecological
inference**

Time
10:30 – 11:00 am Chatting
11:00 am Talk and
Discussion

Reservation
Please visit the CalACS
website
www.calacs.org to register
for this meeting or use Brown
Paper Tickets

[RSVP here!](#)

Please register before
Thursday, February 6, 2025,
12 noon. Your email address
is needed to send the ZOOM
link, which will be shared with
attendees on or before the
day of the event via Brown
Paper Tickets.

Cost
Free!

About the Speaker



Karina K. Sand, PhD.

Karina Krarup Sand, PhD, is an Associate Professor at the Globe Institute, Faculty of Health and Medical Sciences, University of Copenhagen, specializing in interdisciplinary research. Her work embodies a unique integration of geochemistry, microbiology, and evolutionary biology to understand and address pressing global health and environmental challenges. Sand's pioneering research in these fields has established her as a leader in the study of processes at the intersection of environmental surfaces and life. Dr. Sand also serves as Chair for Globe's Diversity Programme.

Her pioneering work in studying bio-mineral interactions at the molecular level has recently provided insight into parameters important for DNA preservation in sediments, and how sediments can be considered spatiotemporal gene archives for bacteria. Her work on studying the mechanisms driving bacterial uptake of genetic material stored on mineral surfaces link sedimentary processes to bacterial evolution. The work also provides an explanation for the observed extensive dissemination of antibiotic resistant genes in our environment and is directly relevant for mitigation strategies.

She is an advocate for collecting knowledge that is stored and curated in distinct research silos and co-founded the evolutionary geobiology consortium to drive knowledge collection aiming to address oncoming global threats to human and ecosystem health. Dr. Sand earned her MSc in Geology and her PhD in Chemistry from the University of Copenhagen. She has held various research and academic positions in Denmark, the United States, and the United Kingdom. Her career includes prestigious research fellowships. Her international experience has equipped her with a global perspective and an expansive network within the scientific community.

Abstract

Extracellular DNA (eDNA) in the environment degrades rapidly unless adsorbed onto minerals, which enhances its stability. Currently there are vast amounts of DNA molecules preserved in our sediments. This mineral-bound DNA, although widely used to study past ecosystems, also poses significant implications for bacterial gene acquisition. By utilizing interfacial geochemistry, molecular level and bacterial approaches, this study explores (1) the role of mineral surfaces in DNA preservation in sediments and (2) the potential of soil bacteria to acquire mineral-adsorbed DNA through horizontal gene transfer (HGT).

The findings demonstrate that mineral surface properties substantially impact DNA stability, offering new insights into sedimentary DNA taphonomy. Understanding these interactions can enhance environmental DNA (eDNA) applications for ecosystem. Moreover, our data show that bacterial transformation of mineral-adsorbed DNA can lead to genetic diversity, and is influenced by mineral surface properties. These insights suggest that mineral-facilitated HGT could serve as a pathway for bacterial evolution, potentially affecting gene dispersal over extended temporal and spatial scales. In such an evolutionary scenario mineralogy and interfacial geochemical processes become central to the evolutionary process of maintaining fitness.

Questions?

Please contact Elaine Yamaguchi at eyamaguchi08@gmail.com

Presented by the CSU Chico Department of Chemistry and Biochemistry

Together with CSU Chico Women in STEM and the California Section of the American Chemical Society


Saturday, February 8th, 2025, 2 PM to 4 PM
Cal State University Chico, Colusa Hall 100 A/B
Space is limited; [Register HERE](#) for this FREE event.

Join us for **“Beer, Cheese & Wine”** – an exciting collaboration between CSU, Chico Chemistry and Biochemistry Department, CSU, Chico Women in STEM and the California Section of the American Chemical Society! Discover how chemistry plays a fascinating role in crafting the food and beverages we love. This event offers a unique opportunity to taste, learn, and connect over hors d'oeuvres, wine, and beer.

Our speakers are top experts in their fields: Aimee Sunseri of New Clairvaux Winery, Dr. Glen P. Fox, and Dr. Moshe Rosenberg from UC Davis. They'll dive into the science and chemistry behind brewing, winemaking, and cheesemaking, sharing insights that will deepen your appreciation for each craft.

CSU, CHICO CHEMISTRY & BIOCHEMISTRY DEPARTMENT
CSU, CHICO WOMEN IN STEM & THE NORTHERN CHAPTER OF THE AMERICAN CHEMICAL SOCIETY
PRESENTS
**CHEMISTRY OF
BEER, CHEESE, &
WINE**

LEARN MORE,
& RSVP



CONTACT: AMARQUEZ2@CSUCHICO.EDU

LOCATION: CSU CHICO COLUSA 100
DATE: FEBRUARY 8TH, 2024
2:00 PM TO 4:00 PM

MEET OUR
PANELISTS

AIMEE SUNSERI
New Clairvaux Vineyard

DR. GLEN PATRICK
UC Davis

DR. MOSHE ROSENBERG
UC Davis

CSU, Chico Colusa Hall 100 A/B
February 8th, 2:00 PM

CHEMISTRY OF BEER, CHEESE,
& WINE

CALACS Partners Networking Event

*Accelerating Equity in Science**

When: Tuesday, February 11, 2025, 5-8 pm

- 5:00 – 6:00 pm – Zoom Virtual Networking
- 6:30 – 8:00 pm – In-Person Get Together

What: Join CALACS and partners for a free virtual networking event (followed by an in-person get together for locals at the Emeryville Public Market)

Where: via Zoom, followed by in-person for locals

Details: see <https://calacs.org/> for additional info & registration

Primary Sponsor:



* The goal of the GWB series is to establish an active network of people of all genders to overcome the barriers to gender equality in science.

IUPAC

W. Br.

ACCELERATING EQUITY IN SCIENCE

FEBRUARY 11

GWB2025

<https://iupac.org/gwb/>

iupac.org/gwb

#GWB2025

“CALACS Partners Networking Event on February 11, 2025” by Marinda Wu, 2013 ACS President, 2001 California Section Chair

The California Local Section of ACS (CALACS) invites all students and professionals to join our annual “**CALACS Partners Networking Event**” as part of the global IUPAC GWB2025 on February 11, 2025 (Tuesday). Feedback from prior years indicates that this is a wonderful event to promote personal and professional networking.

Please circle the date on your calendar because February 11 also celebrates the “*International Day of Women and Girls in Science*”. The theme this year for GWB2025 is “**Accelerating Equity in Science.**”

This is a global event organized by IUPAC that was initiated during the International Year of Chemistry (IYC) when chemistry was celebrated in 2011. That year, roughly 100 breakfasts were organized involving almost 5,000 scientists (both men and women) from

academia, industry, and government around the world.

The second IUPAC GWB, with the theme of “Empowering Women in Chemistry,” was held in February 2019 during the centennial celebration of IUPAC. A global map was created showing all the breakfasts or events held around the world. This second GWB was almost double the size of the first event. It involved approximately 200 events with an estimated attendance of roughly 10,000 participants worldwide. Since then, the GWB has been hosted annually by IUPAC, attracting more participants from different nations each year. Most participants are members of ACS (American Chemical Society), RSC (Royal Society of Chemistry), and many other international chemical societies around the world. Please visit <https://iupac.org/gwb> for more details.

Our local California Section of ACS joined the IUPAC GWB in 2021 during the pandemic with a successful virtual event for networking under the leadership of the California Section Chair Alicia Taylor, Councilor Alex Bruefach, and myself. Alicia had contacts with several other professional organizations she belonged to and invited these organizations to partner with our local CALACS Section. This was a successful event in which both students and experienced professionals, mostly from chemical industry and academia, networked together.

Using the model of networking in small breakout rooms to facilitate good discussion between university or college students and experienced working chemical professionals, the CALACS Partners virtual networking event has been successfully held every year in February since 2021.

From the start, I explained to the IUPAC organizers that our ACS local section prefers an after-work event to a breakfast. Each year that we celebrated GWB, our CALACS event is opened by either our California Section Chair or myself, along with other officers and leaders participating. CALACS has successfully partnered with many other organizations and groups over the years. These include the WCC (Women Chemists Committee), EWOC (Empowering Women of Organic Chemistry), the CACS (Chinese American Chemical Society) NCC (Northern California Chapter) and similar minded organizations and other local ACS sections.

Last year was the first time that we held not only a virtual networking event via Zoom, which attracted participants from across the USA (including the ACS President Mary Carroll), but also included breakout rooms to facilitate small group networking and conversation. This virtual networking was then followed by an optional in-person get together for local attendees to continue

networking and casual conversations with refreshments at the Emeryville Public Market. We plan to have a similar format this year.

Please see the following publicity flyer from which you can register to attend this CALACS Partners Networking Event on February 11, 2025. Our 2025 CALACS Section Chair is Dr. Alex Madonik, who has run many of the public outreach events for CALACS. Alex, along with Dr. Elaine Yamaguchi, Chair of our WCC (Women Chemists Committee) and Project SEED, will help with this year's event. Also assisting will be Mariana Alves from Novartis, who helped last year along with Dr. Vanessa Marx, also from Novartis.

We especially hope that our Past CALACS Chairs, ACS Councilors, and other CALACS officers will consider participating this year. Most of you, even if retired, can help young students – both undergrad and graduate students – with some good career tips. Elaine Yamaguchi will be running the Breakout Rooms this year, so she will try to place at least one senior ACS member in each Breakout Room with students. Our CALACS Chair, Alex Madonik, is well connected with his own students as well as UC Berkeley students and AXE, which we will also invite to join this global CALACS Networking event.

Please email me at marindawu@gmail.com with any questions. I do hope you will consider participating in our GWB2025. If you are local, we would love to have you join us in person after the virtual session.

Please also consider participating in any of the many other CALACS events this year. A similar event to celebrate International Women in Science will be held on March 8, organized by Dr. Sheila Kanodia, Past CALACS Chair and current member of the national ACS Ethics Committee. Stay tuned and please visit www.calacs.org for more information.



FEB 27

Trash to Treasure: Upgrading organic & plastic wastes via chemical and biological conversion

5885 Hollis St, Suite 320
Emeryville CA

Driving Direction: From HW 80, take Powell Street Exit, heading east; turn left on Hollis Street (after the overpass); the destination is on the left

Parking: Free street parking after 5 PM



chemical and
biological
conversion



The Northern California Chapter of Chinese American Chemical Society (CACS - NCC) cordially invites colleagues and friends to join us for a seminar and lab tour at Lawrence Berkeley National Lab (5885 Hollis St, Emeryville CA) on 02/27/25 (Thursday) and enjoy delicious Chinese Food free of charge to celebrate the Chinese New Year!

- 5:30 PM: Check-in & social hour
- 6:00 PM: Dinner reception
- 6:45 PM: Seminar Presentation
- 7:45 - 8:30 PM: Lab Tour

Limited space available. Please scan the QR code to register. Email cacs.norcal@gmail.com for any questions



Dr. Ning Sun

Staff Scientist
Lawrence Berkeley
National Laboratory

Professor Philipp Zerbe, UC Davis – Investigating Plant Terpenoid Metabolism and Bioproduct Applications

On Sunday, January 19, 2025, 18 Cal ACS members and friends gathered at the North Berkeley Senior Center for a buffet lunch, networking, and a chance to explore the exotic chemistry of plants. Professor Philipp Zerbe presented new results from his laboratory at UC Davis, including their studies of the scent compounds from the Wollemi Pine. This ancient species dates to the era of the dinosaurs, and was thought to be extinct until its discovery in the remote mountains of New South Wales, Australia in 1994. Its survival in the wild is threatened, and the UCB Botanical Garden is one of many centers working to preserve the species.

Our visitors enjoyed networking over a buffet lunch, followed by Professor Zerbe's talk at 1 PM, which was shared with additional viewers via Zoom. Over a dozen people registered for the Zoom meeting, with about half actually joining us online for the

presentation. At least one unregistered guest tried to join as well, which is a good reason to use the Zoom waiting room to screen attendees.

Professor Zerbe's talk focused on the links between genetic variation and plant terpenoid composition, and the consequences for health and quality of some key agricultural species, including maize (corn) and strawberries. Terpenoids are an amazingly diverse group of compounds derived from a five-carbon building block, isoprene. They function as plant hormones, pollinator attractants, and defensive chemicals, and many are valuable chemical products, including natural rubber and pharmaceuticals such as taxol and artemisinin. These studies can guide plant breeding for improved flavor and for resistance to pests, drought, etc.



In the case of maize, the need for improved pest resistance is clear, because millions of bushels are lost each year in the U.S. alone to a variety of fungal diseases. Professor Zerbe began working on maize defensive terpenes in collaboration with Professor Eric Schmelz of UC San Diego, who sadly died last 2024. Cytochrome P450 enzymes play a key role in hydrocarbon precursors to active compounds by adding oxygen-containing functional groups such as ketones, esters, alcohols, and epoxides. For example, synthesis of the antifungal diterpene kauralexin is linked to specific, pathogen-activated genetic elements. Combinatorial gene expression studies reveal the pathways; knocking out any one of the genes using CRISPR/Cas9 reduced plant resistance to fungal pathogens.



Professor Zerbe explained that gene duplication is a common mechanism that results in new functional pathways without disrupting the original function of the gene. His group has extended their studies to a novel diterpenoid group, the dolabralexins; derivatives that combine an allylic alcohol and an epoxide group exhibit broad antifungal activity.

Strawberry terpenes play an essential role in flavor and aroma. Breeding has greatly increased their genetic complexity; wild strawberries are diploid while modern cultivars are octaploid! Professor Zerbe's collaborators have carried out extensive genetic mapping studies of strawberry varieties, showing how their aroma profiles have diverged over 300 years of breeding. Linalool and nerolidol are the predominant aroma compounds, but dozens of other rare terpenes occur in specific cultivars. There are around 75 different terpene synthase genes distributed randomly over the octaploid genome, and Professor Zerbe's group has completed functional characterization of over a third of these enzymes. The work enables precision breeding to enhance strawberry aroma.

A third research focus has been the engineering of new enzymatic pathways to produce valuable chemical products more efficiently and sustainably. Genetic elements from different diterpenoid pathways can be recombined to produce natural and novel products.

Finally, Professor Zerbe shared some brand new results on the terpenes extracted from the Wollemi pine. Chromatographic separation and mass spectral analysis have revealed numerous unknown terpenes and diterpenes. Plants are truly Nature's chemists!

Alex Madonik

Red Dye No. 3 Banned in Foods

Donald MacLean

In January 2025 the US FDA (Food and Drug Administration) banned Red Dye #3 (also known as erythrosine and as 2-(6-Hydroxy-2,4,5,7-tetraiodo-3-oxo-xanthen-9-yl)benzoic acid, CAS 16423-68-0)¹ in foods and ingested pharmaceuticals. The FDA banned Red Dye #3 in topical pharmaceuticals and cosmetics in 1990 using the Delaney Clause from the Food Additives Amendment of 1958 to the United States' Food, Drugs, and Cosmetic Act of 1938. That clause banned any carcinogen compound in food. This new FDA ban comes after the California ban placed in October 2023 (California Food Safety Act, Assembly Bill No. 418, 2023).^{2,3} The food sector has 2 years to replace the dye, while the ingestible pharmaceuticals have 3 years to replace the dye (the process is called reformulation).

Chemistry and Pharmacokinetics

Red Dye #3 has a chemical formula $C_{20}H_8I_4Na_2O_5$, with molecular mass 879.86 g/mol. (See Figure 1). It is the disodium salt of 2,4,5,7-tetraiodofluorescein (fluorescein is a major fluorescent dye best known for detecting blood stains). Note the 4 iodides in the structure, which directs the compound to the thyroid. The toxicity concerns have been from large doses in male rats cause thyroid cancer. Red dye #3 may be linked to behavioral impacts in children but that could be sugar in the items that contain the dye. Note the ring structure. The dye absorption maximum is 530 nm (green) which visually appears red due to complementary color phenomenon. It is subject to photodegradation (as with all iodo compounds, ergo the brown bottles that many iodo compounds come in). Its Emission (E_m) max is around 560 nm (yellow-green), but its fluorescence quantum yield is around 0.02, therefore fluorescence is not a major issue.

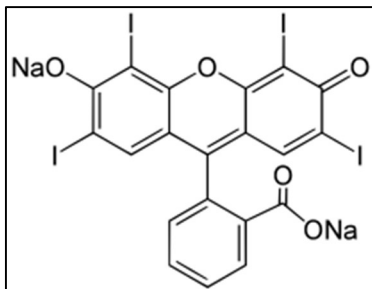


Figure 1. Chemical Structure of Red Dye No 3.¹

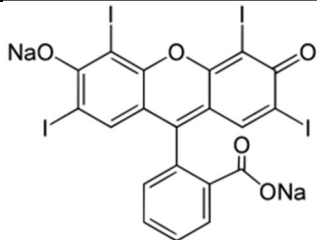
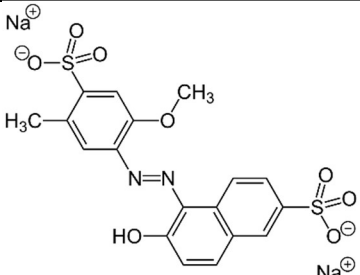
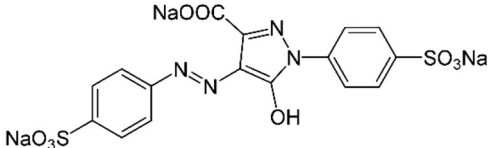
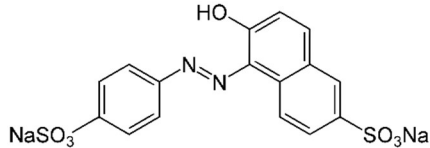
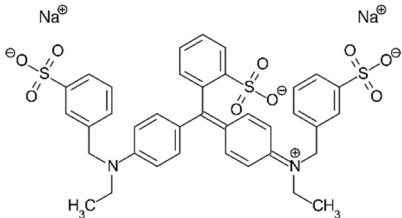
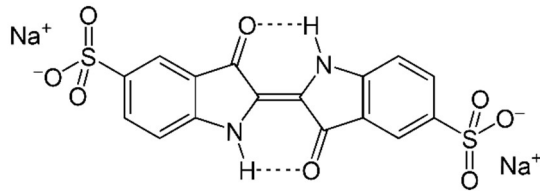
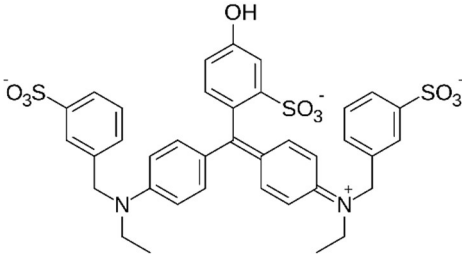
Some foods and drinks that contain Red Dye No. 3 include:

- Candies (Brach's Candy Corn and Jelly Beans)
- Baked goods and snacks (red icing or decorations).
- Dairy and frozen foods
- Fruit products (Maraschino cherries and some fruit cocktails)
- Beverages (sodas and fruit drinks)
- Medications (cough syrups, gummy vitamins)

Red dye No 3 was banned in California in 2023 under AB-418. In 2024 California banned an additional 6 dyes under Assembly Bill 2316, California School Food Safety Act. It outlawed Red 40, Yellow 5, Yellow 6, Blue 1, Blue 2 and Green 3 from the meals, drinks and snacks served at public schools statewide. This is part of the California crackdown on ultra processed foods and dyes.

Figure 2. Structure, Name, Chemical Family, and Abs Max. ⁶⁻¹²

7 Synthetic Banned Food Dyes in California ^{3,4}

 <p>Red Dye No 3 (erythrosine) Organiodine (derivative of fluorone) Emax abs at 530 nm (green)</p>	 <p>Red Dye No 40 (Allura Red AC) Azo Dye Emax abs at 504 nm (blue-green)</p>
 <p>Yellow Dye No 5 (Tartrazine) Azo Dye (pyrazolone family) Emax 425 nm (violet)</p>	 <p>Yellow Dye No 6 (Sunset Yellow) Azo Dye 480 nm at pH 1 and 443 nm at pH 13</p>
 <p>Blue Dye No 1 (Brilliant Blue FCF) Triarylmethane Emax abs 595 nm (yellow - orange)</p>	 <p>Blue Dye No 2 (Indigotine) Sulfonated indigo Abs max 610 nm (orange)</p>
 <p>Green Dye No 6 (Fast Green FCF) Triarylmethane Emax abs 625 nm (red)</p>	

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11. https://en.wikipedia.org/wiki/Indigo_carmine
12. https://en.wikipedia.org/wiki/Fast_Green_FCF

World of Wonders Science Museum Lodi (San Joaquin County)

By Donald MacLean

This month's science recommendation is the Museum of Science in Lodi (San Joaquin County). This is a physics focused museum. It will take 1 hour to 90 minutes to do the museum exhibits. For those in the Bay Area, the time to get there is a bit deceptive so plan more time than you think to get there. Lodi is an agriculture area with the Sacramento River to the West. Take the drive through the Delta as there is more to see than just the fast food, lodging, and gas stations using the interstate and Hwy 99.

Most of the exhibits are in working order. They tend to have a high proportion of light topics like complementary colors, fluorescence, and sound topics like parabolic dish voice transmission, sound electro spectrum. You can see their exhibits on their website to get an idea. Several exhibits are not on their website. Here is a topics list I thought interesting.

Illumination:

Shadow Table - Explore light and shadows. This is a playful and inventive way to explore light, shadows, reflection, and motion.

Shadow Wall - A large phosphor wall will store light from a strobe flash, temporarily freezing the visitor's shadows. Visitors can stretch and pose before the strobe flashes to produce unique shadows. It acts like a picture, except it is illuminating or black (the area where the light was blocked).

Colored Shadows - Red, blue and green spotlights shine on a wall while your body casts 3 different colored shadows. By moving your body, complimentary colors are produced (Figure 1).



3-D Shadows – A spring has a red and blue light shown on it to create a red and blue shadow that does not overlap. Looking through the blue filter or the red filter will block either the red or blue shadow.

Convection Current- This is a water tank, heater and light source. The tank sits between a light source and a screen. When the heater is turned on, the water heats and rises due to convection. The Schlieren image is not seen in the tank, but on the wall that the light reflects off of.

Two-Faced Exhibit- An activity in which two people sit across from each other and observe each other through a dividing, clear barrier. As each participant adjusts the lighting, the image they see changes.

Figure 1.
Complementary Shadow Colors. Three separate colors are projected onto the wall. When a person gets between the wall and the light sources, the red, blue, and yellow mix and provide secondary colors on the shadow.

Momentum:

Newton's Cradle - This exhibit demonstrates the three main physics principles at work: conservation of energy, conservation of momentum and friction using seven billiard balls.

Turntable - A large disk rotates. Place items on rotating disk and see the path change.

Pendulum Snake - Pendulums of different lengths swing differently to create some fascinating patterns (Figure 2).

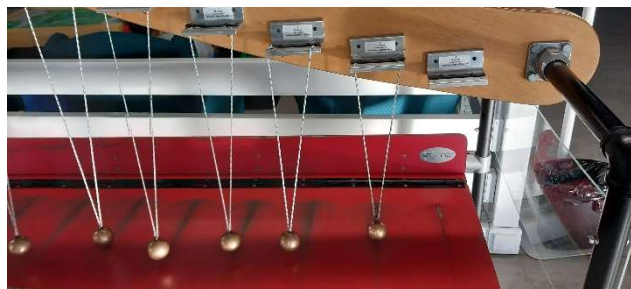


Figure 2. Pendulum Timing. Shorter Pendulum = faster pendulum (period).

Chaotic Pendulum - Pendulum executes chaotic motion when non-linear initial conditions are imposed (Figure 3).

Electrical:

Plasma Ball - A clear glass orb, filled with a mixture of various gases at low pressure that generate high-frequency alternating current. A smaller orb in its center serves as an electrode (Figure 4).

Hand Battery- Placing one hand on a copper plate and the other hand on an aluminum plate will demonstrate that electrons can move through your body to complete a circuit. The amount of electric current that flows through you can be observed on a meter (Figure 5). Reverse the hand placement causes the voltage to change signs. No voltage is created if both hands are on the same metal type.



Figure 4. Plasma Ball. The arc goes from the center to the glass at the location of the object that touches the glass.

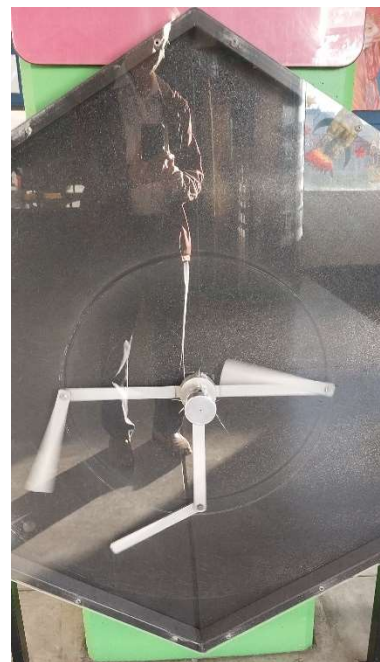


Figure 3. Chaotic Pendulum. This is like a double pendulum.

Generate Electricity - Manual cranking to generate electricity to work one to six objects in the window (Figure 6).

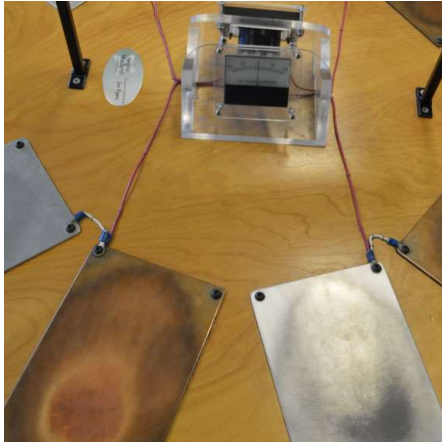


Figure 5. Hand Battery. Touch the aluminum plate on one side and the copper plate on the other side to get electrical current. *



Figure 6. Turn the red crank to make one to six items work. The more items with the circuit selected the more difficult to turn the crank.

Sound:

Parabolic Dishes – this is a 2-person experiments where, if positioned correctly, you can hear a whisper from the other person.
 Listen to your Heart – place your hand on a spot to get your heart rate and a drum beats on the plastic tube at your heart rate.

Reactions:

See Your Retina contract when exposed to bright light.
 Test your reaction time with the change in light color.

Wind Tube – Venturi affect if you try to pull the ball out of the wind stream.

Mechanical:

Gear Clock using pendulum as timing source (Figure 7).

*Image from web site.

Address: 2 N Sacramento St, Lodi, CA 95240-2164

Cost: free to \$9

Parking: free street parking.

Website: wowsciencemuseum.org



Figure7. Gears for a Clock.