

THE VORTEX

AMERICAN CHEMICAL SOCIETY
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CALIFORNIA SECTION
SEPTEMBER 2017



What happens when low-cost biosensors embedded in tattoos can detect blood alcohol, sugar, or biomarkers related to diseases like malaria or zika? How will that impact not just the health and wellness of individuals, but the healthcare ecosystem? Attend the September Calacs Meeting, see page 4.

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California Section, ACS September Section Meeting

Tuesday, September 26, 2017 Register early, space is limited!

Topic: Programmable (bio/nano) Matter

Speaker: Carlos Olguin, MS

Location: Chabot College, 25555 Hesperian Blvd, Hayward, CA – Room 355, Building 300, Upstairs. A FREE parking pass for the event will be provided to those who register.

Time: Social-6 pm – 6:50 pm; Talk 7: 00 pm to 8:15 pm

Cost: \$10 Members, (FREE for students) Includes Appetizers and Non-alcoholic beverages during Social Hour

Reservations: Contact the CalACS office by email office@calacs.org or 510-351-9922 by Weds., September 20, 2017. You may prepay by mailing your check to Cal. Section ACS at 2950 Merced St. #225, San Leandro CA 94577 or with PayPal using our email address office@calacs.org. Pay at the door with cash or check (credit/debit not accepted at the door)

Abstract: Materials which are able to change their physical properties (shape, optical properties, etc.) in a programmable fashion, based upon user input or autonomous sensing are considered to be programmable matter. Such matter may be derived from chemical (synthetic polymers, etc.), biological (DNA, other oligomeric species, etc.) and physical materials and may have significant industrial, architectural, health and other applications. The talk will center on various materials, concepts, prototypes; and supporting design, simulation, and optimization software that were developed jointly by the author and his collaborators.

Biography: Carlos is the co-founder and CEO of LogicInk Corporation, (www.logicink.com), a San Francisco based company that makes electronics-free wearables. Powered by chemistry and biology, these are non-invasive, temporary tattoo-like devices that transform in color or shape to signal conditions of interest in our body or in the environment. Prior to founding LogicInk, Carlos worked at Autodesk where he founded the Bio/Nano/Programmable matter group that brought together an incredible group of scientists, designers and outside collaborators to develop tools for the nascent field of programmable matter. Carlos has a MS in Information Networking from Carnegie Mellon University.

California Section Nominations & Election 2017

The 2017 election will be conducted by email. An email will be sent to all members with an e-mail address; a postcard will be sent to those whose email got returned. A postcard will be sent to those members without e-mail address. This process can save approximately \$1000 in postcard mailing cost to all members California Section Election – 2017

The California Section, ACS, will hold an election this fall for the following positions: Chair-elect, Treasurer, Director, three Councilors, three Alternate Councilors, and two Members-at-Large. All these positions are members of the Section's Executive Committee, and the first three positions are members of the Section's Board of Directors. If you have an inter-

est in being a candidate for one of these positions or would like more information, please contact Michael Cheng, Secretary, [(510) 242-2588, mtch@chevron.com], Paul Vartanian [(510) 763-0195, pfvartanian@gmail.com], a member of the Nominations and Election Committee, or Lou Rigali [(510) 268-9933, qpfans@qpfans.com], the chair of the committee, by September 15, 2017. While the first five elected positions may be filled only by full members of the ACS, the positions of Member-at-large are open to both members and student members of the Society.

Also on the ballot will be a revision of the Section Bylaws on postal ballot mailings of previous years.



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Chair's Message

If your life is connected to the academic calendar, through either your job or your children, you probably can relate to my sense that September feels more like New Years than the one held in January. That certainly fits the California Section.



As I write this, our councilors are all in Washington, DC at the ACS National meeting. They will return to a calendar full of activities; five in September and October.

Our Section meetings kick off on Tuesday, September 26 at Chabot College (a new venue for us.) The speaker is the co-founder and CEO of LogicInk Corporation (<http://www.logic.ink/>), Carlos Olguin. His topic is very cutting-edge: Programmable Bio/Nano-Matter.

The following Saturday (September 30) the Sacramento Section is hosting the third annual event in their series, The Flavors of Chemistry (<http://www.acs-sacramento.org/save-the-date-flavors-of-chemistry-2017>), This year will feature Coffee, Olives, and

Chocolate. Past events have included the chemistry of wine and cheese; they were well done and very informative. The event is held at the UC Davis Recreation Center, a large venue, but even then, it's been selling out.

Turning to October, our Women's Chemist Committee is hosting another career-oriented event. It will be held at CSU East Bay, on Saturday October 14. The speaker, Dr Miki Susanto Park from the University of the Pacific will be speaking of her personal experiences with the title: From Indonesian Student to Industrial Scientist to UOP Pharmacy School Professor.

Two more events are planned for October: our October Section Meeting on the 18th features Stanford University's Prof. Richard Zare, His topic: Reactions in Microdroplets, a New Chemistry. If you need to have your enthusiasm raised as well as your knowledge, this talk is for you. This event will also be held at CSU East Bay. And Prof. Richmond Sarpong from UC Berkeley will present a talk for us on Oct. 26.

More information on each of these events is available on our website, www.calacs.org. I hope you can take advantage of a couple of these (or more).



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Chemistry and Artistry of Tempering Chocolate

September 26, 2017 7:00 PM
Community Hall

Everything from the quality of the cacao beans and their harvesting to the processing and blending can impact the final results when baking with chocolate.

Understanding the tempering process to produce the right **snap, shine, and texture** of chocolate confections is a must!



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Future Meetings

October 14, Saturday, –WCC: Dr Miki Susanto Park, University of the Pacific, From Indonesian Student to Industrial Scientist to UOP Pharmacy School Professor, CSU East Bay

Oct. 18, 2017, evening time TBA, Reactions in Microdroplets, a New Chemistry, Prof. Richard Zare, Stanford University, held at TBD

ACS Sacramento Local Section is pleased to announce that the 3rd Annual Flavors of Chemistry will be occurring on Saturday, September 30th at the UC Davis Activities and Recreation Center, the same location as last year) from 1-5pm.

September 2017: Flavors of Chemistry: Coffee, Olive Oil, and Chocolate

Date: Saturday, September 30, 2017, 1 – 5 PM

Location: UC Davis Activities and Recreation Center Ballroom, Davis, CA

Speakers/Tastings:

Bill Ristenpart, Professor of Chemical Engineering, Director of the UC Davis Coffee Center, and instructor for the Design of Coffee course at UC Davis will speak about The Chemistry of Coffee.

Chocolate Fish Coffee Roasters will be hosting a coffee tasting before Prof. Ristenpart's presentation. The coffee tasting will feature Chocolate Fish's well-known nitro brew tasted with a cold brewed coffee- both using coffee beans of the same origin to emphasize the taste difference acquired through the nitro brew process.

Selina Wang, Assistant Adjunct Professor of Food Science and Technology and Research Director of the UC Davis Olive Center will speak about The Chemistry of Olives. Dr. Wang will integrate the tasting of the olive oil into her presentation.

Howard and Sally Peters, known as Mr. and Mrs. Chocolate and winners of the 2016 ACS Helen M. Free Award for Outstanding Public Outreach, will speak about The Chemistry of Chocolate. Dr. and Mrs. Peters will have a chocolate tasting as part of their presentation followed by a drawing for a ten-pound chocolate bar!

Event: Flavors of Chemistry: Coffee, Olive Oil, and Chocolate

Date: Saturday, September 30, 2017

Cost: General Public: \$30, ACS Member: \$30, Student ACS Member: \$15.

Time: 1 – 5 PM

Location: UC Davis Activities and Recreation Center Ballroom, Davis, CA

Reservations: <http://flavors-of-chemistry-2017.brownpapertickets.com>



Toxic Terra Part II

Bill Motzer

In Parts 9 and 10 of this series (March and June 2017 Vortex), I discussed natural (geogenic) chromium-6 [Cr(VI)] occurrences in California's groundwater. In July 2014, California established a drinking water primary maximum contaminant level (MCL) of 10 µg/L or 10 parts per billion (ppb). On May 31, 2017, the Sacramento County Superior Court issued a judgment invalidating this MCL, siding with the plaintiffs that the State Water Resource Control Board (SWRCB) had not taken economic considerations into account when establishing the MCL. The court also ordered that the SWRCB adopt a new MCL for Cr(VI). On August 1, 2017, the SWRCB decided not to appeal this decision but rather reopen the MCL process to establish a new MCL and they've indicated that this may take several years. Therefore, until a new primary MCL is determined for Cr(VI) the total Cr primary MCL of 50 µg/L, which includes both Cr(III) and Cr(VI), will be used by California water districts and suppliers.

So how does Cr(III) species change to Cr(VI)? The process is rather interesting and largely requires the presence of manganese (Mn) oxides to oxidize slightly soluble Cr(III) to more soluble Cr(VI). Over the last 40 years, this has been established by experimental and empirical data. The Eh-pH (redox) diagram in Figure 1 is an example of how different Mn species form in groundwater. Solid Mn(IV) and dissolved Mn(II) species occur over a wide pH range: e.g., at a pH of ~7.5, Mn²⁺ concentrations are ~0.55 mg/L (550 µg/L) but as the pH increases above 8, solubility drops to 55 µg/L. If you compare Figure 1 below, with Figures 1 and 2 in Part 10 (June 2017 Vortex), you'll note that the stability zones for Cr(VI) species are in similar positions as those for Mn(IV) species (gray shaded areas). What occurs is that Mn oxides in insoluble Mn minerals such as bernesite "catalyze" and oxidize the Cr(III) species. Bernesite and

other δMnO₂ minerals in particulate form tend to sorb cations because they have negative surface charges (see Figure 2). In Part 9 (March 2017 Vortex), I noted the abundance of Cr(III) minerals in California rocks. Manganese minerals and deposits are also very common in California and we'll discuss these in a future article.

Once oxidized, hydrous ferrous oxides (HFOs) such as ferrihydrite (generally FeOOH • nH₂O) particles become the predominant sorptive substances for complex oxyanions such as CrO₄²⁻ because these HFOs have positive surface charges (Figure 2). Therefore, HFOs likely act as "storage" sites for Cr(VI) oxyanions. This is important because as infiltrating water percolates downward through the unsaturated zone it tends to "remobilize" the sorbed Cr(VI), which then accumulates in groundwater.

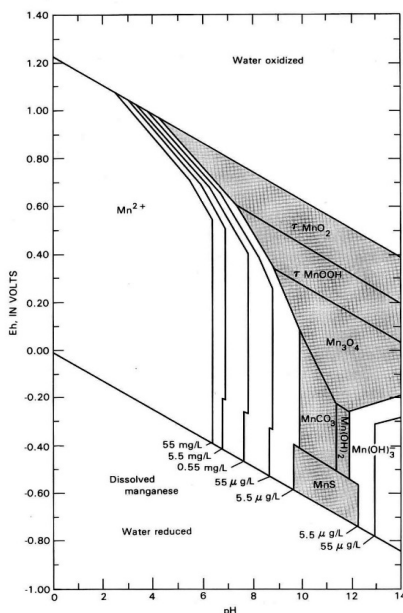


Figure 1: Eh-pH stability diagram for Mn-O-C-S at 25° C and 1 atmosphere pressure. Solid Mn species highlight in gray. Diagram from J.D. Hem (1989), U.S. Geol. Survey Water Supply Paper 2254.

(continued on page 7)

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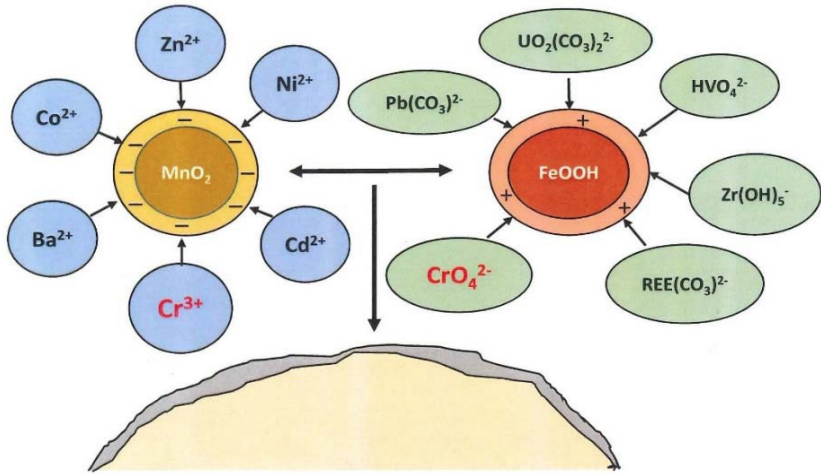


Figure 2: Electrochemical model for sorption of soluble cations (“blue” circles on left) to MnO_2 with formation of Cr(VI) oxyanion species such as CrO_4^{2-} (“green” ovals on right) and subsequent sorption on ferrihydrite (FeOOH). Sorption of cations and oxyanions is generally restricted to particle surfaces which may occur at nanometer scales. Diagram modified after Koschinsky and Heim (2017): DOI: 10.2113/gselements.13.3.177

43rd Annual Solano Avenue Stroll Sunday – September 10th 2017, 10am – 5pm

The California Section will be in booth number 1857 (close to last year’s location) with fun activities for the whole family. We look forward to seeing you

Since 1974, Solano Avenue and the cities of Albany and Berkeley CA, have hosted the Solano Avenue Stroll, the East Bay’s largest street festival! 250,000 participants and event guests visit from all over the west coast.

This family event promotes the unique traits of Solano Avenue, helping independently-owned businesses, artists, and community organizations to thrive by exposure and fundraising.

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Draft Report on Climate Change

Journalist from the New York Times, A.J. Chavar, Chris Cirillo, Lisa Friedman And Dave Horn made public a draft report by scientists from 13 federal agencies that directly contradicts statements by Scott Pruitt, the E.P.A. administrator, that human contribution to climate change is uncertain. While it was not widely publicized, the report was uploaded by the nonprofit Internet Archive in January; it was not first made public by The New York Times. One scientist who worked on the report, Katharine Hayhoe, a professor of political science at Texas Tech University, called the conclusions among “the most comprehensive climate science reports” to be published. Another scientist involved in the process, who spoke to The New York Times on the condition of anonymity, said he and others were concerned that it would be suppressed.

The report concludes that even if humans immediately stopped emitting greenhouse gases into the atmosphere, the world would still feel at least an additional 0.50 degrees Fahrenheit (0.30 degrees Celsius) of warming over this century compared with today. The projected actual rise, scientists say, will be as much as 2 degrees Celsius.

A small difference in global temperatures can make a big difference in the climate: The difference between a rise in global temperatures of 1.5 degrees Celsius and one of 2 degrees Celsius, for example, could mean longer heat waves, more intense rainstorms and the faster disintegration of coral reefs.

Among the more significant of the study’s findings is that it is possible to attribute some extreme weather to climate change. The field known as “attribution science” has advanced rapidly in response to increasing risks from climate change.

The E.P.A. is one of 13 agencies that must approve the report by Aug. 18. The agency’s administrator, Scott Pruitt, has said he does not believe that carbon dioxide is a primary contributor to global warming.

The National Climate Assessment “seems to be on autopilot” because of a lack of political direction, said Myron Ebell, a

senior fellow at the Competitive Enterprise Institute.

The report says significant advances have been made linking human influence to individual extreme weather events since the last National Climate Assessment was produced in 2014. Still, it notes, crucial uncertainties remain.

It cites the European heat wave of 2003 and the record heat in Australia in 2013 as specific episodes where “relatively strong evidence” showed that a man-made factor contributed to the extreme weather.

In the United States, the authors write, the heat wave that broiled Texas in 2011 was more complicated. That year was Texas’ driest on record, and one study cited in the report said local weather variability and La Niña were the primary causes, with a “relatively small” warming contribution. Another study had concluded that climate change made extreme events 20 times more likely in Texas.

Based on those and other conflicting studies, the federal draft concludes that there was a medium likelihood that climate change played a role in the Texas heat wave. But it avoids assessing other individual weather events for their link to climate change. Generally, the report described linking recent major droughts in the United States to human activity as “complicated,” saying that while many droughts have been long and severe, they have not been unprecedented in the earth’s hydrologic natural variation.

Worldwide, the draft report finds it “extremely likely” that more than half of the global mean temperature increase since 1951 can be linked to human influence.

In the United States, the report concludes with “very high” confidence that the number and severity of cool nights have decreased since the 1960s, while the frequency and severity of warm days have increased. Extreme cold waves, it says, are less common since the 1980s, while extreme heat waves are more common.



Monsanto in the news again

Internal documents released from a US Cancer litigation confirms that Monsanto used lies, bribes and unethical campaigns to defame Seralini* and his 2012 publication and work on the possible toxicity of Roundup, a Monsanto product. It was also shown that Wallace Hayes, Editor of *Food and Chemical Toxicology (JCT)* was paid over \$50,000 at \$400 per hour under contract to Monsanto before he, as Editor, had recommended the retraction of Seralini's paper using obtuse reasoning for the rejection, Mr. Hayes lied, saying he had no connection with Monsanto even as he continued to publish a series of negative correspondence supporting his rejection by those shown to have direct connections with Monsanto.

It has taken a long time to confirm this example of corporate malfeasance. While one can consider this a victory for Seralini and his group, and for the scientific community, Monsanto has not been converted to any level of respectability.

We know or should know that Monsanto and Bayer are in the midst of a giant merger. These two Pharma, and Agra companies are looking to extend their monopolistic power into our food supply. President Trump is reportedly favoring the merger. The key talking point to convince the American public of the benefits is that the merger would increase the research and development budget of the combined companies to 16 billion over the next six years or 2.67B per year. But the current companies already spend an average 2.59 billion per year. That

is not much of an increase.

While alternate facts are in mode these days, this may be just a little white lie because the trend of Pharma corporations is to reduce the expenditure on research so that they can buy back their stock, which benefits the managers and major shareholders long term and the smaller stockholders short term. Workers and the American consumers are severely penalized. Jobs are fewer and the companies get tax reductions for the loans that they use to buy back their stock.

From the farmers' point of view the merger means higher prices and less competition. This is also bad news for the American Consumer.

The larger story is that, beginning in the 1980s, most large US companies as is shown by the graph below used an increasing percentage of their profits for stock buy back rather than invest in people, machines, or research. The shortage of manufacturing jobs in the US have less to do with foreign companies and more to do with corporate greed. For those that would like to argue the point one then has to explain why during many years of high productivity American workers' income increased very little. The ratio of CEO's salaries of the top 200 companies to the average worker's went from about 90 to 1 to over 600 to 1.

Lou Rigali

*Seralini, Gilles-Eric; Mesnage, Robin; Clair, Emilie; Gress, Steeve; De Vendômois, Joël; Cellier, Dominique (2011). "Genetically modified crops safety assessments: Present limits and possible improvements". *Environmental Sciences Europe*. 23: 10. doi:10.1186/2190-4715-23-

THE FINANCIAL STRIP-MINING OF AMERICA

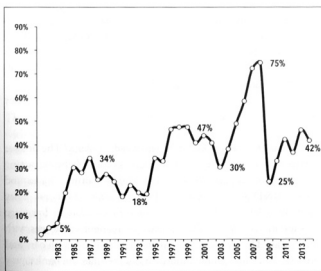


Chart 4.2: Stock Buybacks as Percent of Corporate Profits
Source: Based on data provided to the author by Willem Lazonick, The Academic Industry Research Network, www.theamint.org

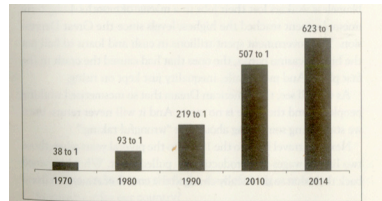


Chart 2.3: Wage Gap: Top 200 CEOs vs Average Worker*
*Average worker is production or non-supervisory worker, based on weekly wages multiplied by 52 weeks.
Source: CEO pay from CEO compensation survey, Forbes, April/May issue, 1971-2011 and "The New York Times/Equity 200 Highest Paid CEO Rankings", 2015; Worker earnings based on U.S. Bureau of Labor Statistics data, <http://www.bls.gov/charts/wages>

Cal ACS at the Lafayette Library MakerFest on July 22



CalAcS Volunteers Lena and Dan have fun with thin iridescent films

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