

# THE VORTEX

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# THE VORTEX

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## Chair's Message



Jim Postma

As the end of the year approaches and we look forward to the holidays, I thought I would take a different approach this month. Instead of touting the California Section and

its programs I thought I would offer you some suggestions for your holiday reading or gift-giving needs. You could use these books to recruit future chemists, as most of them should be interesting to anyone from high school age through adulthood. I own a copy of each but have not had the time yet to read each one. Your reviews might make a good note for the Vortex or could serve the J. Chem. Ed. column of book reviews.

*Napoleon's Buttons: How 17 Molecules Changed History* (Penny Le Couteur and Jay Burreson): This book is a fascinating study of history and economics structured around 17 chemical substances that are (or were) in great demand.

*The Disappearing Spoon: And Other True Tales of Madness, Love, and the History of the World from the Periodic Table of the Elements* (Sam Kean): If you enjoy history but need more adventure and intrigue in your literature, try this one out.

*The Poisoner's Handbook: Murder and the Birth of Forensic Medicine in Jazz Age New York* (Deborah Blum): For fans of CSI (or Agatha Christie) this is the one. If you like "happily ever after" tales, perhaps you should choose another.

*Periodic Tales: A Cultural History of the Elements, from Arsenic to Zinc* (Hugh Aldersey-Williams): This may be the one for those already interested in chemistry. It describes the quirky history of the names and origins of the elements and their uses.

*The Joy of Chemistry: The Amazing Science of Familiar Things* (Cathy Cobb and Monty L Fetterolf): This may be the one to use for recruiting new chemists to the fold. It describes the fascinating chemistry of familiar phenomena such as the turning of the seasons and fireworks.

(continued on page 8)

## Memorial Service

A Memorial Service for Glenn Fuller will be held at the Berkeley City Club at 2315 Durant Ave. on Nov. 11 at 2:00pm.

## November Section Meeting

**Topic:** Infant feeding strategy affects gut microbial composition, immunity, and metabolism

**Speaker:** Carolyn Slupsky, Assistant Professor, Dept. of Nutrition & Dept of Food Science & Technology, University of California, Davis

**Date:** Thursday, Nov 15, 2012. Social Hour: 6:00, Dinner: 7:00, Talk: 8:00

**Place:** Caffe Venezia; 1799 University Ave, Berkeley, CA 94703; (510) 849-4681.

Cost: \$35 (Students \$18). Reservations at office@calacs.org (510-351-9922). Pay at the door.

**RSVP:** By 10pm Friday, Nov 9, 2012

**Directions:** from I-80 or I-580; Take University Ave. exit, head east on University Ave., up to thee corner of University and Grant.

**Dinner:** House Salad, Caesar Salad or Soup Entree Course (Choose one) \*Pizza Margarita \*Malfatti: house made pasta, crimini and porcini mushroom, roasted tomatoes, vermouth and cream \*Orecchietti with Sicilian pistachio, pesto, bacon and bull blood sprouts \*Grilled Rib Eye with potato croquettes, caramelized onions, gorgonzola and arugula \*Roasted Salmon with chard, parsnip mash and English pea lemon butter.

**Dessert:** Almond Torte, Tiramisu or Torta Gelato

### *Abstract:*

The long- and short-term health benefits of breast-feeding have long been recognized. Indeed, breast-feeding is associated with lower incidences of diarrhea and necrotizing enterocolitis (intestinal tissue death) in early life, in addition to lower incidences of inflammatory bowel diseases, type-2 diabetes, obesity, and cardiovascular disease later in life.

The mechanism by which breast-feeding imparts these protective measures is poorly understood partly due to a lack of available analytical methods to measure the comprehensive effects of feeding practices on infant metabolism. Rhesus Macaque monkeys are widely used as models for human physiology and behavior given their genetic and developmental similarities to humans, as well as similar susceptibility to disease. The early nutritional requirements of infant Macaques closely match those of human infants, making them ideal for studies on infant nutrition and metabolism. Comprehensive metabolic, cytokine, and microbial profiling have been accomplished on infant rhesus Macaques either bottle-fed a standard infant formula or breast-fed.

We observed substantially different gut microbial patterns, cytokine profiles, and overall metabolism in formula-fed infants

compared with breast-fed. These studies highlight a link between early infant feeding practices and the potential development of metabolic diseases later in life.

### *Biography:*

Dr. Carolyn Slupsky is an Assistant Professor in the Departments of Nutrition, and Food Science & Technology at the University of California, Davis. She is an NMR spectroscopist, with a PhD. in Biochemistry from the University of Alberta, Canada. Her research background includes metabolomics, protein structure and function, receptor-ligand and protein-protein interactions, structure-aided drug design, and software development. She previously served as Chief Scientific Officer for Chenomx Inc., developing software for metabolite analysis by NMR, and pioneered the technique of targeted profiling by NMR. She previously led metabolomics translational research at the University of Alberta for several years, focusing on diagnostics in infectious and pulmonary diseases, gastroenterology and oncology, and is now engaged in research at UC Davis to understand the role of bacteria in health and the onset and progression of disease.



*SCIENCE CAFE*  
*Co-Sponsored by*  
*Lafayette Library and Learning Center Foundation*  
*California Section ~ WCC of the American Chemical Society*  
*Tuesday, November 27, 2012*  
*CARBON CYCLE 2.0: A sustainable energy future?*

Most scientists now agree that the earth's climate is changing in large part due to human activity. So, is it possible to produce the energy we need without carbon emissions? Paul Alivisatos, an award-winning chemist and scientist at Lawrence Berkeley National Laboratory, will join us to share his latest work: Carbon Cycle 2.0 (CC2.0). CC2.0 is a multifaceted approach which includes research efforts in climate modeling, energy analysis, building efficiency, combustion, batteries and energy storage, biofuels, carbon capture and sequestration, solar PV and artificial photosynthesis. Join us to get the full story, hear the potential solutions, and find out what our energy system could look like in 2050!

**WHEN:** Tuesday, November 27th Doors Open 6:30 p.m. ~ Program 7:00 to 8:00 p.m.

**WHERE:** Lafayette Library and Learning Center, 3491 Mt. Diablo Blvd.

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*International Year of Chemistry (IYC)*

Attila Pavlath, as Chair of the International Year of Chemistry and with the support of the California Section, continues to carry on in the spirit of IYC11.

A visit was made to the Panhandle Plains Section on their 75<sup>th</sup> year anniversary celebration. Dr. Pavlath provided Certificates to all past Chairs still alive and living in the Section. He gave a talk on the contributions of chemistry to our life while displaying the Technology Milestones in Chemistry Exhibit. The Ambassador of Chemistry Ribbon was given to the Chair to be used at the forthcoming National Chemistry week.

Dr. Pavlath, in his continuing efforts to promote cooperation between the five International Science Chapters, helped the Thailand chapter draft their request for cooperation with the California Section.

Dr. Pavlath has arranged a meeting of the Hungarian Chapter with Marinda Wu while she is visiting Romania, Poland, and Hungary.

The Korean Chemical Society invited Dr. Pavlath to visit Korea and help create a book (in English) on the Communication and Public Understanding of Chemistry. It is scheduled for November or December.



## Of Groundwater & Graves

Bill Motzer

### Introduction

"Because," said Scrooge, "a little thing affects them. A slight disorder of the stomach makes them cheats. You may be an undigested bit of beef, a blot of mustard, a crumb of cheese, a fragment of an underdone potato. There's more of gravy than of grave about you, whatever you are!"

Ebenezer Scrooge to Marley's Ghost  
in Charles Dickens' "A Christmas Carol"

This time of year (October and Halloween), I wax nostalgic concerning certain past projects. One such project entailed the siting at a proposed memorial park and cemetery. Under California's Environmental Quality Act (CEQA) if large developments require an Environmental Impact Report (EIR) it is the public's right to comment and question potential environmental concerns. One questioner asked if a new cemetery could cause soil and groundwater pollution from decaying bodies and caskets. Such concerns are reflected in newer natural or "green" burial methods where no embalming occurs. However, very few detailed scientific papers exist discussing potential environmental impact.

### Sources

Bodies: a 70 kg human male body is a complex mixture (by weight) of organic (~20% protein/muscle, 10% fat, 1% carbohydrates), inorganic (5%) substances, and water (64%). Approximately 85% of the human body is either readily to moderately degradable, while only 20% degrades slowly and 5% is inert. A human corpse decays rather rapidly in about one year, and after 10 years less than 0.1% of original load remains

Decomposition chemicals include volatile fatty-like butyric and propionic acids (primary decay products of muscle and fat), amino acids, ptomaine [e.g., skatole or 3-methylindole, cadaverine and putrescine, a foul-smelling amino-organic compound:  $\text{NH}_2(\text{CH}_2)_4\text{NH}_2$ ] and end products (e.g.,  $\text{CH}_4$ ,  $\text{CO}_2$ ,  $\text{CH}_3\text{SH}$ , and  $\text{H}_3\text{PO}_4$ ).

Soft tissue decomposition begins several

hours after death largely by autolysis, followed by fermentation from intestinal tract pathogens (bacteria and viruses). The process is mostly anaerobic, followed by both aerobic and anaerobic facultative bacterial decay. Other microorganisms such as saprophytic fungi and insects help in the putrefaction process. Four principal phases of human body decomposition occur: chromatic, gaseous, humorous and skeletonization of which the gaseous and humorous phases are the most important in environmental decomposition.

During the first weeks of gaseous decomposition, gas generation in different organs and tissues results in cavity rupture with subsequent humorous liquid release and/or tissue liquefaction. This phase may occur over several months or years, depending on cadaver structure and burial conditions. Abdominal cavity rupture results in very slow fluid leakage allowing water evaporation in and around the burial site. Unsaturated soil may therefore become impregnated with fatty substances and intermediate non-volatile products that could subsequently percolate to shallow groundwater.

Embalming chemicals preserve by retarding decay and present a more life-like appearance to the cadaver, and reduce and prevent pathogen (i.e., bacteria and virus) spread. Embalming fluids are mixtures of formaldehyde ( $\text{CH}_2\text{O}$ ), glutaraldehyde, and preservatives, seldom exceeding 2% in a 5% formalin solution. A saturated formalin solution may contain about 40% formaldehyde by volume or 37% by mass. Stabilizers (e.g., 10 to 12% methanol) with various trace metallic impurities are added to limit oxidation and polymerization. About 9 L of a 2% formalin solution is injected into a body, giving an initial potential effluent concentration of ~90 mg/L. If unreleased, after four years this solution degrades to about 5 mg/L and after ten years to 0.1 mg/L. Formaldehyde is also produced naturally from forest fires, animal waste, and bacterial and fungal decay of vegetation. It may not be possible therefore, to distinguish formaldehyde

*(Continued on page 7)*



*(continued from page 6)*

generated by human decay and natural sources.

The scientific literature contains little information on the transport and fate of cadaver embalming solutions, except to indicate that it may be a problem. Such release estimates seldom account for formaldehyde's natural degradation in soil or groundwater. Formaldehyde has a  $t_{1/2}$  in soil of ~1.0 to 7 days and in groundwater of 2 to 14 days. Using the 14-day  $t_{1/2}$ , if all human cadaver formaldehyde was released at once, almost complete (99.7%) degradation would be expected within approximately 100 days. However, much formalin solution degradation occurs within body tissues and may even occur within the casket by adsorption to casket materials. Therefore, formaldehyde in embalmed bodies is not expected to be a significant environmental contaminant.

### **Pathogens:**

The human body contains many pathogens ranging from benign to toxic. When injected into the body, formaldehyde significantly reduces common pathogens. Additionally, when released from a decaying body, most pathogens are retained at or near the soil's surface. Virus movement through the soil column is more easily fixed or retarded than bacteria because viruses readily become attached to soil particles. Finally, biodegradation within the soil zone is enhanced by natural vegetation cover (i.e., grass, shrubs, and trees). Experiments, conducted in the U.K, showed that repeated

additions of skeletal muscle tissue to soil also led to enhanced decomposition rates, not accompanied by increases in soil microbial biomass. Furthermore, the soil's overall biological and chemical properties did not significantly change. Finally, the experiments showed that soil type can significantly enhance or restrict cadaver decomposition products following burial. To maximize retention, clay and sand mixtures with small- to fine-grained textures and low porosities are desirable.

### **Metals:**

Three metallic sources can be expected from human burials, including those: (1) contained in body tissues, (2) introduced from embalming fluids, prosthetic devices, and amalgam fillings, and (3) within the casket. Natural body heavy metals (e.g., lead) occur only in trace quantities. From 650 BCE to the early 1900s, arsenic and mercury compounds were used in European and American embalming fluids to preserve bodies for detailed dissection and surgical study. Arsenic and mercury were also used in Civil War embalming because families wanted their relative's bodies returned in pristine condition. In 1901, Michigan banned arsenic- and mercury-containing embalming fluids. Other states followed and by 1905, such embalming fluids were declared illegal throughout the U.S. Generally, in modern natural burial, amalgam is removed and most modern prosthetic devices contain relatively inert metals. Simple wooden caskets have little to no metals.

*(continued on page 8)*



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### Groundwater Protection

The few completed cemetery vulnerability studies addressing the above indicate that to protect groundwater, graves should be at least 250 m from wells or springs, 30 m from field drains, and 2.5 to 3.0 m above shallow groundwater. Also, they should not be sited directly above fractured bedrock and not deeper than 1.5 m below ground, with a mean plot density not greater than 1,480 graves per hectare.



(Continued from page 3)

*Uncle Tungsten: Memories of a Chemical Boyhood* (Oliver Sacks): You might call this a boyhood autobiography by the author of *The Man Who Mistook His Wife for a Hat* and *Awakenings*. It might bring back memories of family members with eccentricities (or make you reflect on your own.)

*The Elements: A Visual Exploration of Every Known Atom in the Universe* (Theodore Gray): This would be a great coffee-table book. It is visually stunning and the fascinating for that aspect alone. But the captions and text make it much more than just a picture-book.

Feel free to make your own suggestions for Vortex readers. E-mail me at [jpostma@csuchico.edu](mailto:jpostma@csuchico.edu).



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### Ballots and Elections

If one could convert all of the requests for votes into pennies, someone could make a fortune. Here is one more request that will add to that fortune.

Your California Section ballots should have arrived. If you have not mailed them back, please do so now.

Thank you  
Election Committee  
California Section

The California Section and the staff at the *Vortex* wish all a Happy Thanksgiving





Here are some more pictures of the volunteers that helped make the SOLANO STROLL a successful outreach effort of the California Section.

Thanks to all the Volunteers.

## Leopold May (1924 - 2012)

Sadly we report the passing of Leopold May, Professor Emeritus of Chemistry at the Catholic University of America, and collector of chemical anniversaries, many of which have been published in the *Vortex*. For years, Prof. May gathered and generously contributed chemistry- and science-related trivia for the benefit of many programs of the ACS. Prof. May was a long-time ACS member and active in his local section, the Chemical Society of Washington.

Beloved husband of 65 years to Evelyn May; adored father of Kenneth and Ira (Yvette), and proud grandfather of Stephen. He is survived by a brother, Mitchell.

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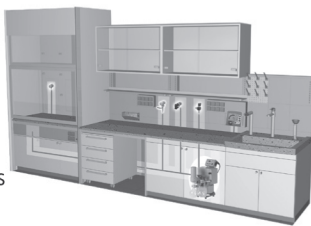
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