

# THE VORTEX

AMERICAN CHEMICAL SOCIETY  
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CALIFORNIA SECTION  
JUNE 2018



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## California Section ACS- June Social and Field Trip- Lunch and Tour Sierra Nevada Brewery

**Time:** Sat. June 9th, 11:00 am to 2:00 pm, please arrive by 10:45 am.

**Location:** Sierra Nevada Brewing Co. 1075 East 20th St. Chico, CA 95928  
(Limited To 45 People) (closed-toe shoes are requested; must be 21 yrs. old to taste beer)

**Cost:** \$35.00 (for banquet lunch and tour)

**Reservations:** Are required- RSVP no later than Friday June 1, 2018 to the Section office by e-mail at [office@calacs.org](mailto:office@calacs.org) or call (510) 351-9922. Please prepay by sending a check to Cal. Section ACS at 2950 Merced Street, #225, San Leandro CA 94577 or pay by PayPal.

## WCC April 14 Meeting

Patricia Li Wang, UC Merced provided a description of work done on HIV Prevention in Young Women in South -Saharan Africa



Editors Note: In the previous *Vortex* issue listing the names of 50/60/70 year members, we did not note that Jorge Labat, Donald A. Hickson, Paul E. Porter, and Leonard D. Greenberg are deceased.

# THE VORTEX

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## Chair's Message



Our ACS California Section is looking forward to an active month of June: On Saturday, June 2, Dr. Monica So will present a talk at UC Berkeley, with the title "Becoming an Assistant Professor at

a Primarily Undergraduate Institution: Past, Present, and Future". This event (organized by our Women Chemists' Committee and open to all) includes coffee and lunch, a good opportunity for networking. You are cordially invited to join our Summer Social featuring a field trip to the Sierra Nevada Brewery in Chico, on Saturday, June 9. The outing includes a special tour of the brewery and a lunch. Please sign up asap if you plan to attend this special event. Details are shown on page 2 in this *VORTEX*.

The Section continues to be active with public outreach events. On June 14 we'll need volunteers to help with hands-on activities at the San Leandro Public Library. If you like to help, please contact our volunteer coordinator Alex Madonik at alexmadonik@sonic.net

We are already looking ahead to National

Chemistry Week in October during which we'll hold a family science night event, most likely at a San Francisco Bay Area middle school. If you have a contact and/or suggestion for a family science night host school please let us know. Either contact us at office@calacs.org or Alex Madonik at alexmadonik@sonic.net

*VORTEX* will take a break in July and August, with our next issue being the September issue.

Meanwhile our CalACS section councilors will represent us at the ACS National Meeting, August 19-23, 2018, in Boston. The conference theme will be: Nanoscience, Nanotechnology & Beyond

We hope you can join us at a section event



*The Vortex will return  
with its next issue in  
September.*

Adults need a reminder, kids,  
puppies and kittens don't.

*Have fun.*

## *Lloyd Ryland Outstanding High School Teacher Award*

This year, we awarded two high school chemistry teachers with our Lloyd Ryland Outstanding High School Chemistry Teacher award: Alex Lee at Irvington High School in Fremont and Paul Matsumoto at Galileo Academy of Science and Technology in San Francisco. Each teacher was honored with a check for \$500 and a membership in the American Association of Chemistry Teachers as well as a check for \$500 to the chemistry department at their high school.

Alex Lee's students have an impressive pass rate of 95% on the AP chemistry exam. His skills in inspiring students has resulted in many that go on to major in chemistry or chemical engineering or other sciences. Former students let him know that their success in college chemistry classes stem from what they learned in his class. He also contributes to improving teaching practices at the district level. Perhaps a downside to that, however, is that he has been unopposed and re-elected as science chair for the past 15 years. He has also been a consistent participant in the Olympiad for the past many years and two of his more recent students qualified to go to Study Camp.

Paul Matsumoto has been an invaluable participant in our Project SEED program for the past 25 years and has recommended several excellent students. One of his former students was in the program for two years and won a four-year scholarship to Cal. Recently, the student mentored a first year SEED student in the lab where she now works.

Impressively, Paul has written articles with some of his former students that have been published in the Journal of Chemical Education, including an article published last year. A former SEED student of his who is now a physics major counts Paul as her best high school science teacher.

Eileen Nottoli,  
Chair, High School Teachers committee



## *Outstanding High School Chemistry Student*

We also awarded three high school students with our Outstanding High School Student Award: Sherry Fan at Irvington High School in Fremont, Drew Johns of Enterprise High School in Redding, and Jamie Lu of Maria Cabrillo High School in Santa Rosa. These students showed initiative and a strong interest in chemistry. Each student received a letter from us and a check for \$100. This will be an annual award for up to ten high school students nominated by their chemistry teachers.



## *Chemistry Olympiad*

Students at twenty high schools in our Section competed in the Local exam, and 18 of the 282 students qualified to take the National exam. We held the National exam on April 21 at Las Positas College in Livermore. Two students, Anugrah Chemparathy at Dougherty Valley High School, and Ian Chen at California High School, qualified for Honors. We are honoring these students with a check for \$100 to encourage their interest in chemistry.



## *Gifts & Donations*

The Section has many outreach programs to help support science and chemistry in our community schools. You can help support the programs including the work with the High School Chemistry Teachers programs through your donations. Call or email and find out how your valued contribution can be used.

Lou Rigali, LR101898@aol.com

## *More on Glyphosate-based herbicides*

According to a new study glyphosate-based herbicides caused adverse health effects in rats at a dose claimed to be safe by regulators, Glyphosate herbicides are used on the vast majority of all GM crops worldwide.

The study used the US Environmental Protection Agency's acceptable daily dietary exposure level of glyphosate(1) – 1.75 mg per kg of bodyweight per day. The same concentration was given to the rats daily over a 3 month period.

The study was focused on the newborn, infants and adolescents phases of life. The results reveal that glyphosate-based herbicides (GBHs) were able to alter certain important biological parameters, mainly relating to sexual development, genotoxicity, and the intestinal microbiome.

The effects occurred at a dose deemed safe by regulators to ingest on a daily basis over a long-term period. In human-equivalent terms the dosing period corresponded to the period from the embryo stage to 18 years of age.

### Results in detail

The results showed an alteration in some sexual development parameters in rats treated with GBHs, especially in females. Moreover, rats treated with GBHs presented statistically significant changes of the intestinal microbiome in particular during development.

Concerning genotoxicity, a statistically significant increase was observed in micronuclei in rats treated with GBHs, especially in the first part of life.

Rats treated with pure glyphosate or its formulation presented similar levels in urine of glyphosate and its principal metabolite (AMPA), thus showing no significant difference in the absorption and excretion of glyphosate among the two treatment groups, but suggesting a bioaccumulation effect of glyphosate that was proportional

to the length of treatment.

The study was conducted at the Ramazzini Institute, Bologna, Italy. In over 40 years of activity, the institute has studied more than 200 compounds from the general and occupational environment and many of its results have provided a solid scientific base for regulating and limiting the exposure of a number of substances. Examples include vinyl chloride, benzene, formaldehyde, trichloroethylene and mancozeb.

### Comments from scientists

Commenting on the glyphosate herbicide pilot study, Prof Philip J. Landrigan, Icahn School of Medicine at Mount Sinai, said, “By its very nature and purpose, the pilot study does not resolve the uncertainties puzzling the various agencies (IARC, EFSA, ECHA) as to whether glyphosate and Glyphosate Based Herbicides (GBHs) are carcinogenic or not, but it does highlight health effects that are equally as serious, that might manifest as long-term oncological pathology [cancer], and that might affect a huge number of people, given the planet-wide use of the GBHs. These early warnings must be further investigated in a comprehensive long-term study”.

Dr Fiorella Belpoggi, Cesare Maltoni Cancer Research Center, Ramazzini Institute, said, “Whatever the outcome of the Ramazzini Institute study, the findings will provide regulatory agencies and policymakers with solid independent results obtained by a shared research project on which they can confidently base their risk assessments and their evaluations, including the upcoming decision for the re-authorization of glyphosate use in Europe in 2022.”

Prof Jia Chen, Icahn School of Medicine at Mount Sinai in New York City, said, “Glyphosate-based herbicides (GBHs) are of significant public health concern because of their widespread and sharply increased usage. As an herbicide, glyphosate exerts its herbicidal action by inhibiting the Shikimate pathway which exists not

*continued on Page 7*

## Troubles with Tattoos? (Part 3)

Bill Motzer



In Part 2 (May 2018 Vortex), I noted that some tattoo carrier chemicals and pigments are potential and/or known mutagens, teratogens, carcinogens, and toxins, possibly affecting or participating in

adverse internal organ reactions. Although such reactions may not be immediately acute they may be chronic, not appearing as specific diseases for decades. Very recent research continues identifying potential problems associated with tattoo inks and how they may eventually impact internal organs.

In 2016, the Joint Research Centre of the European Commission's In-House Science Service published an important document titled *The Safety of Tattoos and Permanent Make-Up (PMU)*. The Centre's findings indicated that: (1) tattoo and PMU inks contain chemicals that remain in the body for life, (2) adverse health effects, including infections and allergies are increasingly reported, and (3) little is known about the long-term effects of these chemicals. Additionally, as we discussed in Parts 1 and 2 (April and May 2018 Vortex), the report noted that tattoo/PMU inks may contain unknown ingredients and impurities. This is because most pigments are not specifically produced for tattoo/PMU applications and therefore generally are of low purity. According to European Union regulations, many inks are not authorized for cosmetic product usage and several should not be present. More than 80 percent of in use colorants are organic compounds and more than 60 percent contain azo-compounds or pigments, some of which are known to release or degrade to carcinogenic aromatic amines. Such degradation may occur in the skin, particularly under solar/ultra violet radiation exposure or laser irradiation.

In 2017, Schreiver, et al., in *Scientific Reports* (v.7, 11395; DOI:10.1038/s41598-

017-11721-z) noted that the increasing occurrence of tattooing, particularly in young adults, had resulted in safety concerns regarding ink particle distribution and their effects inside the human body. Utilizing human corpse skin and lymphatic tissues, they determined local biokinetics via synchrotron X-ray fluorescence (XRF) at micro ( $\mu$ ) and nano scales. Additional advanced mass spectrometry allowed identification of simultaneous transport of organic pigments, heavy metals, and titanium dioxide from the skin to regional lymph nodes. Organic pigments had the largest particle size range; however, it was the smallest particles that preferentially reached the lymph nodes. Using Synchrotron  $\mu$ -Fourier Transform InfraRed (FTIR) analysis, researchers also detected ultra-structural tissue changes adjacent to tattoo ink particles noting altered amide I, secondary protein structural alterations (e.g.,  $\alpha$ -helix to  $\beta$ -sheet protein ratio changes), and elevated lipid contents. Finally, evidence for migration and long-term deposition of toxic elements and tattoo pigments and biomolecule conformational alterations may contribute to tattooing cutaneous inflammation and other adversities.

A March 2018 study by Benias, et al. (*Scientific Reports*, v. 8, n. 4947; DOI:10.1038/s41598-018-23062-6) noted discovery of a the "new" organ, consisting of fluid-filled spaces in the body's connective tissues, including the dermis, digestive tract linings, lungs, urinary systems, and surrounding muscles. This tissue consists of interconnected open, fluid-filled spaces supported by a lattice of thick collagen, providing a pathway of fluids not previously observed. Existence of these tissues had been missed because they don't appear on standard microscope slides used in cell identification since most tissue sample preparation is by chemical treatment (to fix the cells), cutting them into thin slices, and staining them to highlight key features such as the nucleus and cell membrane. Fixing processes drain these fluids resulting in fluid-filled space collapse. The novel tissue preparation technique is based on a relatively new tool described as: Probe-based Confocal

*(continued on page 7)*

*(Glyphosates continued from page 5)*

only in plants but also exists in some bacteria and fungi and other microbes. However, there are no studies on the potential effects of GBHs on the gut microbiome in the human population.

“Our study provides initial evidence that exposures to commonly used GBHs, at doses considered safe, are capable of modifying the gut microbiota in early development, particularly before the onset of puberty. Further long-term investigations are necessary to elucidate if the shift in the microbiota induced by GBHs exposure is contributing to the other health effects downstream. Nevertheless, understanding the microbiota changes during this critical window of susceptibility could be of great importance for disease prevention”.

Dr Alberto Mantovani, Italian National Institute of Health, said, “An interesting feature is the time-related increase of unchanged glyphosate in the urine. This finding might indicate that glyphosate bioavailability increases with a longer duration of exposure; increased bioavailability, in its turn, might flag an increased internal exposure of target organs and tissues.”

#### Publication and funding

Three peer-reviewed accepted manu-

scripts from the pilot phase of the Global Glyphosate Study are available online today (May 16) today in the prestigious scientific journal *Environmental Health* in open access format (print version to follow later in May). The data on reproductive parameters and genotoxicity is currently in peer review and is soon to be published.

The pilot study involved the participation of multiple institutes and universities in Europe and the US. The study cost €300,000 and was funded by 30,000 members of the public in Italy, who are associates of the Ramazzini Institute cooperative.

A crowd-funding campaign has been launched to help support a long-term comprehensive Global Glyphosate Study, which following these results is now urgently required.

#### Notes

US Environmental Protection Agency (EPA). Glyphosate: Chronic Dietary Exposure Assessment for the Section 3 Registration Action. 2006. [https://www3.epa.gov/pesticides/chem\\_search/cleared\\_reviews/csr\\_PC-103601\\_8-May-06\\_a.pdf](https://www3.epa.gov/pesticides/chem_search/cleared_reviews/csr_PC-103601_8-May-06_a.pdf)  
2. Global Glyphosate Study: <http://glyphosatestudy.org/>



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#### Motzer continued from page 6)

Laser Endomicroscopy (pCLE), combining an endoscope with a laser and sensors to analyze reflected fluorescent patterns, thereby allowing microscopic views of living tissues. According to the researchers, fluid-filled spaces can now be identified as an organ they called the Interstitium: a source of lymphatic fluid draining into the lymphatic system. Although requiring additional verification, this research may explain why cancer tumors invading the Interstitium can spread to the lymph nodes. It also may

explain why the Schreiber, et al. study noted tattoo nanoparticle transport from the skin to regional lymph nodes.

In conclusion, an adult's decision on getting a tattoo remains a personal choice currently shaped by their understanding of acceptable and perceived risks. To date, the actual risks have not been clearly defined but recent scientific studies suggests that possible chronic diseases may be associated with tattooing. Future investigations will ultimately help in determining such outcomes.



## *Leg exercise is critical to brain and nervous system health*

Groundbreaking research shows that neurological health depends as much on signals sent by the body's large, leg muscles to the brain as it does on directives from the brain to the muscles. Published today in *Frontiers in Neuroscience*, the study fundamentally alters brain and nervous system medicine -- giving doctors new clues as to why patients with motor neuron disease, multiple sclerosis, spinal muscular atrophy and other neurological diseases often rapidly decline when their movement becomes limited.

"Our study supports the notion that people who are unable to do load-bearing exercises -- such as patients who are bedridden, or even astronauts on extended travel -- not only lose muscle mass, but their body chemistry is altered at the cellular level and even their nervous system is adversely impacted," says Dr. Raffaella Adami from the Università degli Studi di Milano, Italy.

The study involved restricting mice from using their hind legs, but not their front legs, over a period of 28 days. The mice continued to eat and groom normally and did not exhibit stress. At the end of the trial, the researchers examined an area of the brain called the sub-ventricular zone, which in many mammals has the role of maintaining nerve cell health. It is also the area where neural stem cells produce new neurons.

Limiting physical activity decreased the number of neural stem cells by 70 percent compared to a control group of mice, which were allowed to roam. Furthermore, both neurons and oligodendrocytes -- specialized cells that support and insulate nerve cells -- didn't fully mature when exercise was severely reduced.

The research shows that using the legs, particularly in weight-bearing exercise, sends signals to the brain that are vital for the production of healthy neural cells, essential for the brain and nervous system. Cutting back on exercise makes it difficult for the body to produce new nerve cells -- some of the very building blocks that

allow us to handle stress and adapt to challenge in our lives.

"It is no accident that we are meant to be active: to walk, run, crouch to sit, and use our leg muscles to lift things," says Adami. "Neurological health is not a one-way street with the brain telling the muscles 'lift,' 'walk,' and so on."

The researchers gained more insight by analyzing individual cells. They found that restricting exercise lowers the amount of oxygen in the body, which creates an anaerobic environment and alters metabolism. Reducing exercise also seems to impact two genes, one of which, CD-K5Rap1, is very important for the health of mitochondria -- the cellular powerhouse that releases energy the body can then use. This represents another feedback loop.

These results shed light on several important health issues, ranging from concerns about cardio-vascular impacts as a result of sedentary lifestyles to insight into devastating diseases, such as spinal muscular atrophy (SMA), multiple sclerosis, and motor neuron disease, among others.

"I have been interested in neurological diseases since 2004," says co-author Dr. Daniele Bottai, also from the Università degli Studi di Milano. "The question I asked myself was: is the outcome of these diseases due exclusively to the lesions that form on the spinal cord in the case of spinal cord injury and genetic mutation in the case of SMA, or is the lower capacity for movement the critical factor that exacerbates the disease?"

This research demonstrates the critical role of movement and has a range of potential implications. For example, missions to send astronauts into space for months or even years should keep in mind that gravity and load-bearing exercise play an important role in maintaining human health, say the researchers.

"One could say our health is grounded on Earth in ways we are just beginning to understand," concludes Bottai.



## *Understanding the Controversy and Science of GMOs*

By Nirvana Abou-Gabal at Sonima.com

The subject of genetically-modified organisms (GMOs) is one of the most hotly-debated food and environmental topics in the world today. Just look at the response to Chipotle's recent announcement that the chain would cease to include GMO ingredients on its menu. Health advocates applauded the move as a step in the right direction on the heels of Whole Foods' 2013 commitment to label all genetically-modified products in its stores by 2018. Detractors called it yet another example of a food maker using unsubstantiated claims to sell food and hypocritical, given that the chain will continue to serve soda, which contains high-fructose corn syrup made with genetically-modified corn.

At the crux of the controversy are a number of unknowns about the long-term health effects of ingesting genetically-modified (GM) foods and the impact these plants and accompanying farming methods have on the environment. With some experts saying 60 to 70 percent of food products contain GMOs in recent years, it's clear this issue is central to the future of our food supply. To help answer some commonly asked questions and further a constructive dialogue on the topic, here is a brief overview of the facts we know today. There are currently no genetically-modified animals approved for sale and consumption in the United States, although the feed of conventionally raised livestock and poultry often contains genetically-modified ingredients.

### *Are GMOs Safe?*

Many proponents of genetically-modified foods state that they are completely safe to eat and that this process has taken place in nature for thousands of years. They cite research such as a review by Snell et al., which carried out a comprehensive analysis of 24 studies on the health effects of animal diets containing genetically-modified

feed. The authors determined that, "the studies reviewed present evidence to show that GM plants are nutritionally equivalent to their non-GM counterparts and can be safely used in food and feed." Any differences observed between conventional and GM feed "fell within the normal variation range of the considered parameter and thus had no biological or toxicological significance."

However, not everyone is convinced. A joint statement developed and signed by over 300 independent researchers asserts that contrary to popular claims, there is "no consensus on GMO safety," and that differences of opinion are present regarding the interpretation of the safety parameters employed by the review's authors. Furthermore, the design of the studies profiled by Snell et al. were called into question.

These same scientists are concerned that despite the common claim that "trillions of GMO meals" have been consumed in the United States without any adverse effects, no epidemiological studies (observational studies used by researchers to test the relationship between factors and determine the existence of correlations) in human populations have been carried out to support this declaration. The authors go on to state that "as GM foods and other products are not monitored or labeled after release in North America, a major producer and consumer of GM crops, it is scientifically impossible to trace, let alone study, patterns of consumption and their impacts. Therefore, claims that GM foods are safe for human health based on the experience of North American populations have no scientific basis."

There is also growing concern regarding the chemicals that certain GMO foods are treated with, particularly in the case of "Roundup Ready" crops. Roundup is the brand name for the herbicide glyphosate, produced by Monsanto, an American agrochemical and agricultural biotechnology corporation responsible for most of the transgenic varieties of crops in the world today. Many GMOs such as soy, corn, canola, alfalfa, cotton, and sorghum are

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designed to be resistant to the effects of Roundup. These patented breeds of plants make it possible for farmers to spray crops with the herbicide to kill weeds without threatening their harvest. Unfortunately, an agency of the World Health Organization has cautioned that glyphosate “probably” causes cancer, which naturally raises alarm bells about the safety of these foods. Of course, this is not to say that genetically-modified foods are categorically unsafe. However, it is apparent that research on this topic is young, emerging, and far from being conclusive.

### *What About the Environment?*

It is equally important to understand the effects of GM crops on our environment. Proponents of this technology will argue that GMOs increase yields while decreasing the use of chemical pesticides (a seemingly win-win situation). However, it has been shown that this is not necessarily the case. A study examining the history and sustainability of U.S. staple crop production, such as soybean, maize, rapeseed, and cotton, in the American Midwest showed that, “relative to other food secure and exporting countries (e.g., Western Europe) [which unlike the U.S., are highly conservative when it comes to GMOs], the U.S. agroecosystem is not exceptional in yields or conservative on environmental impact.”

Another study has determined that herbicide and insect-resistant crops has led to a 527 million-pound increase in herbicide use in the United States between the years 1996 and 2001, while only decreasing insecticide use by 123 million pounds. In other words, while the use of insecticides has decreased, the use of herbicides has increased much more substantially, likely due to the proliferation of glyphosate-resistant weeds.

The development of such “super weeds”

is another growing concern. Indianapolis-based Dow AgroSciences, a division of Dow Chemical that specializes in biotechnology and agricultural chemicals, has recently gained approval bring its Enlist weed control system to market. Enlist weed control is the company’s answer to weeds that have developed a resistance to Monsanto’s Roundup herbicide (they infest over 70 million acres of farmland in the U.S.), and is designed to be used in tandem with GM corn and soybeans. Enlist contains the chemical 2,4-D (a highly controversial chemical) in addition to glyphosate. The prevalence of these herbicide-resistant weeds and the industry built around solving this problem raises many questions: What happens when weeds eventually become resistant to Enlist? Is it sustainable for us to continue to rely on increasingly potent (and controversial) herbicides in support of this technology? Are we imprisoning the farmers who adopt these modern methods into a perpetual technology trap?

Other highly important environmental issues include the potential for GMOs to cross-pollinate with other crops and plants in the ecosystem, the challenge of maintaining biodiversity in the era of industrial crop production, the role and potential benefits of agroecology, the effects of GMOs on farmers (particularly in the developing world), and of course, the ethics behind the commoditization of nature, a worldview which certainly shapes much of the agribusiness industry. All of these issues must also be addressed as we evaluate the risks and potential benefits of this technology.

In the meantime, those who wish to exercise caution by avoiding GM foods can do so by buying organic when possible (by law organic foods cannot contain GMOs), and by supporting local farmers who do not employ this technology.



# BUSINESS DIRECTORY

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Robertson Microlit

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### SEARCHING FOR THAT SPECIAL JOB?

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