THE VORTEX

AMERICAN CHEMICAL SOCIETY **CALIFORNIA SECTION**
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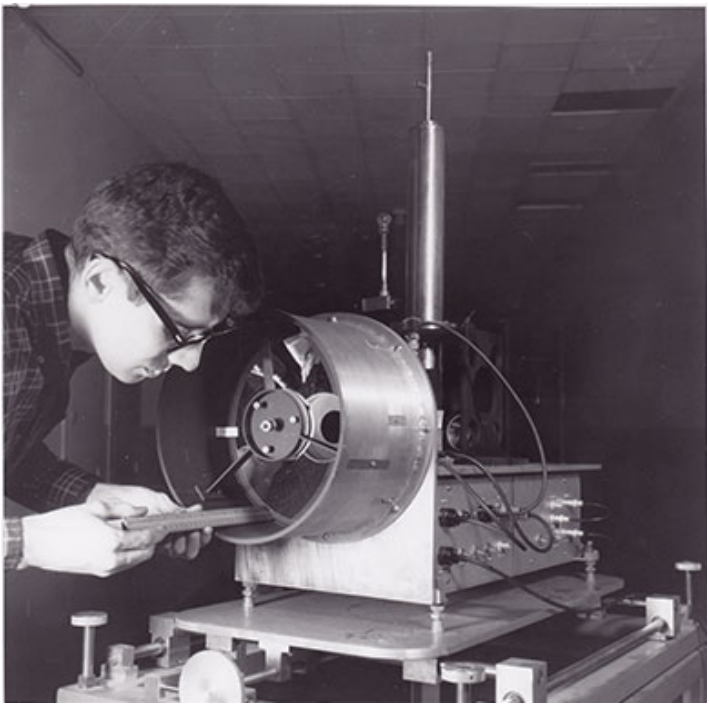

Kenneth Herr is shown with a test model of the Mars Mariner infrared spectrometer at UC Berkeley's Space Sciences Lab, ca. 1967.

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March Meeting of the California Section

What has chemistry contributed to our everyday life? Without chemistry we would be living in the Stone

Date: March 8, Sunday, 2:00 p.m.
Place: Lawrence Hall of Science, 1 Centennial Drive, Berkeley

Description: Four 15-20 minutes lectures will describe the role of chemistry in the areas of Transportation & Energy, Medicine, Food & Agriculture and Communications. The emphasis will be on WHAT, not HOW! The presentations will be done in layman language, no chemistry background is needed

PROGRAM.

1. Transportation and Energy, Dr. Paul Jagodzinsky, Northern Arizona University, ACS District Director

2. Medicine, Dr. Hannah Powers, Maze Therapeutics, Pharmaceutical Research Chemist

3. Food and Agriculture, Dr. Wally Yokoyama, WRCC- USDA, ACS Division of Food and Agriculture

4. Communications, Dr. Attila Pavlath, ACS President, 2001

It will be followed by leisurely viewing of the exhibit of 32 colorful posters with the chronology of developments and illustration of 75 special examples. The posters can be found on www.chemistryinyourlife.org in 32 languages. A contest will be held to find anything in your life which has nothing to do with chemistry.

Please call the Section Office 510-351-9922 to register your and your guest's attendance. Entrance to the Lawrence Hall of Science requires a fee of $16, but for those registered it will be free (though, you have to buy a parking ticket ($1/hour) at a kiosk). A special check-in desk will be set up at the entrance for those registered.

Reminder: Women Chemists Committee (WCC) Meeting – Sat., February 15, 2020

Topic: – "Imminent Shaking"; What Kind of Earthquake Warning is Possible?

Speaker: Dr. Sarah Minson, U.S. Geological Survey's Earthquake Science Center.

Time: 10:30-11:00 am Snacks & Coffee, 11:00 am Discussion & Lunch

Cost: $15.00 ($7.00 for students and unemployed). Technical discussion is free.

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Chair's Message

Jim Postma

Groundhog Day isn't until February and you may feel a bit like Phil Connors, Bill Murray's character in the memorable movie as you welcome me to the Chair position in the California Section. Haven't we done this before? Yes, back in 2012 and 2017. But others such as Attila Pavlath have done the same, so it is not unheard of.

If you read the December *Vortex* you would have a sense of why someone would want to be Chair: it's a great Section. Past Chair Lee noted our Section's leadership in the ACS Project SEED thanks to Elaine Yamaguchi and others. Alex Madonik noted the extensive array of outreach activities. We have a very active Women's Chemists Committee and several energetic Student Affiliate groups. We're a notable presence in all of the Bay Area's science festivals. Our Younger Chemists Committee has been growing noticeably the past few years and we even have a fledgling Senior Chemists Committee. There are a lot of ways to get involved; please join us.

As Alicia Taylor takes over as Program hair(part of the Chair-Elect's role) there's already a few events scheduled in 2020. On Wednesday, January 8, 2020 at 5:30pm, there will be a Fireside Chat with Dr. Barbara Smith sponsored by our Women Chemists Committee. Dr. Smith is a VP at the Chevron Oronite Company. The event will be held at the Chevron Richmond Technology Center, Building 10 Auditorium.

At the end of January, I will be giving a talk in Chico on the 2019 Nobel Prize in Chemistry, describing the work of John B. Goodenough, M. Stanley Whittingham and Akira Yoshino. The explanation of lithium-ion batteries and their significance will be targeted at a science-interested audience, not strictly chemists. We started this series last year with the help of an ACS Mini-Grant for Innovative Programs. This year we plan to have talks on the prize-winning work in Physics and Medicine (Biology) in addition to the chemistry talk. Check our website (www.calacs.org) for details.

We also have a Section Meeting planned for mid-February, "Imminent Shaking: What Kind of Earthquake Warning is Possible?"

Once again the ACS has scheduled one of its National Meetings in San Francisco, so we will be co-hosting that event along with the Silicon Valley Section. Those events always provide lots of opportunities for member involvement and it's exciting to see the big world of chemistry that is represented. Hang on for a busy 2020.

Celiac disease: A comparison of modern and heritage varieties part 2

Broad diversity in celiac immunoreactivity also exists among varieties of common wheat. Varieties that express more Gli-2 genes from the A or B genomes, rather than the D genome, will produce fewer α-gliadin celiac T-cell epitopes (Salentijn and others 2009). Other varieties have mutations in α-gliadin coding sequences that alter expression of celiac disease T-cell epitopes.

Data compiled from a limited number of studies indicate that heritage genotypes, on average, express lower levels of celiac immunoreactive compounds. Van den Broeck and others (2010b) compared European heritage and modern varieties for the production of α-9 epitopes implicated in celiac disease. Twelve of 44 heritage collections produced low levels of the epitope, compared to only 1 of 36 modern varieties. In another study, 2 modern genotypes had lower frequency of α-gliadin expression from the A genome (15%), when compared to 5 landraces (29%; Salentijn and others 2009). Among 61 durum accessions, the genotypes expressing the lowest amounts of 3 α-gliadin epitopes (DQ2.5-Glia-α1 (PFPQPELPY), DQ2.5-Glia-α2 (PQPELPYPQ), and DQ2.5-Glia□α3 (FRPEQPYPQ)) were a mix of landraces, old varieties, and modern breeding lines (Salentijn and others 2013). However, modern durum varieties tended to fall in the highest categories of epitope expression. Modern breeding lines constituted 91% of varieties in the most immunodominant category, while old varieties and landraces only represented 9% (Salentijn and others 2013). Genetic linkages between loci for α-gliadins and HMW glutenins may explain why some modern varieties contain more celiac T-cell epitopes. Many modern varieties have been bred for increased HMW glutenin content, which improves bread baking quality when using common wheat and pasta quality when using durum.

Not all heritage genotypes, however, had low T-cell immunoreactivity. Although average intensity of α-9 epitopes was higher in modern varieties, the most immunodominant variety identified by van den Broeck and others (2010b) was a heritage wheat. As Vincentini and others (2009) concluded, old varieties and landraces exist with potent celiac epitopes, indicating that humans have long been exposed to immunoreactive genotypes of wheat. Conversely, studies have identified modern varieties with low expression of α-gliadin epitopes (van den Broeck and others 2010b; Salentijn and others 2013) and IgA reactivity (Constantin and others 2009). Certain varieties of modern wheat have also shown less immunoreactivity than ancient wheat species. In an evaluation of 16 ancient and modern wheats, one line of modern club wheat [T. aestivum L. ssp. compactum (Host) MacKey] induced the second lowest *in vitro* T-cell response and IFN-γ release (Spaenij-Dekking and others 2005).

Efforts have been made to create modern wheat genotypes with lower celiac immunoreactivity. Varieties devoid of any immunoreactive glutens would not be functional, as a portion of celiac patients react with HMW glutenins, which are essential for baking quality (Molberg and others 2003; Dewar and others 2006; van den Broeck and others 2009). Due to linkage with some immunoreactive gliadins and HMW glutenins (van den Broeck and others 2009), traditional breeding methods have not been able to develop celiac-safe bread wheat. Wheat lines which lacked portions of the short arms of chromosomes 1 and 6 expressed fewer celiac T-cell epitopes, although most had reduced baking quality (Molberg and others 2005; van den Broeck and others 2009). One deletion line, lacking part of the short arm of chromosome 6D (6DS-2), had reduced celiac T-cell epitopes and improved bread quality, but demonstrated poor kernel size and milling yield (van den Broeck and others 2011). Lafiandra and others (1987) developed a mutant line with good baking quality by limiting α-, γ-, and ω-gliadins

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Digital Dentistry (Part 1)

Bill Motzer

I have a new dentist and she's great! My old dentist was also great, but I needed one that was closer to home. Like many, I have a tendency to avoid dentists, but when I went in for a long overdue cleaning, my new dentist took a series of full mouth X-rays, also known as dental radiographs. These are used to locate hidden dental structures, malignant or benign masses, bone loss, and dental caries (cavities). Commonly, an image is formed by a controlled and very rapid burst of X-ray radiation penetrating dental structures at different levels before striking X-ray sensitive film or a sensor. The final image depends on varying oral anatomical densities: e.g., teeth appear lighter because less radiation penetrates them before reaching the film. Dental caries, infections, bone density and periodontal ligament changes, all appear darker because X-rays readily penetrate these less dense structures. Dental restorations (fillings, crowns, and bridges) may appear lighter or darker, depending on their material density. Patient X-ray radiation dosage is typically very small: 5 to 10 microsieverts (μSv) per exposure or for a full mouth series ~0.150 millisieverts (mSv). According to the American Dental Association, this is equivalent to a few days of background environmental radiation exposure (in the U.S. this is 6.34 mSv per year or ~0.01 mSv per day), similar to a dose received on a cross-country airplane flight. X-rays taken requiring X-ray film exposure have to be developed in a dark room using traditional chemicals. Although, in the past, this was a rather time-consuming process, newer automatic methods allow the dentist or technician to develop film within a few minutes. However, if any mistakes occurred in film placement, over exposure, or development, the dentist or technician would have to retake the X-ray images, requiring additional time and additional X-ray exposure to the patient. Within at least the last two to three years, a relatively new technique has replaced X-ray film with a solid-state electronic sensor requiring less radiation and with rapid processing capabilities, generally within minutes of exposure. Results can then be almost instantaneously viewed on a computer screen. This process requires small flexible solid-state plates, known as indirect detector scintillators (scintillometers); these contain some very interesting substances, involving a combination of chemistry, materials, and solid-state engineering. Indirect detectors contain a layer of scintillator material capable of converting X-rays into light. For X-ray imaging, the most frequently used substances are terbium- (Tb, Z=64) activated or doped gadolinium oxysulfide (Gd_2O_2S:Tb; aka gadolinium sulfoxylate, GOS or Gadox, CAS number: 12339-07-0) or cesium iodide (CsI). [Note: Gadolinium (Gd, Z=64) is an interesting element in the Lanthanide group, aka "rare earth elements;" see "How Rare is Rare," March to May 2011 *Vortex*. Gadolinium, like most lanthanides, forms trivalent ions with fluorescent properties therefore: gadolinium(III) salts are commonly used as phosphors.] Both substances are capable of converting X-rays into light in a phosphor layer suspended in a polymer matrix. When exposed to X-rays, Gd_2O_2S:Tb, emits a green light at wavelengths ranging from 382 to 622 nanometers (nm), with a primary emission peak at 545 nm because of Tb(III). Gadolinium energy conversion can range to 20 percent, meaning that at least one-fifth of the X-ray energy striking the phosphor layer may be converted to visible photons. Behind the scintillator layer is an amorphous silicon substrate detector containing a thin-film transistor that forms a grid patterned on the substrate. This is similar to detectors in liquid-crystal display (LCD) television and computer monitors, where millions of ~0.2 mm pixels contain a photodiode receptor capable of generating an electrical signal proportional to light produced by the scintillator layer in front of the pixel. Photodiodes signals are then amplified and encoded by

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additional electronics located at the edges or behind the sensor array to produce an accurate and sensitive digital representation of the X-ray image. Final images shown on a computer screen can be readily observed and reviewed by both the dentist and patient with explanations by the dentist of the patient's condition. In my case, a carie or cavity had formed under a crown and she recommended the crown's removal and replacement. I cringed, knowing the time and effort it took when the original crown was put in. But I was in for a surprise and that's a story for next time.

A Project SEED Bequest from Bruce J. Harris

The California Section has received a bequest of funds for Project SEED with the passing of Bruce J. Harris, a long time contributor to the program. Mr. Harris passed away in Kalispell, Montana, on September 15 of last year. He was a longtime resident of Berkeley and had permanently moved year round to Kalispell in 2017. He is survived by his wife, Marilyn Reynolds, son Chris (Karen) and granddaughter Jazmine, along with many step-children, step-grandchildren, and step great grandchildren. He was previously married to Phyllis Brooke Colson, Emily Barlow King, and Sondra Kennedy Harris.

Mr. Harris was an electrical engineer and graduated from the University of California, Berkeley, in 1948. He obtained a master's degree from Golden Gate University in 1979. He was a veteran of both World War II and the Korean War. Mr. Harris had a career in telecommunications and radio. He was a founder of the East Bay Chapter Hearing Loss of America. He and his wife spent summers in Montana for many years where they volunteered at Glacier National Park before they moved to Montana on a permanent basis. Mr. Harris had supported the Section's Project SEED program for many years through contributions as he was an admirer of the efforts of SEED founder, Dr. Alan Nixon.

The Section is very grateful for the bequest and it will be administrated by the Board of Trustees for Project SEED's use.

We thank the East Bay Times for permission to use information in Mr. Harris' obitu-

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encoded by the Gli-A2, Gli-D1, Glu-D3 loci. When tested with an i*n vitro* organ culture, the mutant line did not cause damage to villi (Frisoni and others 1995), but it did induce IFN-γ and cytokine IL-2 production (Carroccio and others 2011).

Transgenic approaches have been successful at reducing celiac T-cell epitopes while maintaining bread quality. Gil-Humanes and others (2010) used ribonucleic acid (RNA) interference to downregulate α-, γ-, and ω-gliadins. The transgenic lines produced up to 91% fewer α-gliadins, 81% fewer ω-gliadins, and no γ-gliadins. When tested against T cells derived from celiac patients, several lines were able to substantially reduce T-cell responses. As an added benefit, the transgenic lines compensated for gliadin reductions by increasing HMW-glutenins, which resulted in medium to high bread quality. As these lines still induced low levels of T-cell responses, celiac patients would need to limit consumption of these wheat varieties in their diets.

ATIs (Amylase-trypsin inhibitors)

Different species and genotypes of wheat produce varying types and amounts of ATIs implicated in celiac disease, wheat allergy, and NCWS (Figure 3B). ATIs are encoded by the B and D genomes of common wheat, suggesting that diploid and tetraploid species lacking one or both of these genomes might produce fewer ATIs. Specifically, Wang and others (2006) mapped the problematic 0.19 fraction to the D genome of wheat. As it lacks both B and D genomes, einkorn contained no coding regions and produced no proteins for ATIs (Wang and others 2006; Larré and others 2011; Zoccatelli and others 2012) and no human α-amylase inhibition was detected in various einkorn genotypes (Bedetti and others 1974; Vittozzi and Silano 1976; Sánchez-Monge and others 1996).

Varieties of durum and emmer inhibited total α-amylase activity in human saliva at levels equal to (Vittozzi and Silano 1976) or higher than common wheat (Bedetti and others 1974; Sánchez-Monge and others 1996). While ATIs of durum and emmer differ from those of common wheat, they did contain the CM3 ATI that was implicated in celiac disease, wheat allergy, and NCWS (Capocchi and others 2013). Although significant varietal differences were found among 3 durum genotypes by Prandi and others (2013), environment had a stronger influence on CM3 ATI content than genotype. Locations that yielded more protein content consistently produced lower amounts of CM3 ATI (Prandi and others 2013).

Types and quantities of ATIs also vary among genotypes within a species. Two-fold intraspecific differences were recorded in α-amylase inhibition among 7 durum lines and 113 common wheat lines (Bedetti and others 1974; Baker and others 1991; Sánchez-Monge and others 1996). Although Junker and others (2012) indicated that ATIs may have been increased through modern wheat breeding programs, no studies that directly compared heritage and modern wheat genotypes for inhibitory activity against human enzymes were found. ATI activity for only 1 variety that was released before 1950 was reported in the literature. The heritage variety, "Clarkan," induced the 5th highest ATI activity out of 104 common wheat varieties studied (Baker and others 1991). Hypoallergenic rice has been developed by downregulating ATIs (Tada and others 1996), but no such varieties have been developed in wheat.

ESCAIDE 2019 – A Smörgåsbord of Infectious Disease Epidemiology
Posted January 21, 2020 by Artur A in Conferences

(The title is an homage to the host country of the conference – Sweden – where the smörgåsbord is a buffet-style meal served on a large table. In English, the term has also adopted a more general meaning describing a variety of items on offer, such as a conference with a wide choice of interesting sessions!)

In November 2019, *PLOS ONE* staff editor Artur Arikainen attended the European Scientific Conference on Applied Infectious Disease Epidemiology (ESCAIDE), held this year in the home of the European Centre for Disease Prevention and Control (ECDC) – Stockholm, Sweden. The conference brought together over 600 attendees from 46 countries, including 20 non-EU countries. As with ESCAIDE 2018, the themes of the scientific sessions were varied and engaging – ranging from emerging diseases, to healthcare-associated infections, to food- and water-borne diseases.

Speaker Mike Ryan (left) with ESCAIDE Scientific Committee Chair and session chair Mike Catchpole [Credit: ECDC]

On the topic of health security and preparedness, Dr. Mike Ryan (WHO Health Emergencies Program) provided an insightful update on the ongoing Ebola outbreak in DR Congo, where local conflict and community frustrations present increased challenges to stopping the spread of this deadly disease. The World Health Organization, WHO, has been responding to 30,000 Ebola infection alerts each week, and has traced an impressive 235,000 contacts so far (which required 5,000,000 total patient visits). Given the >170 current infectious disease outbreaks occurring worldwide (of which Ebola is merely one), Dr. Ryan highlighted that preparedness capacity still needs to be developed and maintained for possible future high-impact, large-scale epidemics, deadly global pandemics, and/or cases of deliberate or accidental bioterror agent release.

A number of agencies and organisations that conduct field operations like those in DR Congo have a strong presence at ESCAIDE every year. The ECDC themselves run two training programmes in field epidemiology (EPIET) and public health epidemiology (EUPHEM), with many current and past fellows attending ESCAIDE, including the EPIET alumni network (EAN). Other organisations well represented at ESCAIDE include the Training Programs in Epidemiology and Public Health Inter-

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ventions Network (TEPHINET) and the Global Outbreak Alert and Response Network (GOARN).

During the conference, delegates were invited to participate in a live, on-screen vote via the conference app on what they thought the key priorities for epidemiologists should be for the near future. On a national level, antimicrobial resistance (AMR) was deemed most important, followed by climate change. From a global perspective, climate change ranked highest, followed by AMR. Other issues like outbreaks, vaccines, microbiomes, and non-communicable diseases scored somewhat lower, highlighting the pressing desire in the epidemiology community to address AMR and climate change problems first. We at *PLOS* recognise the importance of these topics to human health and well-being, and have launched several Calls for Papers on related topics, including AMR, Urban Ecosystems, and Microbial Ecology of Changing Environments. Of note, the AMR Collection publishing today was inspired by the discussions at ESCAIDE 2018.

On the impact of climate change on human disease epidemiology, Dr. Henriette De Valk and Prof. Ana Maria de Roda Husman presented informative and sobering overviews on changes in vector-borne, water-borne, and other diseases that have been observed and can be expected to occur in the future. Warming temperatures in Europe create opportunities for mosquitos and other disease vectors to spread further North, reaching new human populations, as has been the case with West Nile virus. The conclusion drawn from their talks is that time is running out and action is needed now to stop things becoming much worse later down the line.

Speakers Henriette De Valk (top) and Ana Maria de Roda Husman (bottom) [Credit: ECDC]

The important issue of vaccination was also covered in a plenary session and in multiple parallel sessions. Prof. Wolfgang Gaissmaier (University

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of Konstanz) and Dr. Robb Butler (WHO Europe) presented an overview of human behaviour and decision-making that gives rise to vaccination hesitancy in some countries. This is particularly pertinent with the backdrop of multiple current outbreaks of measles around the world – a disease that had practically been eradicated in the developed world until these recent resurgences. Recommendations presented include communicating benefits/harms more understandably, complementing evidence with human stories, understanding reasons for hesitancy and targeting concerned patients, setting positive messages (without repeating myths), lowering barriers to vaccination access, and highlighting social benefits (e.g. herd immunity). Original blog is located at this link. *https://blogs.plos.org/everyone/2020/01/21/escaide-2019*

Speakers Robb Butler (left center) and Wolfgang Gaissmaier (right centre) with session chairs Františka Hrubá (left) and Bojana Beović (right) [Credit: ECDC]

BUSINESS DIRECTORY

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