

# THE VORTEX

AMERICAN CHEMICAL SOCIETY  
VOLUME LXXXII NUMBER 7

CALIFORNIA SECTION  
September 2020



Dr. Cheryl Sundari Dembe, Speaker see page 2

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## California Section ACS Women Chemists September Meeting

**Title:** A 48-year PhD Pathway: Secrets to  
Success in Attaining One's Goals

**Speaker:** Dr. Cheryl Sundari Dembe

**Date:** Saturday September 12th  
**Time:** 10:30 – 11:00 a.m. Chatting  
11:00 a.m. Talk and Discussion

### **Reservation:**

RSVP by September 8th, 2020.

All are welcome.

For more information visit our website  
[calacs.org](http://calacs.org) or email [office@calacs.org](mailto:office@calacs.org).

Here is the link for reservations starting

<https://www.brownpapertickets.com/event/464214>

*Biography:* Dr. Cheryl Sundari Dembe has a BS from The Univ. of Michigan and a MS (1970) and PhD (2018) from The Univ. of Chicago, working in superfluidity. She taught chemistry at DVC for 34 years, serving three times as Department Chair, as well as an interim Division Chair of Physical Science and Engineering. She hired architects for a Physical Science building, and spent 3 years with them designing it.

She was the first woman chemist, first woman Chemistry Department chair, and first woman Physical Science Division chair (interim) at DVC, as well as one of the first women to have children while teaching. She also worked in chemical industry.

She authored the ancillary materials for "The World of Chemistry", a 26-episode TV series hosted by Nobel laureate Roald Hoffman. Barred from normal research pathways without the doctorate, she developed 25 original chemical theories applied to life, society and the individual, interwoven at a lay level in the story line of her book, "The Choice of Happiness, Glimpses from an Extraordinary Ordinary Scientific Mystical Life" (<https://www.amazon.com/dp/0998299197>) She has been active in

music, singing with SF Opera, Oakland Symphony, a global Pineal Toning Choir, and has YouTube music videos, two on chemistry reactions. She has traveled to 45 countries, and been a rancher, and a meditation teacher. She speaks before many groups, has been interviewed on TV and radio, as well as having her story appear in major news publications, including Chemistry World, NPR, Mercury Sun, NYTimes and CBS News.

**Abstract:** Dr. Dembe explores supportive educational, role model, and historical influences, along with difficult equity issues along her 48-year pathway to the granting of her PhD. The degree was completed in 1971, but blocked from write-up and publication when her advisor died, and those close to her research area refused a woman in their group. In 2000, she discovered that two years after she would have published, very similar parallel research was published, and awarded the Nobel Prize. After contacting Douglas Osheroff, the Nobel laureate, she was encouraged and offered support by him in requesting that The University of Chicago award her the degree. At that point, the letter went unanswered. In 2018, she was inspired by the #MeToo movement to write again, this time with a successful outcome. Her Four Steps used to encourage a correction when unjustly treated, are detailed. They include the importance of dropping anger, viewing the person or institution before you as the solution not the problem, believing that they have the integrity to want to right an error, considering that there is always a win-win solution, offering multiple items that could be satisfactory resolutions, and releasing focus on a specific outcome. This leads to successful results for everyone involved.



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## Chair's Message

Jim Postma

As I contemplate writing this column each month, a lot of ideas swirl through my head. One of them was to write a column entitled, "Things That Are Better With the COVID Pandemic" and then leave the rest of the article blank. That would make for an easy writing assignment, but it would trivialize the severe consequences that most are experiencing and do a disservice to those whose lives and livelihoods have been altered to the extreme.

The California Section's activities have been significantly modified by the circumstances as well. Especially significant was the loss of the San Francisco National ACS meeting in August. And with schools closed, our outreach efforts to those audiences are curtailed, and even Project SEED, our summer research experience for disadvantaged high school students morphed into an online camp. The International Chemical Olympiad became an online event with no hands-on lab component. That is certainly not

the exciting experience that is usually is. (But just to brag a little, a student from Dougherty Valley High School in our Section was one of 5 chosen for the U.S. team. See CE&N June 29, 2020.)

But I have to say that a few things have worked well during the COVID era. Our monthly Executive Committee meetings have been well attended since travel is not the hurdle it was in the past. The discussions may be a bit constrained compared to in-person meetings, but we've had great participation.

We have had to postpone some events but due to the creativity and energy of several members, especially Atefeh Taheri and Alicia Taylor, our Section meetings, seminars, and conferences have been numerous, well attended, wide ranging, and very engaging. You can read about several of them in this *Vortex* or check out our [www.calacs.org](http://www.calacs.org) website.

We have plans for some worthwhile career-development and job-hunting offerings coming up soon. Watch the *Vortex* and website for those as well.

Jim  
[jpostma@csuchico.edu](mailto:jpostma@csuchico.edu)





## Biochemistry and Artificial Intelligence

Thursday – October 1, 2020 – 5:00 to 6:30 PM (PDT)  
Online Zoom Event

The event will include brief presentations on careers and research surrounding the use of artificial intelligence and machine learning to solve complex biochemistry questions, followed by a Q&A.

[RSVP here!](#)

Zoom link to be shared with attendees the day of the event.

### Our Distinguished Panelists:



Kate Stafford, PhD  
Atomwise



MarCTRICKIA Charles, PhD  
Candidate at  
University of Michigan



Joel Karpjak, PhD  
Glean.SenichDine



Jocelyn Surseri, PhD  
Candidate at  
University of Pittsburgh

The event is FREE and open to the community. More information at: [calacs.org](http://calacs.org) or email [calacmataylor@panetl.com](mailto:calacmataylor@panetl.com)



## Digital Dentistry: Revisited (Part 1)

Bill Motzer

In the February  
through March 2020

Vortex (Part 1 – 3 of Digital Dentistry) Vortex, I described the relatively new methods of digital dentistry that allows dentists to rapidly and precisely produce X-ray images without film. I also reviewed the relatively new methods and materials employing CAD/CAM and 3D printing technology for crowns using materials such as yttria-stabilized zirconia (aka zirconia or YSZ). And finally, in Part 3, I discussed new uses for yttrium aluminum garnet (YAG) lasers in dental surgery. Such lasers are excellent for cutting with little blood loss and pain. Although I mentioned that YAG laser output is absorbed by water and hydroxyapatite or  $\text{Ca}_5(\text{PO}_4)_3(\text{OH})$ , the main component of human bone and dental enamel, I did not elaborate on this unique biomaterial. Therefore, I was intrigued with a recent article by Ariana Rimmel in the July 6, 2020 issue of Chemical & Engineering News (v.98, n.26, p.4) that described new tooth enamel research.

(Note: The natural mineral apatite or  $\text{Ca}_5(\text{PO}_4)_3(\text{F},\text{Cl},\text{OH})$  occurs in sedimentary, metamorphic, and igneous plutonic and volcanic rocks but is also one of the few minerals produced and used by biological and micro-environmental systems.)

What is currently known about tooth enamel is that it is one of the human body's hardest substances containing the highest percentage of minerals (mostly hydroxyapatite at ~96%), with some water and less than 5% organic material (in the form of proteins, such as amelogenin, ameloblastin, enamelin, and tuftelin).

As enamel matures, the amount of these proteins declines; however, they act as a framework on which other minerals can form. Along with the proteins, enamel's structure is mostly in the form of rods and interrod crystals, measuring approximately 4 to 8  $\mu\text{m}$  in diameter. Rods are tightly

packed hydroxyapatite or crystalline calcium phosphate or  $\text{Ca}_3(\text{PO}_4)_2$ . In human enamel, its thickness varies but it is thickest at the tooth's cusp at about 2.5 mm. Although relatively strong: 5 on the Mohs hardness scale with a Young's modulus of 83 GPa, it can be brittle. (Which is why it's not good to crunch on ice or use your teeth to open a bottle.)

Rimmel's article (a summary of a 2020 Nature research paper at: DOI: 10.1038/s41586-020-2433-3) noted that the new research indicated that tooth enamel is more complex than previously known. Enamel had been determined to be composed of closely packed hydroxyapatite crystallites (rods) but there has been a lack of understanding about the crystallites' composition. Apparently crystallite cores will dissolve in acid but not the outer surfaces. Why this occurs has eluded researchers until now. Using scanning transmission electron microscopy (STEM) and an atom tomography probe (ATP), researchers determined the enamel crystallites' internal structure as showing that there are distinctive shell and core regions (see Figure 1). Such structures were never seen before in human enamel. Additionally, the ATP scans showed that core regions were further divided into two magnesium (Mg)-rich layers surrounding a carbonate-, sodium-, and fluoride-rich central zone. Another interesting point is that a subsequent computational model indicated that magnesium in the core could cause distortion of the hydroxyapatite lattice thereby adding stress. However, this stress may actually result in strengthening of crystallite because magnesium may actually cause human enamel hardening.

So, what is the significance and importance of this research? An outside structural biologist, not involved with this research, commented that an understanding of human enamel crystallites' complex structure could help in the understanding of how tooth decay develops and progresses and may also help dentists study enamel diseases. Additionally, pathologies affecting enamel formation might leave clues to

*continued on Page 7*

## *Project SEED mentors from the CA Section Stick with It*

By E. S. Yamaguchi

You may know by now that SEED 2020 became a virtual one-month program due to the pandemic. ACS National developed a program that enabled approximately 300 students from all parts of the country to:

Demonstrate competency in wet lab safety techniques. Learn and demonstrate ethical discretion in crediting contributing authors and resources, and make connections between the over-arching goals of research projects with the smaller experiments that support them.

Learn and practice professional communication techniques and improve their personal statement and resume writing abilities.

Compare professional career paths by means of exposure to academic, industrial, government and entrepreneurial via career panels and activities using ACS career resources.

The students were paid \$1000, and their supervising Cabin Leaders, many former SEED students, were paid \$1500. All Campsite Managers (I was one) were volunteers. However, I want to inform you of the super SEED mentors that we have in our own midst who contributed to the 2020 SEED program, even though in theory they had the summer off.

Dr. Michael Cheng serves on the National SEED committee, so he knew earlier than most that SEED 2020 might be different from past years of in-the-lab experiences. He alerted me to a series of online talks offered by the NSF-CREST Center for Cellular and Biomolecular Machines at UC Merced (UCM). One of those talks, Understanding Living Systems through Scientific Computing, fit our schedule. Students

learned about how the code, NetLogo, can be applied to virus spread in a population. This part-lecture, part-interactive presentation by UCM professors was the most enjoyable event for that week, according to a poll that I conducted, partly because it was so timely and fun.

Our CA Section SEED site coordinator at UCM, Professor Andy LiWang, was surprised by my frantic request for help in recruiting a speaker on the topic of financial aid for college. All SEED students need help in this arena. They would not be SEED students otherwise. He successfully recruited not one but two speakers to present at the SEED students' "Unconference", which was the big event of the virtual program. These UCM representatives made it apparent that the pandemic has affected their area of expertise, while conveying the basics of financial aid to the students. Incidentally, under Andy's leadership, the UCM SEED effort is larger than all the other UC schools combined, quite a feat for the youngest UC campus.

Finally, at the USDA lab (part of the Agricultural Research Service) in Parlier, CA, Dr. Jianchi Chen, a longtime mentor, works on Pierce's disease. What is that; you say? If you like wine, raisins, or table grapes, Pierce's disease threatens these products by manifesting as necrosis of the grape leaf, and by transmission due to the insect vector leafhopper. Dr. Chen told students about the use of polymerase chain reaction (PCR) in his detection of the microorganism, *Xylella fastidiosa*, that causes the disease. Thus, students learned about PCR, gel electrophoresis, and gel imaging. He stressed that his area of study requires that students understand chemistry, biology, and physics, so quite interdisciplinary. Our SEED supporters never take a summer off!



## Congratulations

Congratulations to Anugrah Chemparathy and Michael Han for their outstanding performance on the National Olympiad exam. Anugrah is one of four members of Team USA for the International Competition



STEM studies.

and Michael is the Second Alternate. Both graduated from Dougherty Valley High School in San Ramon and both will attend MIT in the fall where they will both pursue

### Extraordinary Effort During High School.

After taking Honors and AP Chemistry in their first and second years in high school, they both became active participants and later officers in the school's Chem Club. The Chem Club is largely student led and the students would do demonstrations and work on various chemistry problems including past Olympiad exams. Both also studied college general chemistry and organic chemistry texts on their own. Both Anugrah and Michael had older brothers who had participated in the Olympiad before them.

### Virtual Study Camp.

The top 20 students who took the National exam as well as past participants can attend a two-week Study Camp. Both Anugrah and Michael participated in the United States National Chemistry Olympiad Study Camp this summer. It has generally been held at the University

of Maryland but was held virtually this year due to the pandemic. They appreciated seeing lab set-ups and meeting other like-minded students, and they enjoyed the online games and social events.

### International Competition.

Instead of the planned international competition in Istanbul, the International Olympiad will be held virtually on Saturday, July 25. Ethan Schnell, Anugrah and Michael's chemistry teacher, will proctor Anugrah during the five-hour exam.

Eileen Nottoli

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*Motzer continued from page 5)*

their mechanisms.

So how did we obtain all of this calcium and magnesium in our endoskel-etons and where did it come from? Was there dentistry before modern dentistry? Those are questions to be answered.

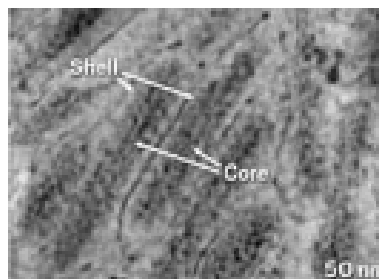


Figure 1: Human tooth enamel crystal-lites cross section from a STEM image, showing shell and core regions. The core regions are more Mg-rich. Source: July 6, 2020 C&EN, p.4.



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## Letters to the editor

On reading the article on "...Origin of SARS-CoV-2" in the June 2020 issue of the Vortex, it was difficult to tell if the article was written and submitted by Claire Robinson, or just cut and pasted from GMWatch by Claire Robinson, or posted by someone on the Vortex staff. The article itself seemed conspiratorial and used a lot of innuendo to lay doubt about the origins of COVID 19 virus with little actual facts. GMWatch website which is associated with the anti-GMO movement has not been rated well when evaluated for telling the truth vs promoting conspiracy theories. The publication of this article in the Vortex seems out of character for the usual Vortex articles which usually dwell on facts rather than conspiracy theories and innuendoes.

Mike Haire , Petaluma,  
CA Retired Sr. Staff Scientist, Chevron  
Editor's response:

Dr. Haire, thank you for taking the time and sharing your comments on the Corona virus article. Also, I apologize that you needed to remind me to respond. Each month as editor of the Vortex, I am charged with filling 10-11 pages of content of Section news and activities plus articles that have a science theme. We try and meet a deadline and have it ready for mailing or web placement by the first of the month. Often, there is not enough contributed material and I try to find some appropriate, interesting, and stimulating article that also complies with copyright laws.

It was my decision to take the report that was on the GMWatch website which met those albeit, controversial, criteria. The names of the original authors that were cited in the article were provided so that those who wanted to check further could. To be clear, I do not support the manipulation of genes for use in food products. I suspect you have a different opinion and can respect that.

I hear your criticisms and concerns. E-mail is not a good medium to have a dialogue but I am willing to participate at an appropriate space and time to share reasons behind our opinions. Rather than address the conflict or dissent from a position of right and wrong, I would like to address the process by which we come by the opinions that we have. We were both trained and believe in the scientific method process, and that facts are important. However cognitive sciences have a different perspective. The most interesting and somewhat counter-intuitive is that hearing dissent stimulates that part of the brain that leads to critical thinking. And, somewhat surprisingly, this happens even if the dissenter is wrong, Charlan Nemeth discusses this in her book, "In Defense of the Troublemaker", (2018) Basic Books, NY. Daniel Kahneman, in his book, "Thinking Fast and Slow" Farrar NY, (2011) provides insights on how our brain works.

I encourage you to submit your current and future comments or an article. The Vortex is always looking for material to publish.

Lou Rigali, editor

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Thank you for interesting and important articles and presentations. I did want to draw your attention to the source of the article on virus genetic engineering. GMWatch is an anti-genetic engineering publication that was found to have factual shortcomings on a fact checking website. The article was very interesting but possibly biased.

Best Regards,  
Robin Charlton

Editor's response

Dear Robin, thank you for taking the time to express your comments and concerns about the Corona Virus article in the June Vortex. I can address the points that you made: GMWatch is found to have factual shortcomings on a fact checking website. GMWatch does not like the process of genetic engineering; and they freely share

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those opinions along with their reasoning and data. My objection to GM is for their use in foods; there has not been enough life testing to render a verdict as safe for all GMO products. That is my opinion and do recognize that it may not be a majority opinion in many disciplines. In the particular article there were several references to studies published in peer review journals that were both pro and con on the topic. On this particular article, I did not note any factual shortcoming. There were different opinions and suppositions, with background information and data.

I did check the "The Real News Network" website and [www.mediabias.com](http://www.mediabias.com) which seemed to be just a copy of each other; the phrasing was exactly the same and is as follows: "Overall, we rate GMWatch a moderate conspiracy website and

quackery level pseudoscience source based on the consistent promotion of anti-GMO propaganda that does not align with the consensus of science."

The use of charged words like propaganda, pseudoscience, and quackery is a lazy way of offering an opinion. I have no idea what moderate conspiracy means, and see no major problem with misalignment with the consensus of Science. Neither fact-finding site used the phrase "factual shortcomings." My position on the technology is that not enough life testing on foodstuff has been done to render the verdict that GMO products are safe; the world's health can be compromised. I appreciate that you shared your thoughts and welcome any future comments.

Lou Rigali, Editor



### *Editor's note*

As you may have guessed there were additional comments and objections to the above article but not directed to the editor. Based on what I understand on the value of dissent, I continue to see the placement of the article as appropriate. Consistent with that position I welcome all expression of dissent.



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## *"Prelude to a tentative idea...."*

Around 1980 Walter and Louie Alvarez came up with an idea that the global extinction 65 million years ago (now revised to 66 Ma) was caused by the collision of an asteroid or comet with the Earth. This idea was called the Alvarez hypothesis.

The Alvarez hypothesis was motivated by their discovery, using neutron activation analysis, of the so-called "iridium anomaly", a relative spike in iridium concentration right at the K-Pg boundary in sedimentary rocks in Gubbio Italy. They reasoned that since there is negligible iridium in Earth's crust, that this iridium anomaly likely originated with an extraterrestrial bolide (asteroid or comet). The K-Pg Boundary /Ir anomaly was subsequently found to be global in extent, triggering a search for the impact site, i.e. a large crater of K-Pg boundary age. Throughout the decade of the 1980s, petrologists and geochemists studied chemistry and mineralogy of the layer, trying to figure out if the impact occurred on continental plate or oceanic plate.

Based on this 1980s geochemical re-

search, the consensus as of 1990 was that the impact occurred on oceanic plate. In 1991, Alan Hildebrand and William Boynton suggested that a previously discovered crater on the Yucatan Peninsula, Chicxulub Crater, was the K-Pg boundary impact site, a viewpoint that remains the consensus viewpoint of the scientific community today. Chicxulub crater is the right age, explains the shocked quartz at the boundary, and isotopically consistent zircons are found in distal K-Pg boundary ejecta. A big problem is that Chicxulub Crater is on continental crust and too small to have excavated to mantle depths, in contradiction to the 1980s geochemical studies which pointed to excavation and ejection of oceanic crust and upper mantle rocks.

*Peter Olds*

*Olds, P. Hypervelocity Impacts and Exposed Lithospheric Mantle: A Way to Recognize Large Terrestrial Impact Basins?. J. Earth Sci. 30, 451–459 (2019). <https://doi.org/10.1007/s12583-019-1225-x>*

### *Some vocabulary and background.*

KT boundary - a (usually thin) sedimentary layer deposited 66 million years ago corresponding to the boundary between the Cretaceous (symbol K) sedimentary rocks and Tertiary (symbol T) sedimentary rocks.

Cretaceous Period 145.5 – 66 million years.

Tertiary Period 66 – 2.6 million years.

Now called the K-Pg boundary

Paleogene Period 66 – 23 million years

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