THE VORTEX

AMERICAN CHEMICAL SOCIETY CALIFORNIA SECTION
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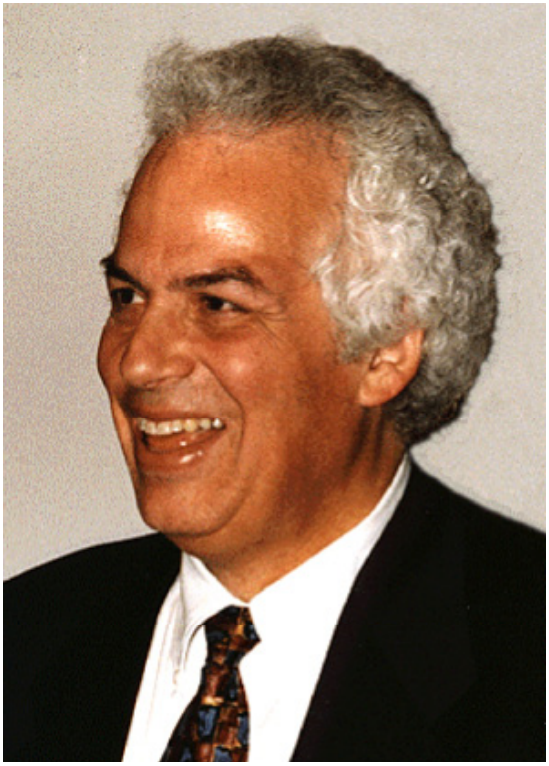


Dr. Stanley B. Prusiner, 1997 Nobel Laureate

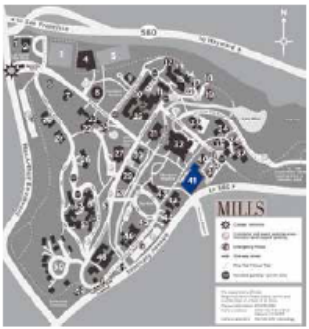
Women CHEMISTS Committee

California Section
Women Chemists Committee Meeting

Saturday, February 7th, 2015

Room 213
Moore Natural Sciences Building,
Mills College, Oakland

Note: The ONLY entrance to Mills College is via MacArthur Blvd.



Title
Seeing the World in Color

Speaker
Karen K. De Valois

About the Speaker
Karen K. De Valois received the A.B. from Mercer University in Macon, GA in 1955, with majors in psychology and German. She received the Ph.D. in physiological psychology from Indiana University in 1973. Her entire academic career was at the University of California, Berkeley, where she was Professor of Psychology, Vision Science, and Optometry. She retired in 2008 and is now Professor Emerita. She was a Woodrow Wilson Fellow in 1956-58. She is an elected Fellow of the Society of Experimental Psychologists and of the Association for Psychological Science.

Abstract
Color vision is not necessary for survival, but its importance is suggested by the fact that it has evolved independently multiple times. Species ranging from insects to fish to primates (and many others) have very good color vision, yet many of the most familiar species have little or none. It is naturally expensive and in many ways inferior to vision based solely on intensity differences. How color vision is accomplished has been a question of great scientific interest and debate for centuries. I will briefly describe the two major historical theories of color vision and their resolution by modern techniques. I will review our current understanding of the basic mechanisms of human color vision, by which we start with only three cone photoreceptor types yet perceive and discriminate among millions of hues. I will also describe some of the oddities associated with color vision.

Time
11:00 am — Meet the speaker and network with other participants
12:00 pm — Lunch
1:00 pm — Presentation "Seeing the World in Color"

Cost
$15.00 Lunch (Students and Unemployed Chemists $8.00) Presentation is free

Reservation
Reservations required. Please register (including lunch or for talk only) by email to office@calacs.org, or by phone 510.351.9922. If mailing a check in advance, please make payable to "California Section ACS" and send to Cal Section Office, 2950 Merced Street #225, San Leandro, CA 94577, postmarked no later than January 24th, 2015

Driving Directions
- **From SF/Oakland/Berkeley:** Take I-580 east toward Hayward/Stockton. Take the second MacArthur Blvd. exit (after High St.). Bear right onto MacArthur Blvd. The Mills gate is immediately ahead on your left.
- **From Hayward and points east:** Take I-580 west to the MacArthur/High St. exit just after the junction with Highway 13. Turn left at the stop sign and proceed under the freeway overpass. Turn left at the light onto MacArthur Blvd. The Mills gate is immediately ahead on your left.
- **From Concord/Walnut Creek:** Take I-680 south to Highway 24 west. Come through the tunnel. Take Highway 13 south toward Hayward. Take the San Francisco exit onto I-580 west. Stay in the exit lane and immediately take the MacArthur/High St. exit.

California Section, ACS Women Chemists Committee (WCC)

PLEASE NOTE: The room number has been CHANGED to room 105.
For reservations, please contact the California Section, ACS office by email at office@calacs.org or by phone (510) 351-9922.
For more detailed information, visit www.calacs.org

THE VORTEX

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Chair's Message

I hope that everyone enjoyed the holiday season and the beginning of the New Year! As we move into the 2nd month of the year, the California section leadership has great plans for 2015 in terms of activities and new initiatives which will hopefully be beneficial to our members and our communities.

During our January ExComm meeting some of the general plans which are starting to come together include: development of a long range plan for the section, and increasing our outreach marketing to corporate sponsors. Regarding long range planning, this is not a new topic: I am picking up the baton from past Chair Mark Frishberg to start a more formal process to develop the plans. The section recognizes that, to continue to be successful, we need to develop a longer view in a number of areas including leadership succession planning, financial growth to better support our activities and outreach programs as well as attracting active younger members. Note that the California section is nationally recognized as an exceptionally strong section in terms of activities, outreach and member participation! However we do need to look toward the future and further build on the legacy that has been established. Over the coming months, I look forward to working with members of our executive committee to develop a robust long range plan for our future development.

Regarding increasing our outreach marketing, this effort is being spearheaded by Chair-Elect Lou Rigali and Wally Yokoyama. You may have seen the ad in the Jan 2015 Vortex seeking donations for outreach. This is part of a systematic effort to seek additional funding through donations and sponsorships to help support our member and outreach activities. Historically, the section has been successful in getting ACS grants to help defray costs associated with our membership and outreach activities. In addition, we have been very successful in receiving significant funding to help support our exceptional Project SEED activities led by Elaine Yamaguchi. However, we would like to expand our fundraising efforts in order to do even more for our members and the communities in which we reside. As such, this new initiative is being put in place.

Regarding activities that are being planned in the next few months, we continue to put together events and programs which (hopefully) are interesting to our members.

Events in addition to our regular monthly section meetings on Feb 23 at UCSF

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February Section Meeting

Topic: Advances in Prion Biology and the Quest for Therapeutics
Speaker: Stanley B. Prusiner, UCSF, Institute for Neurodegenerative Diseases, SF
Date: Monday Feb. 23, 2015. 5:30 – 6:45 PM Social Hour, 7:00-8:15PM Presentation.
Place: UCSF Mission Bay Campus, Helen Diller Cancer Research Building, 1450 3rd St., San Francisco, Room HD-160, Street parking is available in addition to a garage at 1630 3rd St. Public Transportation: Take BART to Muni KT line toward AT&T Park, get off at UCSF/Mission Bay stop, the building is about a 500 foot walk.
Cost: $10 (Free to Members over 50) Reservations, office@calacs.org (510-351-9922).

Biography:

Stanley B. Prusiner is Director of the Institute for Neurodegenerative Diseases and Professor of Neurology and Biochemistry at the University of California San Francisco (UCSF). He received his B.A. in Chemistry in 1964 and his M.D. in 1968 from the University of Pennsylvania. After completing his military service as a lieutenant commander in the U.S. Public Health Service at the National Institutes of Health and his neurology residency training at UCSF, he joined the UCSF faculty in 1974 and set up a laboratory to study brain diseases.

Prusiner discovered an unprecedented class of pathogens that he named prions. Prions are proteins that acquire an alternative shape that becomes self-propagating. As prions accumulate, they cause neurodegenerative diseases in animals and humans. Prusiner's discovery led him to develop a novel disease paradigm: prions cause disorders such as Creutzfeldt-Jakob disease (CJD) in humans that manifest as (1) sporadic, (2) inherited and (3) infectious illnesses. When proposed, many scientists considered Prusiner's concept of "infectious proteins" as well as his proposal that a single protein could possess multiple biologically active shapes or conformations to be heretical. Based on his seminal discovery that prions can assemble into amyloid fibrils, Prusiner proposed that the more common neurodegenerative diseases including Alzheimer's and Parkinson's diseases may be caused by prions. Remarkably, a wealth of evidence continues to accumulate arguing that prions cause not only these common degenerative diseases, but also ALS, the frontotemporal dementias (FTDs), chronic traumatic encephalopathy (CTE) and multiple system atrophy (MSA). Much of Prusiner's current research focuses on developing therapeutics that reduce the levels of the specific prions responsible for Alzheimer's, Parkinson's, MSA, the FTDs, CTE and CJD.

Prusiner's contributions to scientific research have been internationally recognized: He is a member of the National Academy of Sciences, the Institute of Medicine, the American Academy of Arts and Sciences and the American Philosophical Society, and a foreign member of the Royal Society, London. He is the recipient of numerous prizes, including the Potamkin Prize for Alzheimer's Disease Research from the American Academy of Neurology (1991); the Richard Lounsbery Award for Extraordinary Scientific Research in Biology and Medicine from the National Academy of Sciences (1993); the Gairdner Foundation International Award (1993); the Albert Lasker Award for Basic Medical Research (1994); the Wolf Prize in Medicine from the State of Israel (1996); the Nobel Prize in Physiology or Medicine (1997); and the United States Presidential National Medal of Science (2009).

Prusiner is the author of over 500 scientific research and 300 review articles, and editor of 11 books on diseases caused by prions. Prusiner's recently published single author book *Madness and Memory,* which chronicles his discovery of prions, has received wide acclaim. He holds 50 issued or allowed United States patents, all of which are assigned to the University of California. He has delivered over 150

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(Prusiner continued from page 4)

honorary and over 725 invited lectures. Currently, Prusiner is the President-elect of the American Neurological Association.

Abstract:

Mounting evidence argues that prions feature in the pathogenesis of many, if not all, neurodegenerative diseases. Such disorders include Alzheimer's, Parkinson's, Lou Gehrig's and Creutzfeldt-Jakob diseases as well as the fronto-temporal dementias. In each of these illnesses, aberrant forms of a particular protein accumulate as pathological deposits referred to as amyloid plaques, neurofibrillary tangles, Lewy bodies, as well as glial cytoplasmic and/or nuclear inclusions. The heritable forms of the neurodegenerative diseases are often caused by mutations in the genes encoding the mutant, prion proteins that accumulate in the CNS of patients with these fatal disorders. The late onset of the inherited neurodegenerative diseases seems likely to be explained by the protein quality control systems being less efficient in older neurons and thus, more permissive for prion accumulation. To date, there is not a single drug that halts or even slows one neurodegenerative disease.

References:

Prusiner, S. B. (2013). Biology and genetics of prions causing neurodegeneration. Annu. Rev. Genet. 47, 601–623.

Jucker, M., and Walker, L. C. (2013). Self-propagation of pathogenic protein aggregates in neurodegenerative diseases. Nature 501, 45–51.

January Meeting Report

Alex Madonik

California Section Chair Charlie Gluchowski welcomed 20 guests at the Ocean Garden Restaurant in Dublin, CA on Wednesday evening, 21 January 2015 for a talk by David Taus, Northern California Program Director for EnCorps. Since joining EnCorps last fall, David has taken the lead in guiding Bay Area scientists and engineers who want to explore the possibility of teaching STEM subjects (science, technology, engineering, and math) in public schools. He is an experienced biology teacher who has developed advanced placement (AP) curricula in psychology.

David opened his presentation with some data slides, challenging the audience to guess what they represented. We soon learned that they showed the low rank of U.S. school achievement relative to many industrialized nations, as measured by the Program for International Student Assessment (PISA) or by the California Standardized Tests (CST); the latter show that less than half of California students reach proficiency in reading or basic algebra. In addition, there are significant achievement gaps across racial and socio-

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Toxic Terra (Part 2)

Bill Motzer

In Part 1 of this series (see September 2014 Vortex), I discussed a simple classification of naturally occurring hazardous substances (NOHS). In this and future articles, I'll pursue some of the chemistry and geochemistry associated with NOHS that are toxic to humans (also known as toxicological geochemistry of earth materials). NOHS includes elements such as arsenic, chromium, lead, and mercury. For these elements, speciation plays an important role in their degree of toxicity.

Arsenic (As, Z= 33), with only one stable isotope (^{75}As), is 55th in Earth's crustal abundance among the 88 to 94 (or more) naturally occurring crustal elements. (This depends on which definition is used for a "naturally-occurring element.") Arsenic is classified as a metalloid element; its chemistry is predominately nonmetallic, and it is not certain if it actually forms cations in solution. It is not found in high concentrations in crustal rocks, having an average abundance of 1.5 mg/kg (ppm). Igneous rocks (e.g., basalt, andesite, and granite) have average concentrations of 2.3, 2.7, and 1.3 mg/kg, respectively. However, arsenic commonly concentrates in sulfide-bearing minerals, such as pyrite (FeS_2) and arsenopyrite (FeAsS) – both often associated with hydrothermal (hot spring) activity and gold mineralization. Pyrite is also common in sedimentary rocks (mudstones, marine shale, and their metamorphic equivalents such as slate/phyllite); average arsenic concentrations for these rocks are: 3, 15, and 18 mg/kg, respectively. Some of the highest arsenic concentrations occur in coal, ranging from 0.3 to 35,000 mg/kg. Arsenic is also concentrated in sedimentary environments by sorption to hydrous iron oxides (iron hydroxide).

Arsenic can naturally accumulate in soils, possibly contaminating surface water and groundwater, and it can subsequently be taken up by plants and animals affecting the food chain. Such arsenic may be derived from the parent rocks underlying the soil horizons and typically this is reflected in the lowermost C horizon (see Figure 1). The global average concentration of arsenic in uncontaminated soil is 5 to 6 mg/kg; however, variations of an order of magnitude or more, may occur depending on the soil type and horizon (e.g., soil B horizons tend to concentrate arsenic because of higher iron hydroxide concentrations).

A Typical average baseline (uncontaminated) arsenic concentrations for terrestrial rainwater is 0.02 µg/L (ppb); in baseline river water it averages 0.83 µg/L with ranges from 0.13 to 2.1 µg/L; and British Columbia lake water average 0.28 µg/L. Much greater arsenic concentrations are found locally in waters, soils, and sediments where arsenic is associated with mineralization (ore deposits) or within active geothermal systems, which can enhance background concentrations by one or more orders of magnitude. Arsenic can be easily solubilized in groundwater from surrounding aquifer materials; speciation and concentrations depend on pH, Eh (redox), temperature, and solution composition. Generally, baseline groundwater will have concentrations ranging from <0.5 to 10 µg/L. However, geothermal waters may contain significantly higher arsenic concentrations and it is not uncommon for these waters to be above the drinking water maximum contaminant level (MCL) of 10 µg/L.

Speciation, Relative Toxicity, and Bioavailability: In weathering environments arsenic and arsenic-bearing minerals (e.g., pyrite and arsenopyrite) oxidize with the arsenic readily forming soluble oxyanions such as $HAsO_4^{2-}$. Therefore, arsenic toxicity depends on speciation; four oxidation states are known: As(–III), As(0), As(III), and As(V). As(0) forms as native elemental arsenic, rarely occurring in nature; it is not considered poisonous (toxic). Most natural speciated arsenic occurs as As(III) and As(V) under reducing and acidic conditions (Figure 2). As(III) predominates and is more mobile, while under oxidizing and alkaline conditions As(V) predominates and is less mobile. As(V) is less toxic than

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As (III), which in the form of arsenite (e.g., AsO_3^-) is considered to be 25 to 60 times more toxic than arsenate (AsO_4^-). However, both As(III) and As(V) are relevant in human toxicity because As(V) reduces to As(III) and is then methylated [e.g., $(CH_3)_3As$] in the human digestive system. However, organic arsenic compounds are believed to be much less toxic and even nontoxic than inorganic arsenic.

Arsenic's relative acute (poisonous or arsenicosis effect) and chronic (both long-term arsenicosis and cancer effect) toxicities in animals and humans are well known. The major exposure pathway is via absorption either by ingestion and inhalation. In most animal studies, the lethal oral dose (LD_{50}) ranges from 1.0 to 25 mg/kg body weight (depending on the animal) as sodium arsenite. Numerous human epidemiological studies show that long-term acute exposure results in both chronic non-cancer effects and cancer end-points with affected organs including the nervous system, liver, vascular system, skin, and lungs. In humans, arsenic is most commonly ingested from naturally-occurring arsenic-contaminated groundwater. Food sources such as seafood (e.g., shrimp and fish) average 1.0 and 4 µg/kg, respectively; meat (pork and chicken) average 1.0 µg/kg. Edible plants such as fruits and vegetables also do not contribute significant amounts of dietary arsenic (e.g., apple juice averages 5 µg/L). However, rice has been found to concentrate significant amounts of arsenic, averaging 100 µg/kg.

In a subsequent article I'll discuss some of the world sources where arsenic contaminated groundwater poses significant problems and health effects.

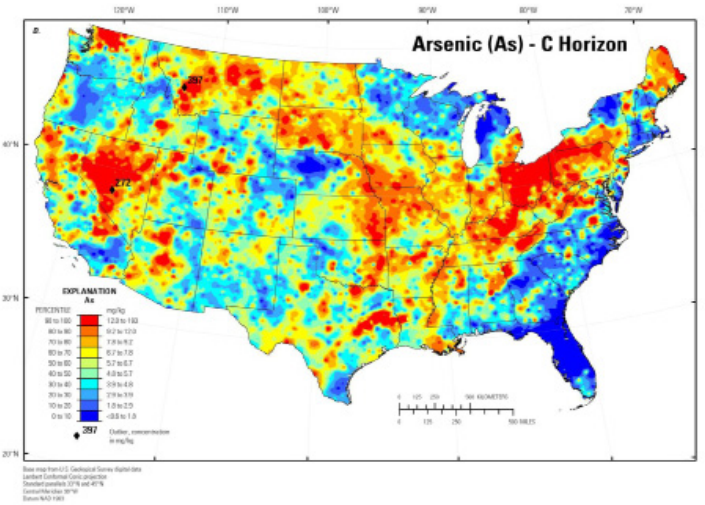

Figure 1: Arsenic concentrations in C horizon soil. Note the high concentration (in red) at 12 to 193 mg/kg in Nevada (Basin and Range geomorphic province) possibly due to hydrothermal sources. Reference: U.S. Geological Survey OF 2014-1082.

The American Association of Chemistry Teachers (AACT)

After about four years of feedback from the chemical education community, a national organization dedicated solely to supporting K–12 teachers of chemistry came alive in September 2013 at the ACS national meeting in Indianapolis,

Over the past year, an advisory board comprising secondary chemistry teachers, professors, industry experts, and ACS leaders has worked together with ACS staff and resources to shape the programming and direction of what is know as AACT.

AACT is founded on the principal that we are creating a community by and for teachers of chemistry. The AACT website is a professional home through which the K–12 chemistry teaching community has access to customized resources and support—from staff and most importantly, from colleagues and peers.

As the landscape of chemical education changes and new challenges arise, AACT will help teachers navigate their path to success by offering new curriculum to implement in the classroom, vetting chemistry teaching resources, and providing professional development opportunities that address current topics.

AACT membership is open to educators and anyone with an interest in K–12 chemistry education. Benefits include an annual subscription to ChemMatters and Chemistry Solutions; classroom resources such as lesson plans and multimedia; professional development opportunities; and platforms to connect with other educators.

We're looking for trailblazers to help shape the future of AACT. Are you interested in taking on a leadership position, or have questions about leader opportunities? Please visit the website. http://www.teachchemistry.org

Chair, continued from page 3)

Mission Bay (Dr. Stanley Prusiner) and March 10 at Pyramid Ale House in Berkeley (Dr. Dan Erlanson) they include: Feb 7 at Mills College, a Women Chemists Committee (WCC) sponsored seminar on color vision, Family Science Night at John Muir Middle School on March 12 and an interview Skills Workshop with SCVACS & AIChE at Stanford on April 11. Sometimes events get scheduled without a lot of lead time; so I suggest that you check your email regularly for notes from office@calacs.org.

If you are interested in volunteering to help out at these events or want to attend, please check www.calacs.org for details.

Finally, I am always interested in suggestions on how to improve our section. Please contact me by phone at 925-640-0550 or by email at charles.gluchowski@gmail.com.

Technical Meetings and Expositions

Spring 2015 National Meeting & Expo March 22-26, 2015 Denver, CO Early registration Extended to February 13

Pacifichem 2015 Chemical Networking - Building Bridges Across the Pacific Dec. 15-20, 2015 Honolulu, HI, USA. For Abstract submission or other information please visit http://www.pacifichem.org

Regional Meetings
2015

Central/Great Lakes May 27-30 Grand Rapids, MI
Northwest June 21-25 Pocatello, ID
Southeast/Southwest Nov. 4-7 Memphis, TN
Northeast June 10-13 Ithaca, NY
Midwest Oct. 21-24 St. Joseph, MO
Western Nov. 6-8 San Marcos, CA

For more information on these meetings, please visit http://www.acs.org/content/acs/en/meetings.html

Call for Nominations from the California Section for new P3 Award

Marinda Li Wu

Happy 2015 to all! During the busy holiday season, you may not have noticed my most recent ACS Comment in the Dec. 8 issue of C&EN on "Partners for Progress and Prosperity." It contains some highlights from my last three years in the ACS presidential succession. I mention a new P3 Award for ACS local sections as well as three ACS Symposium books based on presidential symposia in 2013 and 2014. Please visit www.pubs.acs.org and look under ACS Symposium Series eBooks to see on-line details on my ACS books published: "Vision 2025: How to Succeed in the Global Chemistry Enterprise" and "Careers, Entrepreneurship, and Diversity: Challenges and Opportunities in the Global Chemistry Enterprise." Remember that as an ACS member, you can get most of these ACS books at no cost since a member benefit from ACS Publications is 25 free downloads of journal articles or ACS eBook chapters per year!

I am working with our local section Awards Chair, Dr. Wally Yokoyama, to solicit nominations for the new P3 (Partners for Progress and Prosperity) Award. We would like to be able to present the first P3 Salute to Excellence at our May Awards luncheon program if possible, along with our usual local section program of honoring our 50 and 60 year members and the Petersen Award winner. Our 2015 California Section Chair, Charlie Gluchowski, has invited me to give a presentation covering highlights from my last three years in the ACS presidential succession for our May Awards program.

A description of the new P3 Award can be found at www.acs.org/awards under Regional Awards. All local section P3 Award winners will be automatically nominated for the P3 Regional Award offered by different regions. When I made a brief announcement about this at our Jan. 6 CalACS Executive Committee meeting, several ideas for nominations were made.

As I visited local sections across the country, I saw examples of great partnerships and collaborations. I know our California Section also has wonderful examples of partnerships, some of which have been long standing successful collaborations. It is now time to recognize and honor some of these great partnerships with a new P3 Award!

Please submit at least two letters of support to nominate a successful partnership in any of the categories specified in the description of P3 Awards on the ACS website. The nomination and support letters should be sent to wally.yokoyama@ars.usda.gov and marindawu@gmail.com by April 1. If you have any questions, please email marindawu@gmail.com. Thanks!

Jan. Meeting Continued from page 5

economic lines. As David sees it, the jobs of the future will demand more skills, especially in the STEM fields, as we try to cope with environmental issues and resource shortages. There are not enough qualified STEM teachers, and the shortage will get worse unless many more can be trained.

EnCorps was created to assist STEM professionals who want to share their knowledge at the middle school or high school level. They have the depth of knowledge, they understand how it's relevant to the real world, and they bring a passionate commitment to their fields. They can serve as role models to students, while providing access to opportunities and resources that are unavailable to most STEM teachers. EnCorps presents these professionals with three alternative pathways: Single Subject Credential (traditional "core" subject teaching)

Career and Technical Education Credential (CTE, high school programs focused on career readiness)

STEM tutoring (part time, less formal training)

Interested STEM professionals submit applications to EnCorps on-line, and then participate in face-to-face interviews that include brief presentations of a lesson plan. Once accepted into the program, they are placed in volunteer tutoring positions and invited to training workshops. Candidates who choose the traditional credentialing path apply to a credentialing program during their first year, while those on the CTE path can enroll in their initial courses during the second half of the year. A provisional CTE credential is granted on the basis of professional experience, and these candidates can start classroom teaching immediately, although EnCorps recommends starting in the fall semester. CTE candidates have up to three years to complete the requirements for a "clear" credential.

David introduced me (Alex Madonik) as a CTE candidate in the EnCorps program. I have just started a CTE Foundations course at the University of California Extension in Berkeley; the focus is on lesson plans that align with California State Model Curriculum Standards for specific industrial sectors, while learning to engage industrial partners who may serve as formal advisors to a school's CTE program and as mentors for student interns.

An important point is that people who would potentially apply to participate in the EnCorps program do not need to know whether they are ready for a full time or even part time teaching gig. They simply need to have an in interest in STEM education, and in participating in some way. Once people are accepted and get going, they can make their own choice as to whether they want to continue to volunteer (the STEM Tutor track), or they want to pursue a credential.

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