THE VORTEX

AMERICAN CHEMICAL SOCIETY CALIFORNIA SECTION
VOLUME LXXVI NUMBER 4 APRIL 2015

Be an Earth Advocate

Women CHEMISTS Committee

California Section
Women Chemists Committee Meeting

Saturday, May 2, 2015

USDA
800 Buchanan Street
Albany, CA

Driving Directions

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

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

TIME

11:00 am - Meet the speaker and network with other participants
11:30 am - Lunch
12:00 pm - Presentation "Innovative Food Processing"

Cost $16.00 Lunch (Students and Unemployed Chemists $8.00). Presentation is free.

Innovative Food Processing for Improved Health, Safety and Sustainability

Speaker: Tara H. McHugh

Abstract

Research is needed to increase utilization and consumption of specialty crops. The development of new processing technologies can add value to specialty crops and their waste products through the development of new foods containing up to 100% specialty crop based ingredients with enhanced healthfulness, convenience, and overall consumer appeal. Increased consumption of nutritious fruit, vegetable, nut, legume and mushroom based foods will improve the American diet and reduce the prevalence of obesity in our nation. This research will also improve profitability for U.S. growers and processors by increasing demand for specialty crops and by developing new value added products with high potential for export. Development of sustainable processing technologies which result in energy and water savings is another benefit of this research. Food safety will also be improved. Applications of infrared, ultraviolet, microwave, solar, forming, casting, and extrusion technologies will be discussed to form novel value added, healthy food systems.

Biography:

Tara McHugh has an undergraduate degree in Food Science from Cornell University, and a PhD from UC Davis in the same field. Since 1994, Tara has worked at the USDA Western Regional Research Center in Albany, and as a Research Leader since 2002. She currently leads a 30 member group, including twelve PhD scientists, on projects to improve the healthfulness, marketability and safety of food through development and implementation of novel processing technologies. She is a leader in the fields of edible packaging and sustainable processing technologies for production of healthful, convenient restructured fruit and vegetable products. In addition she leads novel research programs exploring antimicrobial edible films, food processing effects on allergenicity and applications of nanoscience to foods. Her cutting edge team research – integrating food chemistry, processing, microbiology and engineering - has resulted in many direct, positive impacts on specialty crop processing industries and rural economies, providing new viable approaches to utilize and add value to specialty crops and co-products while saving energy and water and at the same time creating jobs and improving human health.

THE VORTEX

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Chair's Message

Charles Gluchowski

Hello folks, the California section had strong participation in the 249th national ACS meeting in Denver with our Councilors participating in meetings and discussions to help strengthen the organization at the national and local levels.

In addition, one other highlight from the meeting: our own Janelle Ball, Chico State High School teacher and the 2015 ACS James Bryan Conant award recipient, was formally recognized at the meeting in Denver. It is a pleasure to congratulate her on this outstanding achievement!

Regarding our future section meetings, at the moment the information is still a work in progress. Our April meeting will be on April 30 and will be at Las Positas College in Livermore where Dr. Felice Lightstone of Lawrence Livermore Labs will give a talk on modeling biochemical processes using the supercomputer at LLNL. The Wine, Cheese, Chocolate event that was originally planned for May 23 has been postponed until September 12 at UC Davis. I am scrambling to identify a speaker for May. On June 10, Dr. David Sedlak, of UC Berkeley and author of the book "Water 4.0" will give a talk at a location to be determined.

Breaking tradition, we will be planning section meetings in the summer, so please stay tuned for notices for July and August. As always, check your email, www.calacs.org and the *Vortex* for updates.

CAL ACS outreach programs for students and teachers

Most public schools experience diminishing resources. More so those schools serving an economically challenged population. I want to call attention to some of our programs that benefit primarily teachers and students, but ultimately all of us, and is consistent with the Section's Mission Statement, "... r*ecognize and assist educators and students, and host public outreach events to convey the importance of chemistry"...*

I have a dual purpose in bringing these activities to your attention, one is to encourage you to offer comments on how we can improve or add additional programs. The second is to ask for donations so that we can reach more students and teachers. This issue mentions Earth Day and Chemistry Olympiad, on page 4, Educational Grants on page 8 and Family Science Night on page 9. Read more about these programs and let me know which programs you would like to support.

Editor and Chair-elect, Lou Rigali, qpfans@qpfans.com

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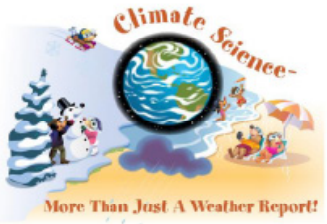
Chemists Celebrate Earth Day
2015 Illustrated Poem Contest



The California Section of the American Chemical Society (ACS) is sponsoring an illustrated poem contest for students in Kindergarten - 12th grade.

Contest Deadline: April 22

Prizes: Gift card

CalACS, 2958 Merced St, Suite #225, San Leandro, Ca 94577 office@calacs.org

Winners of the California illustrated poem contest will advance to the ACS National Illustrated Poem Contest!

Write and illustrate a poem using the CCED theme, **"Climate Science–More Than Just A Weather Report!"**. Your poem must be **no more** than 40 words, and in the following styles to be considered:

AIKU • LIMERICK • ODE • ABC POEM • FREE VERSE • END RHYME • BLANK VERSE

Possible topics related to water and chemistry include:

- Seasons and weather
- Particulate matter
- Greenhouse Gases
- Ultraviolet light
- Atmospheric changes

Entries will be judged based upon:

- Relevance to and incorporation of the theme
- Word choice and imagery
- Colorful artwork
- Various physical properties of water
- Any other relevant topics

Contest Rules:

- Poems must conform to a particular style. No poem may be longer than 40 words.
- The topic of the poem and the illustration must be related to the CCED 2015 theme, **"Climate Science–More Than Just A Weather Report!"**.
- All entries must be original works without aid from others.
- Each poem must be submitted and illustrated on an unlined sheet of paper (of any type) not larger than 11" x 14". The illustration must be created by hand using crayons, watercolors, other types of paint, colored pencils or markers. The text of the poem should be easy to read and may be printed with a computer, before the hand-drawn illustration is added, or the poem may be written on lined paper which is cut out and pasted onto the unlined paper with the illustration.
- Only one entry per student will be accepted.
- All entries must include an entry form.
- All illustrated poems and/or digital representations of the poems become the property of the American Chemical Society.
- Acceptance of prizes constitutes consent to use winners' names, likenesses and entries for editorial, advertising and publicity purposes.

Entry form and rules can be found on the Section's website. Click on the Earth Day link on the home page or go to http://calacs.org/?page_id=1807

Chemistry Olympiad

Eileen Nottoli, Chair of the High School Teachers Committee, reported that this year, 24 schools participated in the Olympiad. One school, Lowell, had all of its 124 students participate. The scores ranged from 21 to 58 out of 60. Our quota of 18 students was reached with those scoring 42 or above. The schools for which students qualified are: Irvington, Mission San Jose, Dougherty Valley, Amador Valley, Campolindo, American, Foothill, Monte Vista, Dublin, Albany, Lowell, Marin, Head Royce, College Prep, Oakland Tech, Castro Valley, and James Logan.

WCC FEBRUARY MEETING REPORT-COLOR VISION CONTROVERSIES

Linda Wraxall

The California section Women Chemists Committee meeting held at Mills College on Saturday February 7 was attended by 22 people to hear Karen De Valois speak about research on color vision. Her doctorate in physiological psychology landed her at UC Berkeley as a professor of Psychology, Vision and Optometry, and her husband's research into vision in monkeys got her interested in the history of how animals see color. How it has been accomplished has been the subject of intense scientific interest and debate for centuries.

The first startling thing she told us was that color is not a property of light or the surface of an object but is only formed in the brain. She demonstrated this by having us stare at two colored squares next to each other: one red and the other green. She then instructed us to move our eyes to two white squares. What we saw were the colors pale blue and purple, known as after-images. She explained that eyeballs are developed very early on in the fetus and it was found that the retina, where light is perceived, is formed directly from the brain. In addition, half of the cortex of the brain is devoted solely to sight. Every time we open our eyes, an extraordinary amount of brain processing occurs. The visible color spectrum ranges from 400-700 nm wavelength, and what color one person sees may not be the same hue that another person perceives. According to Wikipedia, color vision is the ability of an organism or machine to distinguish objects based on the wavelengths or frequencies of the light they reflect, emit, or transmit.

A number of mechanisms were posited beginning in the 17th century with a book by G. Palmer who thought that there were three color mechanisms. In the 1800s, an English physician, named Thomas Young, also suggested three channels because color mixing of the three primary colors, red, green and yellow, produces all the other colors known to man. In the 1850s, Hermann von Helmholtz, the most pre-eminent biologist of his time, expanded on this theory and published a two volume book called "Physiological Optics", theorizing that each primary color had one line to the brain. This was challenged by Ewald Hering, a physicist who found that there were four basic colors, red, blue, yellow, and green, and said that Edward Helmholtz was wrong but because of his reputation, Helmholtz maintained his position. Later James Clerk Maxwell found that three primaries were sufficient and by rigorous psychophysical matching, it was found that three colors, and only three colors, were enough to produce another color.

Dalton, the famous scientist, weighed in at this point. He was colorblind and asked that his eyes be dissected after his death to find the "filter" for this color deficiency. In the 1950-60s, Leo Hurrich and Dorothea Jameson showed compelling evidence that photopigments differ in spectral sensitivities. This means that the term "color blindness" is a misnomer because those people see color differently – they are not blind to color.

There have been lots of models for color vision, and they have all worked. One successful model was developed by Christine Ladd-Franklin (1847-1930), but her work was virtually ignored because she was a woman. Despite being barred from being a regular student at Johns Hopkins University for the same reason, she managed to write a landmark Ph.D. thesis which was not awarded. However she moved to New York to teach and became very famous.

Once physiologists became involved, answers began to be found. Gunnar Svaetichin recorded color vision in fish and found chromatically opponent cells. However he did not know what cells he was recording from or how they acquired their "tuning". He also worked on cat vision and found they had no color perception. Despite getting a Nobel Prize for his work, his disagreement with other scientists meant he was unable to get a job and he ended up teaching in Venezuela! Russell De Valois, Karen's husband, studied sight in Old World monkeys and was able to show that their color vision was essentially the same as in

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PROBLEMS WITH PRIONS (Part 2)

Bill Motzer

In Part 1 of this series (March 2015 *Vortex*), I reviewed the characteristics, sources, and epidemiology of prion diseases in humans and animals. The name prion was originally coined by Nobel recipient, Dr. Stanley B. Prusiner, for proteinaceous infectious particle. Prion diseases affecting both humans and animals are termed transmissible spongiform encephalopathies (TSEs). In this part, I will describe the geochemistry behind the evidence that prions could pose an emerging contaminant of concern (ECC) to surface water and groundwater resources.

ENVIRONMENTAL TRANSPORT/ FATE IN SOIL, SURFACE, AND GROUNDWATER

Soil, Minerals, and Organic Matter

TSE prions are believed to enter the environment through shedding of tissues including excretions of salavia, urine, and feces and host mortalities (carcass). Released prions strongly bind to soil, particularly those that are clay- (steatite or montmorillonite) and organic- (humic) rich (Table 1). This is because prion particles are charged, and soils and minerals such as quartz with high cation exchange capacities tend to attract prions. Although microbial and fungal decay of proteins and prions in soil does occur, tightly bound prions may remain infectious for years. TSE diseases such as scrapie and chronic wasting disease (CWD) recurrence has been documented following 1 to 16 year fallow periods of pastures and these can retain infectious CWD prions for at least 2 years after exposure. Unlike bacteria and viruses, prions do not multiply but soil concentrations may increase by continual input from infected animals, resulting in further transmission to uninfected grazing animals.

Experiments with manganese oxides (MnO_x) suggest that soils with high MnO_x minerals [e.g., the mineral birnessite $(Na0.3Ca0.1K0.1)(Mn^{4+},Mn^{3+})2O_4 \cdot 1.5 H_2O$] will abiotically degrade prion proteins. Copper may have a role in that it tends to bind to the prion particle; therefore, soils that have elevated copper tend to concentrate prions. Soil pH may also play a role; experiments show that more non-infectious fibrils tend to form at a pH of 3 whereas infectious fibril concentrations increase when pH is raised to 7.0.

Water

Experiments involving BSE and scrapie prion decay in aquatic environments suggest that prions are normally hydrophobic, although there are some indications that they become hydrophilic in urine. In water, therefore, they readily bind or sorb to suspended particulates, particularly clays. Prion particles are in the molecular size range ($\sim 10^{-10}$ to 10^{-8} m) but tend to aggregate, placing them in the nanometer range (1×10^{-9} m to 100×10^{-9} m). Because of their ability to retain differential charges, they may be transported in groundwater as colloids. A colloidal suspension's stability is determined by van der Waals forces: these attractive forces tend to promote aggregation, but electrostatic repulsive forces tend to drive particles apart. When electrostatic repulsions are dominant, the particles become stabilized and remain in a dispersed state. Colloid stabilization therefore is influenced by a particle's composition, its surface chemistry, and by other physicochemical factors controlling the surface charge. If the particles are smaller than the aquifer's porosity, colloids suspended in groundwater would tend to move by advective flow. If the particles form aggregates larger than an aquifer's porosity, then colloid transport ceases. If they are electrostatically attracted to a media (e.g., quartz sand grains) and are smaller than the aquifer's porosity, transport will also cease. Subsurface transport therefore may be by both horizontal and vertical colloidal transport, although clay aquitards could be an effective transport barrier (Figure 1). Research in groundwater transport and fate is only now beginning and further research and investigations are required. (Ed note:More to come next issue).

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Table 1: Prion Sorption Capacities for Various Substances

Soil/Mineral	Sorption capacity (µgPrP/mg)	Equilibration time (hours)	Soil/Mineral	Sorption capacity (µgPrP/mg)	Equilibration time (hours)
Soils			**Minerals**		
Whole	ND		Fine quartz sand	>110 @ pH 4, >50 @ pH 7	4
Loamy (with high OM)	30.5	2	Quartz microparticles	13.6–27.1	2
Sandy (w/high OM)	15.5	2	Mica	ND	1
Organic Matter (OM)			Kaolinite	1.7–2.6	2
OM	333 or 1,000	2		≈50	0.17
Synthetic (Catechol)	ND	1 –72	Sodium Montmorillonite	ND	10
				87–174	2
				1,000	2
				>1,200	0.17
			Calcium Montmorillonite	>400	0.17

Notes:
Analysis by brain homogenate, western blot, and ultraviolet spectroscopy.
µgPrP/mg = to parts per million prions
ND = not determined
Modified from Saunders, et al. (2006).

(Color continued from page 5)

are three types of cone cells that perceive color for long, medium, and short wavelengths. The traditional idea that cones detect color and rods only shapes is actually incorrect. Perception of color does not determine the mechanism and humans do not analyze color by wavelength.

Questions from the audience produced some interesting facts. For instance, so-called color blindness is more prevalent in men because coding for the medium and long wavelengths of light (towards the red end of the spectrum) is carried on the X chromosome which is doubled in women. Often men do not know they have this deficiency where the pigment has a slightly different spectral absorbance. True color blindness is very rare because the person has no cones and is blinded by normal light. Many painters can see other colors in flesh tones and are freer and more experimental in expressing what they see. Matisse was one who shocked the public and horrified the critics when the portrait of his wife was first exhibited with a green face.

Some animals have subcategories of cones or more cones than others. Humans have six million cones compared to cats with 30,000 cones. Bats, cats and ungulates (hoofed animals) have no color vision and nocturnal animals use ultra-violet light to detect their prey and marked territories. Insects have excellent color vision, especially in the lower (blue) ranges, but do not live long.

The study of vision is fascinating and can lead down many side alleys, and Karen De Valois showed us a few of them. During the lecture it rained, but afterwards we emerged into sunshine and the beginning of Spring with a greater appreciation of how we see.

Educational Grants

"Tell me and I forget. Teach me and I remember. Involve me and I learn." Benjamin Franklin

The California Section has helped teachers follow Ben Franklin's advice. Educational grants have purchased gas pressure sensors, ipads and spectrophotometers in K-12 Schools to involve students and bring chemistry to life in the classroom. Teachers in Chico, Redding, Brentwood, Fremont, Eureka, Forestville, Union City, Oakland, Antioch, and other cities within the Section's area have submitted proposals for laboratory or classroom equipment needs since 2002. When the economy was booming, the Section was able to budget $15,000/yr. However, in recent years the Educational Grants budget has been reduced to $3,000. This means that hundreds of K-12 students will have to rely upon their imagination about the meaning of light absorption, the role of pressure in the gas laws, the measurement of hydrogen ions using a log scale, and other concepts without doing the experiment with their own hands. If Franklin is correct they may remember but not be involved and the country needs involved students who develop enough interest to pursue science as a career.

Mr. Brian Green, who teaches at Shasta Meadows Elementary School says, "The grants …enhanced interest in science at Shasta Meadows, Grant Middle School and local high schools in presentations by the science team using chemicals, lab glassware, and scientific equipment purchased with grant funds from the Section." Fith graders join the "Shasta Meadows science team". They perform experiments such as acid-base lab using phenolphthalein, universal indicator and red cabbage juice, gak and slime chemical reaction labs, exothermic and endothermic chemical reaction labs, water bottle and sugar rockets, magnetism, electricity, and sound labs, bubble and paper airplane labs. I also do demonstrations for the students and train them to be able help me present them on our visits to local schools. The science team presents a wide range of chemical demonstrations that include acid base changes, exothermic and endothermic chemical reactions, explosive

Learning about acid, base and pH. Photo from Brian Green, Shasta Meadows Elementary School, Redding, CA.

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Educational continued from page 8)

demonstrations such as a hydrogen/helium comparison, calcium carbide cannons, and chemical luminescence demonstrations at various schools. Laser light shows are also used during these visits. For the past fourteen years, during visits to the high schools, we have presented chemsitry experiments to 2-4 combined classes during each period of the day. Thousands of students from the elementary school level through high school have observed presentations by the Shasta Meadows Science Team".

Most schools do not have the resources, that is the funds to purchase even basic equipment, but fortunately they do have dedicated teachers like Brian Green who can do a lot with just a little. The Section would like to further support these teachers by providing equipment and supply grants. With just 10 additional donations of $400 each, we will be able to reach 10,000 students. The U.S. needs more homegrown scientists and more people with an appreciation of science. The outreach programs of the Section accomplishes this by involving both the students and their families. If you or your company would like to help the Section meet its goal, a $400 donation to the Educational Grants fund will support one school for one year. Larger donations will support more. Donations to the Section are tax deductible. Please contact Dr. Bryan Balazs (balazs1@llnl.gov) or office@calacs.org.

Wally Yokoyama

Family Science Night

Dr. Stephanie Malone , Younger Chemist Committee Chair, explains plastic recycling at Family Science Night.

Once again Alex Madonik assembled his team of volunteers to celebrate National Chemistry Week at the Section's Annual Family Science Night to a group of 350 students and parents from John Muir Middle School in San Leandro.

A full report will be in the May Vortex and on the website, www.calacs.org.

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John Muir Laws
How to Think Like a Naturalist

Tuesday, April 21, 2015

7:00pm Community Hall
Doors open at 6:30pm
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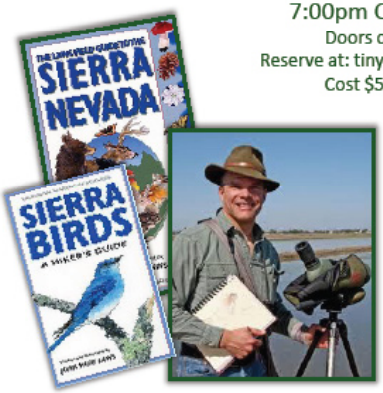
Cost $5.00 at the door



Jack will share his enthusiasm and passion for the natural world as he illustrates ways to improve one's observation of nature, and develop a curiosity and appreciation for one's role as steward of the natural world.

Naturalist, award winning educator and artist John (Jack) Muir Laws is trained as a wildlife biologist and is a Research Associate of the California Academy of Sciences in San Francisco.

Jack teaches nature exploration and field sketching, leads nature journaling workshops and Nature Journal Club meetings around the Bay Area.

Pre-ordered boxed meals available at bookmarkcafe.com/events I Call (925)283-9999 to order

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Younger Chemist Committee(YCC)

The Section is pleased to introduce Dr. Stephanie Malone as the Section's new YCC Chair. Keep current by checking in often (https://www.facebook.com/pages/Younger-Chemists-Committee-YCC-ACS-California-Section/164045583624244)

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