

# THE VORTEX

AMERICAN CHEMICAL SOCIETY  
VOLUME LXXIX NUMBER 9

CALIFORNIA SECTION  
NOVEMBER 2017



Bonnie Charpentier, senior vice president for regulatory, quality, and safety at Cytokinetics, has been elected 2018 American Chemical Society President-Elect

CALIFORNIA SECTION NOVEMBER MEETING	PAGE 2
CHAIR'S MESSAGE	PAGE 3
YCC AND CALACS NOVEMBER MEETING	PAGE 4
DISCOVERY DAYS, AT&T PARK	PAGE 4
MINI MAKER FAIRE REPORT (A. MADONIK)	PAGE 5
STUDYING STEVIA PART 2 (BILL MOTZER)	PAGE 6
MARCH FOR SCIENCE	PAGE 9
SHOULD SCIENTISTS BE POLITICAL? (LOU RIGALI)	PAGE 10
BUSINESS DIRECTORY	PAGE 11
INDEX OF ADVERTISERS	PAGE 11

*ACS California Section  
November Section Meeting  
Thursday, November 16, 2017*

*Speaker: Jennifer Doudna, PhD, Professor and HHMI Investigator,  
UC Berkeley*

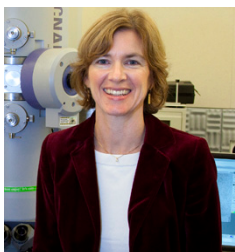
*Title: “The Chemistry of CRISPRs & Genome Editing”*

**Location:** *Chevron Technology Center, 100 Chevron Way, Richmond*

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

**Cost:** *\$10.00 Members, Students – \$5.00: Includes Appetizers and Non-alcoholic beverages during Social Hour*

**Reservations:** *Please contact the CalACS office by email [office@calacs.org](mailto:office@calacs.org) or 510-351-9922 by Monday, November 13, 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](mailto:office@calacs.org). You may also pay at the door with cash or check (credit/debit not accepted at the door).*



**Abstract:** Gene editing with CRISPR technology is transforming biology. Understanding the underlying chemical mechanisms of RNA-guided DNA and RNA cleavage provides a foundation for both conceptual advances and technology development. I will discuss how bacterial CRISPR adaptive immune systems inspire creation of powerful genome engineering tools, enabling advances in both fundamental biology and applications in medicine.

I will also discuss the ethical challenges of some of these applications.

**Biography:** As an internationally renowned professor of Chemistry and Molecular and Cell Biology at U.C. Berkeley,

Doudna and her colleagues rocked the research world in 2012 by describing a simple way of editing the DNA of any organism using an RNA-guided protein found in bacteria. This technology, called CRISPR-Cas9, has opened the floodgates of possibility for human and non-human applications of gene editing, including assisting researchers in the fight against HIV, sickle cell disease and muscular dystrophy. Doudna is an Investigator with the Howard Hughes Medical Institute and a member of the National Academy of Sciences, the National Academy of Medicine, the National Academy of Inventors and the American Academy of Arts and Sciences. She is also a Foreign Member of the Royal Society, and has received many other honors including the Breakthrough Prize in Life Sciences, the Heineken Prize, the BBVA Foundation Frontiers of Knowledge Award and the Japan Prize. She is the co-author with Sam Sternberg of “A Crack in Creation”, a personal account of her research and the societal and ethical implications of gene editing.



# THE VORTEX

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### EDITOR:

Louis A. Rigali  
255 4th St. Ste #101 Oakland 94607 510-268-9933

### ADVERTISING MANAGER:

Vince Gale, MBO Services  
Box 1150 Marshfield MA 02050-1150 781-837-0424

### OFFICE ADMINISTRATIVE MANAGER:

Julie Mason  
2950 Merced St. # 225 San Leandro CA 94577 510-351-9922

### PRINTER:

Quantity Postcards  
255 4th Street #101 Oakland CA 94607 510-268-9933  
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### CONTRIBUTING EDITORS:

Evaldo Kothny  
William Motzer

### EDITORIAL STAFF:

Jim Postma  
Evaldo Kothny  
Lee Latimer  
Alex Madonik  
Margareta Sequin  
Linda Wraxall  
Wally Yokoyama

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## Chair's Report



It is a good time of the year to express thanks, so I thought I would use this month's column for that purpose and in doing so, give you another rundown of the Section's activities, in case you're looking for a way to be involved. I can't cover all of our activities in this short column, so I beg forgiveness from those I overlook.

Margarete (Greti) Sequin deserves our thanks both for her willingness to step up as Chair-Elect but also for her efforts leading our Section's programs this year; it's been an interesting and varied set of presentations and has been run smoothly.

Lou Rigali deserves recognition for running our publications (the paper- and online-versions of the Vortex) as well as our website. The website, in particular, demands continual attention and draws a lot of flak for out-of-date items, whether Lou is responsible or not.

I've mentioned Alex Madonik several times in this column, but as head of the Section's outreach activities he expends a considerable amount of energy and creativity throughout the year, including National

Chemistry Week, Family Science Nights, the Bay Area Science Festival, Earth Day, and others.

Elaine Yamaguchi and Sheila Yeh lead our Women's Chemists Committee and that group stays active with meetings, science cafés and programs of practical value for women and others.

Eileen Nottoli and Bryan Balaz keep us in touch with our high school and community college colleagues by leading our educational programs and awards.

Stephanie Malone has re-activated our Younger Chemists Committee and recruited new members to the Section and to key roles in our programs.

Sheila Kanodia is an active voice on our Executive Committee as well as linking us to minority affairs both within the Section and to national ACS and she's an essential leader of the Section's environmental efforts, including Earth Day.

Similarly, Mark Frishberg plays an essential role with the ACS's efforts in employment assistance and does the same for the Section.

Our Section Treasurer, Paul Vartanian, and Secretary, Michael Cheng, not only play the essential roles that their titles indicate but also keep us "legal" with national headquarters.

I'll refer you to our website ([www.calacs.org](http://www.calacs.org)) for listings of our ACS Councilors, Section Directors, and other officers. Each

*(continued on page 4)*

*Home Brew Competition: Tasting & Judging  
November 11th, noon to 3:00pm*

*Golden State Brewery  
1252 Memorex Lane, Santa Clara, CA  
(In the very back, next to the train tracks)*

*RSVP for the Home Brew Event*

Join the CalACS and YCC over at Golden State Brewery for our first home brew competition. We are (still) looking to get 5-10 brewers/teams to commit to enter a home brew for this event. All entrants will receive a Visa gift card to compensate for the cost of raw materials. All participants will be invited to sample the entered brews and enjoy the company of fellow chemists, engineers, and beer aficionados. Please contact Matt Greaney at greaney19@gmail.com if you are interested in entering a brew for this event.

*The 7th annual Discovery Day at AT&T Park is Saturday 11/11/17. There will be hundreds of hands-on activities, opportunities to meet local scientists and engineers, and plenty of fun and educational entertainment. The entire ballpark is packed to the rafters with science content: on the field, at every entry/exit, and every level of the ballpark. Get ready to unleash your inner scientist.*

*When: Due to popular demand, we are extending the hours of this event to 10AM-4PM!*

*Suggested Age: Families with kids 0-14*

*Cost: FREE! No tickets/RSVP needed.*

Continued from Page 3

of them have in the past and continue to bring success to our Section.

There are slots for more volunteers, so please do not hesitate to contact me if you're intrigued by a possibility. jpostma@



*Congratulation  
to  
Bonnie Carpentier  
Newly Elected 2018 President-  
Elect of the American Chemical  
Society. Bonnie is a Member of  
the Santa Clara Valley, our neigh-  
boring sister section.*

## Cal ACS at the East Bay Mini Maker Faire – 22 October 2017

After warming up at last month's Solano Stroll, the California Section was ready to celebrate the 30th anniversary of National Chemistry Week at the East Bay Mini

parents) who want to learn about minerals and try these hands-on activities at home. Free Periodic Table cards, NCW balloons, NCW stickers, and Nanomoles were popular as well. We conducted an informal survey, "What's Your Favorite Mineral?" and collected around 60 responses (rose quartz



Maker Faire in Oakland on Sunday, October 22nd. In keeping with this year's NCW theme -- "Chemistry Rocks!" -- our booth featured do-it-yourself crystal growing activities, using solutions of borax and Epsom salts, as well as an extensive mineral exhibit, courtesy of College of Alameda chemistry and geology professor Peter Olds. We distributed copies of the NCW 2017 edition of "Celebrating Chemistry" in both English and Spanish, with plenty of information to encourage young chemists (and their

was the winner, followed by diamond and emerald), but that represents a small fraction of the hundreds of visitors our booth hosted throughout the day.

Our display also highlighted last year's dedication of the National Historic Chemical Landmark at UC Berkeley for the development of the Mars Mariner Infrared Spectrometer, featuring the late George Pimentel, who was later ACS President and the founder of National Chemistry Week.

Our volunteers enjoyed interacting with the public, and your NCW coordinator had





## Studying Stevia Part 2

Bill Motzer

In our search for non-caloric sweeteners, an entire market of natural and manufactured artificial sweeteners has arisen (see *Splenda in the Water*, November 2010 *Vortex*). In Part 1 of *Studying Stevia* (October 2017 *Vortex*), I described the discovery of the South American plant *Stevia rebaudiana* (Asteraceae) whose leaves (Figure 1) contribute to many “natural” sweeteners marketed under the generic name *stevia* and several trade names such as *Truvia*® and *PureVia*™.

Steviol glycoside is the name of a distinctive class of glycosylated diterpenes having a steviol saccharide backbone and combinations of glucose, or glucose and rhamnose, or xylose attached by a linked ester. The diterpene known as steviol is the aglycone (nonsugar group) of *stevia*'s sweet glycosides. The two main steviol glycosides are *Stevioside* and *Rebaudioside*. The chemical formula for *Stevioside* (CAS: 57817-89-7) is  $C_{38}H_{60}O_{18}$ , with a mole mass of 804.87; the chemical formula for *Rebaudioside A* (CAS: 58543-16-1) is:  $C_{44}H_{70}O_{23}$ , with a mole mass of 967.01, indicating that *Rebaudioside A* contains an additional glucose molecule ( $C_6H_{12}O_6$ ) connected by an ester bond (with the loss of  $H_2O$  in the process).

On a chemical structure basis, steviol

molecules have a carboxyl hydrogen atom replaced by a glucose molecule to form an ester and a hydroxyl hydrogen with combinations of glucose and rhamnose forming an acetal functional group (Figure 1). The International Numbering System (INS) number for steviol glycoside is 960. As previously indicated, *Stevioside* and *Rebaudioside A* form the major components with associated glycosides such as *Rebaudioside B*, *C*, *D*, and *F*, *Dulcoside A*, *Rubusoside*, and *Steviolbioside*, etc. Based on extraction techniques, the steviol glycosides in *Stevia rebaudiana* leaves (in weight percent), include:

*Stevioside*: 5% to 10%  
*Rebaudioside A*: 2% to 4%  
*Rebaudioside C*: 1% to 2%  
*Dulcoside A*: 0.5% to 1%  
*Rebaudioside B*: trace  
*Rebaudioside D*: trace  
*Rebaudioside E*: trace

As noted, *Rebaudioside B*, *D*, and *E* generally occur in trace amounts; however, *Rebaudioside B* may be a byproduct of extraction techniques. Other commercial steviol glycoside mixtures extracted from the plant were found to contain about 80% *Stevioside*, 8% *Rebaudioside A*, and 0.6% *Rebaudioside C*. The general structural formula for the steviol backbone and types of additional sugar moieties for each of the steviol glycosides is given in the following table.

In the next part, I'll discuss *stevia* extraction/manufacturing methods and possible allergic reactions and toxicity.

*(continued on page 7)*



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**Table 1: Steviol Glycoside Functional Groups**

Name	Radical Group 1	Radical Group 2
Stevioside	Glcβ1	Glcβ1-2 Glcβ1-
Rebaudioside A	Glcβ1-	Glcβ1-2 Glcβ1-3)Glcβ1
Rebaudioside B	H-	Glcβ1-2 Glcβ1-3)Glcβ1-
Rebaudioside C	Glcβ1-	Rhaα1-2 Glcβ1-3)Glcβ1-
Rebaudioside D	Glcβ1-2Glcβ1-	Rhaα1-2(Glcβ1-3)Glcβ1-
Rebaudioside E	Glcβ1-2Glcβ1-	Glcβ1-2Glcβ1-
Rebaudioside F	Glcβ1-	Xylβ1-2(Glcβ1-3)Glcβ1
Dulcoside A	Glcβ1	Rhaα1-2Glcβ1-
Rubusoside	Glcβ1-	Glcβ1-
Steviolbioside	H- Glcβ1-2Glcβ1-	

**Notes:**

Glc = , glucose moiety

Rha = rhamnose moiety

Xyl = xylose sugar moiety

Source: Journal of Applied Glycoscience, (2010), v. 57, n. 3, pp.199-209.



Figure 1: Only the leaves of *Stevia rebaudiana* contain steviol glycosides.

Photo source: <https://pixabay.com/en/stevia-leaf-sugar-plant-sweetness-74187/>

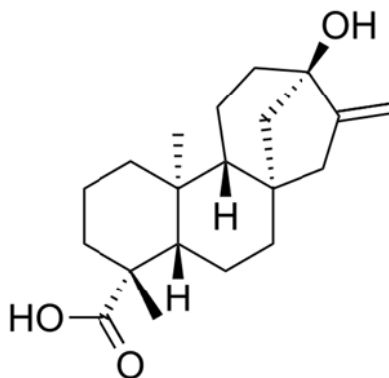


Figure 2: Molecular structure of the aglycon steviol, showing substituted hydrogens on the carboxyl group (bottom) and the hydroxyl group (top). Diagram in the public domain at: <https://pubchem.ncbi.nlm.nih.gov/compound/Steviol#section=Top>

### *Gifts & Donations*

The Sections has many outreach programs to help support science and chemistry in our community. A gift of \$25 to our High School Chemistry Teachers programs helps support the teacher and school with Chemistry supplies and equipment. Call or email and find out how your valued contribution can be used. Donations to the California Section are tax deductible.

Lou Rigali, LR101898@aol.com

## March For Science

On April 22, more than one million people from around the world marched to defend the role of science in policy and society. Scientists and non-scientists, concerned citizens from all corners of the globe stood together in solidarity to champion science and the importance of it in our daily lives.

Six months after the largest ever rally for science, the ideas that we stood for are still helping to shape our national conversations and inspire a growing movement for stronger science advocacy. On this important day, it is vital to remember the goals of the March For Science, MFS, and why we must continue to push onward. <https://www.marchforscience.com/>

We strive to:

Advance the use of evidence in policymaking processes.

Empower meaningful engagement between science and society.

Foster diversity and inclusivity in all areas of science and science policy.

Build a global community of science advocates.

### [How We're Working Toward Our Goals](#)

April 22 was a powerful day in support of science, but more work is needed. No one-day rally can create a miraculous, overnight shift in policy—and so in addition to planning the march, we put together a Week of Action that began the day after the march to carry the momentum forward.

We've also hosted listening sessions with our partners to identify priority areas where the MFS as an organization can fill in gaps in advocacy and outreach needs and to facilitate collaborations with existing efforts.

Based on those conversations, we have continued to develop publicly available resources and toolkits to empower people

around the world to be more effective science advocates, including: Guides to Advocacy, Outreach Planning Guide, Letter-writing campaigns on issues such as the Paris Climate Agreement.

Satellite organizers, partner organizations, and members of the scientific community have spent the last six months strengthening their commitment to science in policy and hosting science outreach events to foster civic engagement and to make science accessible to all.

They've supported their communities during times of need, helping displaced scientists find lab space following recent disastrous hurricanes.

### [Looking to the Future](#)

As we look to the future, our Students for Science have shown incredible leadership as they encourage their peers to write letters to school boards and to speak to elected officials in their communities.

But these efforts are just the beginning of a bigger movement. Both the March for Science event and the organization are ongoing successes in shaping conversations and developing new leaders. We must continue to [#KeepMarching](#) and we need your ongoing participation in upcoming campaigns such as the Vote for Science.

Now is the time to step up efforts. Learn how you can Get Involved as we reenergize and mobilize to make science heard.



Poster designed by Caroline Weinberg





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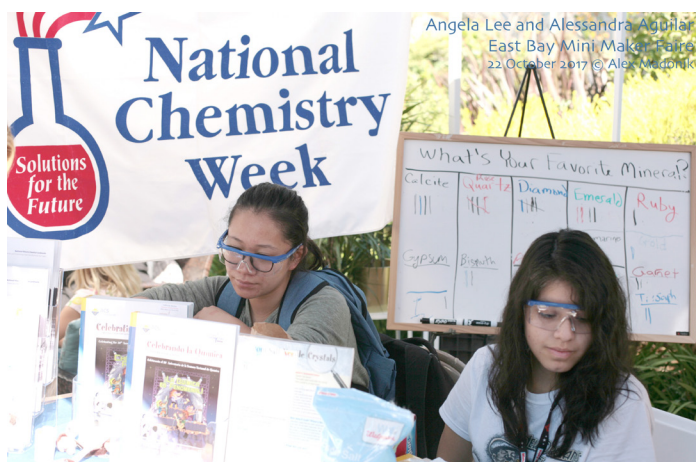
the pleasure of reconnecting with several teachers who have hosted previous outreach events. I also spoke with representatives of informal science groups in the East Bay and San Francisco that hope to collaborate with the ACS in the future. Let me close by thanking the indispensable Al Verstuyft, who was there shortly after 8:30 AM to help me set up, and Alessandra Aguilar, Chief Master Alchemist Angela Lee, and Lisha

Out of UC Berkeley's Sigma Chapter of Alpha Chi Sigma, who assisted us for much of the afternoon. A perfect day for public outreach! The festivities will continue next Saturday (October 28th) with the Bay Area Science Festival's East Bay Discovery Days in Hayward and North Bay Discovery Days in Santa Rosa; finally, look for us at Discovery Days at AT&T Park on Saturday, November 11th.

Alex Madonik  
National Chemistry Week Coordinator



East Bay Mini Maker Faire - 22 October 2017 © Alex Madonik



Angela Lee and Alessandra Aguilar  
East Bay Mini Maker Faire  
22 October 2017 © Alex Madonik

## *Should Scientists be Political?*

Should scientists let their political beliefs be known? For most, it is not a case of yes or no, but how much or how little, how vocal or how silent.

Political discussions are often avoided because they can be controversial and can have consequences. Galileo decided, it seems, to withdraw his views on a solar centric system and continue to (live) do his research.

Some of us like to deal with facts. Other than alternative facts, there is no disputing facts. But even on what seems to be a firm footing with facts, there can be lots of leeway in terms of interpretation.

Fact, alternative fact, or opinion?

Since the early 1980s, the number of manufacturing jobs has decreased continually up to the present, except for a little blip starting in 2011. This trend was due to:

- a. American Labor became less productive and companies had to move manufacturing off-shore. Fact, alternative fact, or opinion?
- b. Executives in American companies made more money with stock buy-back manipulations than investments in new products, R&D or plant improvements.

You may need a background in economics to know which is which.

Political discussions get contentious even if there are some facts because there are

a lot more opinions based on personal or self-serving values. It is easy to be rational when discussing facts. Arguments using personal values or alternative facts tend to get emotional.

Here are some political and scientific topics to review:

The climate of the earth is changing in predictable ways. Fact, alternative fact or opinion?

Mankind is responsible for the changes. Fact, alternative fact, or opinion?

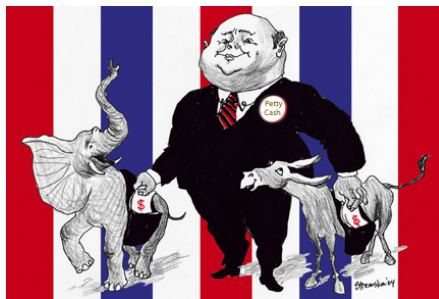
Action should be taken. Fact, alternative fact, or opinion.

The earth has gone through many climate changes. Fact, alternative fact, opinion. In some cases facts may be irrelevant.

The point is, you will seldom change one's mind with facts, as obvious as that may seem to fact checkers. So what do you do if you think there is an existential danger?

You are on the 10th floor of a building and see smoke and are also told that excessive heat has been detected on the first floor. Do you debate if the smoke and heat are connected? Do you debate who or what started the fire? What do you do? You will do everything you can.

Lou Rigali



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Robertson Microlit	6

## SEARCHING FOR THAT SPECIAL JOB?

There are many companies and organizations searching for chemical and biochemical personnel to fill important jobs in their organizations.

- Companies for laboratory and management positions
- Universities & Colleges for teaching positions and laboratory personnel
- Hospitals for technical and research personnel

There are several web sites that may help you search for these open positions.

- [www.mboservices.net](http://www.mboservices.net)
- <http://www.calacs.org/page.asp?id=22>

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