

# THE VORTEX

AMERICAN CHEMICAL SOCIETY  
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CALIFORNIA SECTION  
APRIL 2020



*"What Does Chemistry Contribute?"  
poster and panel presentation" See page 9 for report*

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*Chemists Celebrate Earth Week 2020*  
*“Protecting Our Planet Through Chemistry”*

*Contest rules, see page 4*

*Contest Deadline: Monday 22nd April 2020*

*Prizes: \$50 gift certificate to ACS On-line Store*

*Contact: Sushila.Kanodia@gmail.com/510-351-9922 (section office)*

*2950 Merced St #225, San Leandro, CA 94577*

*Winners of California Local Section's Illustrated Poem Contest will advance to the National Illustrated Poem Contest for a chance to be featured on the ACS website and win more prizes!*

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*Celebration Of Earth Day And John Muir's Birthday – The annual celebration scheduled for Saturday, April 18th 2020 has been canceled so that our communities can cope with the Coronavirus.*

*ACS has resources available for hands-on activities that you can do at home! Our Earth Week 2020 theme is “Protecting Our Planet Through Chemistry” . You can read/download Celebrating Chemistry (in English and Spanish) and then share your photos and stories on our Facebook page.*

**CANCELLED**

*Access additional education resources, including free Earth Week related video content:*

*<https://www.acs.org/content/acs/en/education/outreach/ccew/educational-resources.html>*

*Senior Chemist Committee Report*

We met on March 14: Present were Greti, Jim, Attila, Michael, and Lou. The main discussion was the scope or purpose of the group. Attila opened the discussion by offering the opinion that the purpose should be primarily for the benefit of the committee members as opposed to an outreach activity. Lou added that activities should be challenging and utilize the skills of the members. There was general agreement on that purpose.. The next meeting was postponed because of the COVID-19, We will use Zoom on-line or a similar platform for a meeting. Will advise.

Lou Rigali lr101898@aol.com

# THE VORTEX

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## Chair's Message

Jim Postma

Normally this time of year I'd be reporting on our return from the ACS national meeting in Philadelphia and how we are looking forward to Earth Day/Week activities and a Section Meeting on Ethics at Mills College, but this clearly is not a normal year. So I've done what many of you may be doing: looking to the internet for entertainment or instruction. I've listed a few YouTube ([www.youtube.com](http://www.youtube.com)) entries below that should be of interest to Section members. Rather than give URL information, I've listed the titles and you can use YouTube's search to find them efficiently.

The first, MythBusters Contamination, is a vivid example of the difficulty of staying uncontaminated in a setting like the one we're living through. I've always found that MythBusters episodes are entertaining but also good at modelling sound critical thinking.

The rest of the list is just a sampling of what you'll find on YouTube under a Chemistry theme. I'm not endorsing them as absolutely correct; you may find a few

chemical errors in them as well as counter-examples of good lab safety practices. But you will find a lot of chemistry that isn't part of most college courses today (but used to be) because of safety concerns or challenging content. But I hope you can enjoy until we can meet face-to-face again.

Mythbusters Contamination

25 Chemistry Experiments in 15 Minutes

6 Chemical Reactions That Changed History

5 of the World's Most Dangerous Chemicals

The Molecular Shape of You

Top 10 Chemical Reactions that will Blow Your Mind

As Close as You Can Get to Chemistry Magic!

(If you get hooked on YouTube videos, enter the search term "chemistry ted ed"; you'll find the chemistry-themed TED-x and TED-ed talks.)



*2020 CCEW Illustrated Poem Contest*  
*Protecting Our Planet through Chemistry*  
**ENTRY FORM**

Please fill out this form and attach it after the poem. All fields are required. Incomplete forms will invalidate the entry.

The deadline for the CA Local Section Contest is 22<sup>nd</sup> April. Submit to [office@calacs.org](mailto:office@calacs.org)

Student and Organization Information

Student Name:

Student Grade:

Parent/Guardian Name:

Parent/Guardian Email:

Parent/Guardian Address:

Parent/Guardian City:

State:

Zip:

School or Sponsoring Group (e.g. Boys and Girls Club or Scout Troop, 4-H, etc.):

*Teacher Name:*

*Teacher Email:*

*School Address:*

*School Address 2:*

*School City:*

*State:*

*Zip:*

*Please send any follow up for the student to the parent or school address.*

**Illustration Type (Check one)**

**Hand-drawn art**

**Digitally created art**

**If the poem was digitally created, please name the software used in the box below:**

**Judging Category by Grade (Check one)**

**K-2**

**3-5**

**6-8**

**9-12**

## Digital Dentistry (Part 3)

Bill Motzer



In Part 1 (February 2020 Vortex), I described a newer method for producing dental X-rays, allowing dentists to rapidly and precisely produce X-ray images without

film. In Part 2 (March 2020 Vortex), I reviewed relatively new methods employing CAD/CAM and 3D printing technology for crowns using materials such as yttria-stabilized zirconia (aka zirconia or YSZ). Now, chemistry merging with materials science allows dentists to employ laser surgical techniques that have been used for many decades in other fields such as general-, neuro-, eye- and veterinary-surgery. Lasers are now employed for general dentistry, orthodontics, and oral and maxillofacial surgery. Most lasers are used for soft tissue surgery because they are able to cut, ablate, vaporize, and coagulate tissue effectively preventing and/or stopping bleeding (i.e., hemostasis).

Others are used for harder tissues such as teeth and bone because they can easily cut such tissues. In soft tissue laser surgery, several different laser wavelengths and device settings (such as pulse duration and power) are used to produce different tissue effects. Typical soft tissue surgery lasers types include diode, carbon dioxide (CO<sub>2</sub>), and erbium lasers, which are efficient at both cutting and hemostasis. Diode or hot tip lasers are excellent for hemostasis but are slow in cutting; they also have bactericidal capabilities and can be used for laser-assisted tooth whitening. Erbium (Er, Z=68)-doped yttrium (Y, Z=39) aluminum garnet or YAG lasers are excellent for cutting but provide minimal hemostasis. Laser output is absorbed by water and hydroxyapatite or hydroxyapatite [Ca<sub>3</sub>(PO<sub>4</sub>)<sub>3</sub>(OH)], the main component of human bone and dental enamel, which

makes it a good laser for cutting soft tissue and bone. Er-doped YAG (Er:YAG) dental lasers are therefore very effective for trauma-less tooth decay removal and commonly require no local anesthesia to numb the tooth and nerve. Additionally, dental drill vibration is eliminated removing risk of tooth microfractures. Finally, when initial low power settings are used, the laser energy has a sedative effect on the nerve, allowing the dentist to subsequently increase power without creating pain in the tooth. Additional benefits from the ER:YAG laser are dentin and enamel surface disinfection prior to filling and bonding surface etching that increases the surface area improving bonding adhesion.

So why do we use synthetic garnets in lasers? The reason may lay in garnet's (natural or synthetic) crystal structure. Garnets, as naturally occurring minerals, commonly occur in metamorphic rocks formed under high temperatures and pressures. Therefore, they are very stable at surface pressure and temperature. They are classified as nesosilicates with the general formula X<sub>3</sub>Y<sub>2</sub>(SiO<sub>4</sub>)<sub>3</sub>. The X site is usually occupied by divalent cations (e.g., Ca, Mg, Fe, and Mn); the Y site by trivalent cations (e.g., Al, Fe, and Cr) in an octahedral/tetrahedral crystal framework with SiO<sub>4</sub> occupying the tetrahedral structure. Garnets crystallize in the cubic system, with three equal length axes, perpendicular to each other. They do not have cleavage, so when they fracture under stress they form irregular or conchoidal fragments.

Because of their rather unique crystal structure, synthetic garnets have been created allowing expansion of garnet's crystallographic structure to include other elements. Synthetic garnets have the same general formula: X<sub>3</sub>Y<sub>2</sub>(ZO<sub>4</sub>)<sub>3</sub>. Including silicon, many other elements can be placed within the Z site, including Ge, Ga, Al, V, Nd, Y, and Fe. Because of its fairly high refractive index, YAG was produced in the 1970s as a diamond simulant. However, when doped with either erbium or neodymium III (Nd, Z=60) YAG may be used as the lasing medium in solid-state lasers.

In the example of the Er:YAG solid

*continued on Page 6*

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*(continued from page 5)*

state laser whose active laser medium is erbium-doped yttrium aluminum garnet ( $\text{Er:Y}_3\text{Al}_5\text{O}_{12}$ ), Er doping is generally around one percent. Er:YAG lasers typically emit light with a wavelength of 2940 nm, which is in the infrared light range. Nd:YAG has the formula:  $\text{Y}_{2.97}\text{Nd}_{0.03}\text{Al}_5\text{O}_{12}$ .

In summary, when compared to dental drills, laser advantages are:

(1) In some cases, may cause less pain, thereby reducing local anesthetic requirements.

(2) It may reduce patient anxiety, particularly patients that are uncomfortable with dental drill usage.

(3) Can minimize bleeding and swelling during soft tissue treatments.

(4) May preserve healthier tooth tissue during carie (cavity) removal.

The disadvantages of lasers are that:

(1) They can't be used on teeth with in-place fillings.

(2) They can't be used in many commonly performed dental procedures: e.g., to fill

cavities located between teeth, around old fillings and large cavities requiring crown preparation, to remove defective crowns or silver-amalgam fillings, or prepare teeth for bridge work.

(3) Traditional drills are still required to shape fillings, adjust bites, and polish fillings.

(4) They do not entirely eliminate the need for anesthesia.

So why don't we see more lasers in dentist's offices? The answer is in cost: laser treatments tend to be more expensive because the cost of the laser is much higher than a dental drill, which is about \$600 for a standard drill. Dental lasers costs may range from several thousand dollars for soft tissue lasers to over \$100,000 for those that can be used for tooth and bone cutting. However, as technology and materials science advance and improves and with increasing demand, we may see more dental lasers in the future. And that would be great for all of us who dread going to the dentist.



## *Thoughts on the Corona Virus Crisis*

In a crisis, panic moves one quickly into action and hopefully, out of danger. Our brains, some say the reptilian part, will direct us to the most immediate self-protecting action we can take under the circumstances. Crises also nudge us out of our comfort area. This is a time when we can be most creative. As we rearrange our routine and try to return to the status quo, take the time to reflect and ask yourself, "Should I be doing something different?"

For the last four years I have been motivated to find solutions to homelessness and social justice inequality. This has led me to study the fields of communication, leadership, learning, self-organizing systems, social studies, evolution, and dialogue theories and practices. All have and continue to contribute to my intended project to find a way to address homelessness, social injustice, and community discord. The time is now to launch that project.

The problems and crises we are facing are too complex for one person or one mindset to adequately address. We have to find an alternative to the top-down decision making process. As Einstein said, "No problem can be solved from the same level of thinking that created it".

Send an email if you are interested in hearing more about the alternative processes that are available.

Lou Rigali, LR101898@aol.com



## *Chemists Volunteer at EYH Career Fair at Dublin High School, Feb. 22, 2020*

Expanding Your Horizons (EYH) is a full day event that is intended to excite the interest of young teenage girls in math and science, to foster awareness in math and science related career opportunities, and to provide young women with opportunities to meet and interact with positive role models from math and science related careers. The event features many hands-on activities and presentations by science professionals, in the form of workshops and activities at a career fair. The Women Chemists Committee of our CalACS Section regularly supports the event with financial contributions and with teams from our executive committee who, together with additional volunteers, present hands-on activities at our own CalACS booth at the event.

More than three hundred girls, grades 6 – 9, from 48 schools, attended this year's Tri Valley Expanding Your Horizons event at Dublin High School in Dublin, CA. The young students got to explore 17 workshops and 16 career fair booths. At our CalACS booth the girls were invited to smell and guess scents from plants presented in vials. The students then built molecular models with model sets of some of the volatiles found in the samples. The teenage girls learned about organic compounds, their composition, the composition of some plant odors, and also what is typical of the

molecular structures of volatile compounds.

Our CalACS booth was thronged by the 12- to 14- year old girls who were eager to learn about organic molecules and plant scents. Guiding the girls in these activities and answering their questions was only possible thanks to a dedicated team of volunteers: it consisted of four members of our CalACS executive committee and of a team of enthusiastic additional volunteers, including a group of AXE students from UC Berkeley and several volunteers from AWIS. The brief lunch time break also provided an opportunity for the volunteers to informally chat with small groups of girls and tell them about their own careers and studies. Not only did our volunteers get to interact with very eager middle to high schoolers about science, molecules, and smells; they were also able to informally connect with other women in science from AXE and AWIS.

It was rewarding to experience the interest and eagerness of the girls to try the experiments and to learn about the science behind them. And it was equally rewarding to experience the dedication and skill that our volunteers demonstrated in interacting with the young teenagers.

Margareta Séquin.



Far left Margareta Séquin, Far right Sheila Kanodia.



*Al Verstuyft, left middle*

## *Cal ACS Volunteers at the Glorietta Elementary School (Orinda, CA) Science Fair -*

Before CoVID-19 shut down our outreach events, our intrepid volunteers were back at Glorietta Elementary School on March 4th, 2020 for another delightful evening of hands-on science exploration. The Chevron Slime Team showed even the youngest chemists how to cross-link polyvinyl alcohol (combined with their favorite color, of course), and four volunteers from the Alpha Chi Sigma chemistry fraternity at UC Berkeley assisted in presenting three hands-on activities: Chemistry Makes Scents, Plastic Recycling, and the Red Cabbage Rainbow.

"Chemistry Makes Scents" compares the aromas and chemical structures of two mirror image molecules, D-carvone and L-carvone (with caraway and spearmint flavors, respectively). This activity is part of the NISEnet "Let's Do Chemistry" kit which they provided free to organizations engaged in school outreach activities. We have incorporated it into the molecular model building activity that Greti Séquin created years ago for our Section. Kids love to build models, whether they are as simple as water or acetic acid, or as complex sugar.

Plastic recycling is another old favorite

that has never been more relevant. Plastic packaging is numbered 1 - 6, and these materials can be distinguished by their density and other properties. Can they really be recycled? We exhibited sample products made from recycled plastic, but there's a long ways to go. The Earth Week 2020 edition of Celebrating Chemistry focuses on bio-based and compostable plastics, and visitors took copies so they can investigate these topics at home. You can, too:

<https://www.acs.org/content/acs/en/education/outreach/celebrating-chemistry-editions.html>

Red cabbage juice is a great pH indicator, providing a rainbow of colors from bright red in acid to brilliant blue or green with base. Milk of Magnesia gradually neutralizes added acids (vinegar or dry ice) and the results are spectacular. Kids could also blow into small samples of dilute cabbage juice, and their breath contains enough carbon dioxide to convert the blue-purple solution to pink.

With at least one hundred student exhibits and several activity stations organized by the Glorietta faculty, this science fair was not-to-be missed. Let's hope it will be back next year, along with the rest of our outreach events.

Alex Madonik - National Chemistry Week Coordinator



"Chemistry Makes Scents"  
NISEnet kit  
"Let's Do Chemistry"

Angelika and Adam  
Alpha Chi Sigma  
UC Berkeley

Glorietta Elementary  
Science Fair





## *What Does Chemistry Contribute to our Everyday Life?*

Many of us haven't given much thought to how chemistry affects our daily lives, but without chemistry we'd still be living in the Stone Age. On Sunday, March 8, 2020 over two dozen people gathered at the Lawrence Hall of Science in Berkeley to hear four distinguished speakers take up this topic.

ACS District Director Dr. Paul Jagodzinski of Northern Arizona University began the program with a description of chemistry's contributions to transportation and energy. "How did you get here today?" he asked, and noted that whether you traveled by car, horse, bike, bus, foot, or airplane, chemistry is involved. As for energy, all energy ultimately comes from the sun: wood, fossil fuels, electrochemical reactions, nuclear fuels, and renewable biomass; and all of these energy sources involve chemistry.

Dr. Hannah Powers, a pharmaceutical research chemist at Maze Therapeutics, described the role of chemistry and other sciences in medical research. "If it's green, it's biology; if it stinks, it's chemistry; if it doesn't work, it's physics," she quipped. In the current fight against COVID-19, rapid genomic sequencing, identification of surface protein and complementary receptors, and development of lab testing all involved chemistry. And of course, everyday disinfectants aren't possible without chemistry.

Dr. Wally Yokoyama, a research chemist at the Western Regional Research Center of the United States Department of Agriculture (WRCC-USDA), addressed the role of chemistry in food production. In the Stone Age, people spent most of their time looking for food; agriculture led to civilization by giving people time to invent new things. Agriculture also involved changing plant chemistry by changing the genetic makeup of plants to make them more nutritious and palatable. Today, chemistry helps scientists develop new species of food plants like

mold-resistant bananas.

Dr. Attila Pavlath, past president of ACS, described the contributions of chemistry to advances in communication technology such as radio, telephone, TV, movies, computers, xerography, and photography. For example, the ability to fit billions of transistors onto smaller and smaller areas involved chemistry, because it took decades for scientists to perfect methods of creating defect-free crystals of semiconducting materials. Chemistry was also necessary for the development of optical fibers and of gallium arsenide for high-speed integrated circuits.

After the program, the audience adjourned to a nearby room for a reception that included an exhibit of the English-language posters from "Elements in Your Life." The posters have been translated into Arabic, Chinese, English, Portuguese, Turkish, and Ukrainian, and are available for download at <https://www.elementsinyourlife.org/>.

Nicki Davis, PhD



Dr. Attila Pavlath, past president of ACS.

## *Update on Our Olympiad*

This year, 25 schools will participate in the Olympiad of which 16 schools have generally participated in the past and 9 are schools that have not participated in the past. As an acknowledgment of the extra time and effort expended by teachers, I will be sending a thank you letter to each teacher and their principal. In addition, we offered teachers that generally participate either a one year membership in AACT or the new Olympiad tee-shirt; so far two teachers selected the tee-shirt and six the membership in AACT.

We will be selecting 17 students to participate in the national exam based on performance in the local exam and subject to the limit of two per high school. The national exam will be held on April 25 at Las Positas in Livermore and, as usual, we will participate with the Silicon Valley Section. Thanks to Charlie Gluchowski who made the contact with Las Positas and to Al Verstuyft, Bryan Balazs, and Wally Yokoyama who will help proctor the exam.

This year, we have three schools from outside the Bay Area – Los Banos High in Los Banos (Merced County), Chico High in Chico, and Shasta High in Redding. Because of the distance of these schools from Livermore, should one or both students qualify to participate in the national exam, I would like to ask the Section to consider a travel voucher for hotel, meals, and gasoline. I would suggest a reimbursement for actual expenses up to a cap of \$200-250.

### **Request to National ACS regarding the Olympiad**

The Olympiad is a vehicle that can attract

high school students to a career in chemistry and I have been working with other Sections on improvements to the Olympiad. Last year, I drafted a letter jointly with the Silicon Valley Section on past issues with the lab portion. While there are still open issues, there has been some signs of improvement. This year, there have been a number of other issues that have come up including a request from one teacher for more time for a student. I am currently working with both the North New Jersey and Silicon Valley Sections. The NNJ Section has a fantastic online registration and grading system which would save a considerable amount of Julie's time if this system could be used by all Sections. We will be reaching out to Olympiad coordinators in other Sections to bring some of the issues to ACS' attention.

### **Exceptional Student Award**

We set up this award to help encourage chemistry students in areas outside the Bay Area and will award up to ten students in our Section. Teachers can nominate a student for this award which consists of a congratulatory letter and \$100. We have had one teacher in Redding submit nominations as well as one Bay Area school. We have also given one student whose house had burnt down in the Santa Rosa fires yet managed on her own initiative to participate in the Olympiad (and she qualified to participate in the national exam). This year, we will give an award to a student at Stanford online who has participated in past Olympiad and has been one of the highest performing students

*E. Nottoli*

## *CalACS 2020 Golden Gate STEM Fair Special Awards*

The Section participated in the Golden Gate STEM Fair held on March 14, in Sausalito, by judging entries for a special award. The Section award is a certificate, \$200, and a subscription to the ACS magazine CHEMMATTERS

The award is made for an excellent entry that involves some principle of the chemical sciences. The Section judges were Eileen Nottoli and Paul Vartanian. The award was sent to the three entry collaborators by mail as the Fair ceremony was cancelled due to crowd limiting requirements.

We congratulate all the Fair participants and especially the three students who received the Section's award: Jo Top, Issey Lancelot, Antoine Wellmann for Elephant's Toothpaste: The Catalyst in the Room

## *Drama at The Port of Oakland*

The Port of Oakland had a Coronavirus drama Saturday March 14 as told by John Claassen, Chairman of the Board of IMC (International Maritime Center), a not for profit agency that is an interdenominational mission dedicated to the health and safety and well being of seafarers.

The Port, City of Oakland, State of California, US Coast Guard, and Homeland Security gave permission for the cruise line to disembark its 4000 passengers who had been kept in isolation because they were exposed to a crew member with the coronavirus.

NBC, KPIX, ABC and KPOO provided national and local coverage by Steve Zeltzer from Work Week, KPOO, and Pacifica Labor Correspondent. Steve was the MC of the news conference. Jack Heyman, President of ITF. ILWU, Local 10 sponsored the news conference at the small seafarers rest building at the Port.

### **Jack from ITF, laid out the issues:**

1) There were 4,000 passengers on board with 1100 crew. US Coast Guard air dropped 45 COVID-19 test kits. There were 21 people out of 45 tested who were positive for Coronavirus. (19 crew and two passengers) That means there were nearly 50% of passengers and crew who tested positive. What was the status of the approx. 5050 passengers and crew who were not tested at all?

2) ITF has a contract with Grand Princess, registered in Bermuda with crew represented by an Italian Labor Union. Jack commented that Grand Princess and Carnival Cruise lines are owned by US billionaires but pay no State or US Federal taxes.

3) Under the ITF agreement, Grand Princess crew must be repatriated at once at owners expense.

4) Jack claimed that putting all crew together in quarantine is wrong medical practice. He cited Dr Fauci, Trump Administration chief doctor that it is wrong to quarantine all healthy and sick together is like having a "petrie dish" and all wind up getting infected. Jack had a retired public interest doctor validate what he was saying about the petrie dish.

5) It is a problem for the industry to allow ships to "fly a flag of convenience."

6) ILWU President said repatriation of crew must be top priority. He also disputed the claims of Pacific Maritime that their facilities and ships are now squeaky clean. He said this is a class struggle citing their slogan, "an injury to one is an injury to all." He said that ship owners put profit before health and safety.

7) A retired doctor and a couple of Union officials said that Governor Newsom should order Cal OSHA to investigate at once. They claimed that Cal OSHA now has only one doctor and one nurse on staff to oversee 19 million California workers.

There were also a number of Asian and Filipino workers and community organizations who spoke and are concerned about the fair treatment of the crew of the Grand Princess which is mostly Filipino.



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