THE VORTEX

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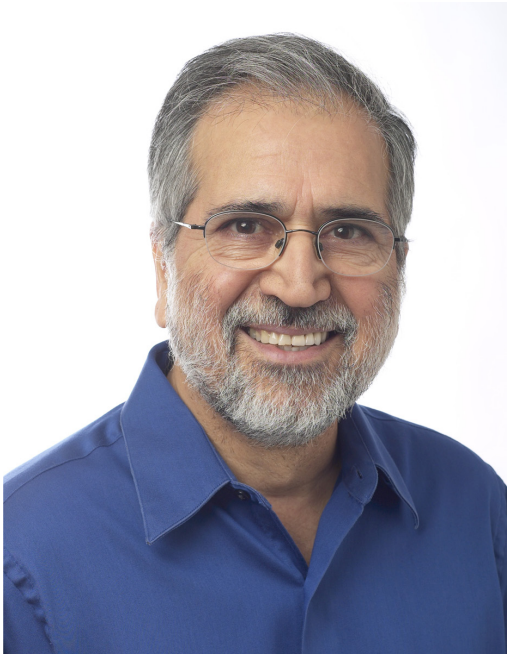

Dr. Ripudaman Malhotra, Speaker, at the January Section Meeting

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THE VORTEX

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Volume LXXIII January 2012 Number 1

Chair's Message

Jim Postma

It is a bit intimidating to take over the Chair role in an ACS section that has such a strong tradition of excellence in leadership. There is the legacy that includes seven (and soon to be eight) ACS national presidents from our section. If it were not for the strong pledges of support from Bryan, Paul, Eileen, Miranda and many others, I would not even attempt to fill the role of Section Chair.

It is great that the spotlight will be shining on Miranda Wu as she begins her Chair-Elect role shortly. That will allow our section to continue to emulate the "How can we make things better?" that she exemplifies and that motivates so many of the members of our section. I will work to see that our Section continues to be one of the strongest and most active. To meet these goals I will need help from all of our Members. We need your participation to help with our outreach programs to children, highschool and college students to name just a few. Hear this call for help. Call our office 510 351 9922, and we will return your call and explore how you can help.

For the past 30 years I have been part of the chemistry faculty at California State University, Chico. I have led the Northern California Subsection of the ACS for the past few years. Our Subsection activities have included one or two meetings each year with a range of interesting speakers from around the State. Our participants are largely from the faculty and students of CSU, Chico as well as Butte, Yuba, and Shasta College.

I hope you can mark your calendars now for an event that I think will be informative and enjoyable on Saturday, February 25 in Chico. The Subsection is inviting all of the California Section (and the Sacramento Section as well) to a behind-the-scenes tour of the Sierra Nevada Brewery, a company that has become well known and admired in the last few decades as one of the first successful microbreweries (although the term "microbrewery" and an annual output of almost 1 million barrels of ale and beer are a bit of a mismatch.) The tour will be followed by lunch in the Brewery restaurant and that will be followed by a presentation from Dr. Charlie Bamforth, the Anheuser-Busch Professor of Malting and Brewing Sciences and chair of UC Davis Food Science and Technology Department. He is the author of several books on brewing and malting science and has studied the nutritional merits of beer. He is a delightful speaker, entertaining and informative. I hope you will consider joining us and maybe even spending the weekend in town.

Educational Grants Committee Report

In the seventeen years of the Section's Educational Grants Program, well over 100 teachers have been chosen to receive almost $150,000 for purchases ranging from spectrometers to glassware to pH meters to registration at ACS national meetings. We have received numerous letters of thanks from the recipients, pictures of grant purchases being used by the students, and copies of students' reports, indicating that the program continues to be a fantastic success! For this past year, the program was funded at the level of $3,000, and this was raised to $3500 by a donation from a section member. Grant applications were solicited from high school, college and university chemistry departments in the Spring of 2011, and awards were made at the beginning of the 2011-2012 academic year.

From the grant applications for this year, the committee selected seven schools at the beginning of the 2011/2012 school year to share the allocated $3,500. Included in this, the grants committee awarded $400 for support of the ACS booth at the International Science and Engineering Fair (ISEF) in May 2011. Bill Anderson from Del Norte High School received funding for an electronic balance, while Jenelle Ball of Chico Senior High School received the funds to buy temperature and radiation probes for her students' laboratory. Beth Cutter from Amador Valley High School (a past winner of our high school teacher award) was funded for electronic lab equipment, while Brian Green from Shasta Meadows Elementary School received funds to support his science demonstrations with students from local middle and high schools. Julie Hubbard from Liberty High School received funding for lab demonstrations, while two other grants went to Kathleen Shoff at Enterprise High School for the purchase of lab equipment, and to Candace Sykes at American High School for solar cells and centrifuge tubes.

The Educational Grants Committee is looking for alternative means to supply funds or donated materials to help the schools that were not selected to receive a full grant and is soliciting support from local companies. The California Section is committed to supporting the chemistry teachers in our local high schools, colleges and universities, and we are excited about this program and gratified by the enthusiastic response we have had in this seventeenth year. We believe that a program such as this is one way to let schools know that the American Chemical Society is vitally concerned about its educators' needs and the needs of their students.

California Section American Chemical Society
January Meeting
"A Cubic Mile of OIL"

Speaker: Dr. Ripudaman Malhota,Associate Director of Chemical Science and Technology Laboratory of SRI International's Physical Sciences Division
Date: Monday, January 23, 2012
Time: 6:00 pm Social Hour, 7:00 pm Talk
Place: Chevron Richmond Technical Center, 100 Chevron Way, Richmond, CA
Cost: $10 Light snacks and beverages will be served during the Social Hour
Reservations: RSVP by Friday, January 20, to the Section office by e-mail at office@calacs.org or call (510) 351-9922. To prepay, please send check to Cal. Section, ACS at 2950 Merced Street, #225, San Leandro CA 94577 no later than Wednesday, January 18, 2012.

Abstract:

One cubic mile of oil (CMO) corresponds very closely to the world's current total annual consumption of crude oil. The world's total annual energy consumption - from all energy sources- is currently 3.0 CMO. By the middle of this century the world will need between 6 and 9 CMO of energy per year to provide for its citizens. Adequate energy is needed to remove the scourge of poverty and provide food, clothing, and shelter for the people around the world, and more will be needed for measures to mitigate the potential effects of climate change such as building dikes and for desalinating water.

A Cubic Mile of Oil describes the various energy sources and how we use them, projects their future contributions, and delineates what it would take to develop them to annually produce a CMO from each of them. The requirement for additional energy in the future is so daunting that we will need to use all resources. We also examine how improved efficiency and conservation measures can reduce future demand substantially, and help distinguish approaches that make a significant impact as opposed to merely making us feel good.

Use of CMO eliminates a multitude of units like tons of coal, gallons of oil, and cubic feet of gas; obviates the need for mind-numbing multipliers such as billions, trillions, and quadrillions; and replaces them with an easy-to-understand volumetric unit. It evokes a visceral response and allows experts, policy makers and the general public alike to form a mental picture of the magnitude of the challenge we face.

Biography:

Dr. Ripudaman Malhotra is Assoc.Director of Chemical Science and Technology Laboratory in SRI International's Physical Sciences Division. Dr. Malhotra is an organic chemist, and has worked extensively on the processing and analysis of fossil fuels, and advanced materials. His work on coal liquefaction and pyrolysis resulted in identification of novel pathways for hydrogen transfer by which strong bonds in coals are broken. He is currently investigating pyrolysis and gasification of coals at elevated pressures under conditions using a radiant furnace that allows complete capture of all the products for detailed mass and element balance. Lately, Dr. Malhotra has been studying the applications of biotechnology in the areas of energy, chemicals, and environment. He has co-authored a book on Nitrations, edited one on Combinatorial Materials Development, as well as co-edited one on Advanced Materials. He recently co-authored a book with Hew Crane and Ed Kinderman on the global energy crisis, *A Cubic Mile of Oil: Realities and Options for Averting The Looming Energy Crisis* to be published by the Oxford University Press. He is Editor for the Fossil Fuels Section of the multi-volume Encyclopedia of Sustainability Science and Technology to be published by Springer. Dr. Malhotra received his Bachelor's (1971) and Master's (1973) degrees in chemistry from Delhi University, India, and a PhD from USC (1979). Dr. Malhotra is the recipient of the SRI 2005 Fellows Award, the highest honor SRI bestows upon its employees for technical excellence.

Recycling Water (Part 2)

Bill Motzer

In the December 2011 Vortex, I described some of Californiaís recycled water (RW) characteristics and history. In 2010, Senate Bill 918 revised California's water code in which the California Department of Public Health (CDPH) was required by December 31, 2013 to adopt uniform criteria for RW that was to be used to recharge groundwater. By December 31, 2016, CDPH must also adopt appropriate surface water criteria. As part of this requirement, CDPH Division of Drinking Water and Environmental Management (DWEM), which also regulates public water systems, must set standards for wastewater reuse to protect public health. However, the Regional Water Quality Control Boards (RWQCBs), under the State Water Resources Control Board (SWRCB) also have permitting and ongoing oversight authority of Groundwater Recharge Reuse Projects (GRRPs) involving RW usage. Because of potential duplication and confusion between two involved state agencies, in 1996 both the SWRCB and CDPH signed a Memorandum of Agreement (MOA) to resolve any technical and/or procedural differences. Essentially, CDPH DWEM reviews RW proposals for compliance with California Code of Regulations (CCR) Title 22 Criteria, which provides requirements and recommendations to RWQCB for RW permits. They also regularly interface with the RW industry and review new and emerging technologies. Since writing Part 1 of this series, a newly revised draft regulation under CCR 22 was issued on November 21, 2011, for RW produced from domestic sewage. The new draft regulation is quite complicated and is in process of being intensely reviewed with workshops and other opportunities for public comment. The draft regulation essentially includes requirements for: (1) source water control, (2) proper treatment processes, (3) management of ongoing monitoring programs for recycled water and groundwater, (4) determination of multiple barriers for identified contaminant types, (5) time required to identify and respond to problems, (6) determination of effective natural barriers, (7) determination of indirect potable reuse, and (8) protection of groundwater aquifers designated as drinking water sources.

One of the uses of RW is to replenish groundwater (GW) basins that are currently used as drinking water sources. To do this however, RW must:

(1) Have low tolerable risk. Generally this is accomplished by determining that there is a one in 10,000 (10-4) annual risk of infection from pathogenic microorganisms (or less), that drinking water standards are met, and that unregulated chemical control has been established.

(2) There is no degradation of an existing water source(s).

(3) There are multiple barriers to potential contaminant transport.

To implement the above, the November 21, 2011 draft regulations refer to indicator compounds for soil treatment process (i.e., RW applied directly to soil). An indicator compound is an individual Chemical of Emerging Concern (CEC) occurring at a quantifiable level, and representing certain physicochemical and biodegradable characteristics in a family of trace organic constituents. These are relevant (and important) to transport and fate processes occurring during wastewater treatment. Examples of suitable indicator compounds are listed below.

Acetaminophen	Estriol (E3)
Metoprolol (Lopressor)	Atenolol
Estrone (E1)	Naproxen
Atorvastatin (Lipitor)	Fluoxetine (Prozac)
NDMA	Bisphenol A (BPA)
Gemfibrozil	Nonylphenol
Caffeine	Hydrocodone
Propranolol	DEET

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(Vicodin)	Salicylic acid
Diclofenac	Ibuprofen
Sulfamethoxazole	Dilantin
Iopromide	Triclosan
Erythromycin–H2O	Ketoprofen
Trimethoprim	17β-Estradiol (E2)
Meprobamate	

Many of the above CECs are included in Pharmaceutical and Personal Care Products (PPCPs) and some are briefly described in ìA Chemistís Conundrum, Part 2î (September 2010 Vortex). Additionally, the draft regulations require that wastewater treatment facilities show or demonstrate that sufficient oxidation has occurred to degrade these substances during wastewater treatment. To do this they must analyze for indicator compounds from at least nine functional groups as listed below.

Therefore, detection of an indicator compound should provide a conservative assessment of treatment/removal processes. However, many of the above CECs are environmentally persistent and do not readily degrade or break down in the environment (i.e., soil, surface water, and groundwater). Others do, and recent research has determined that in some cases the daughter product may be more toxic than the parent. None the less, it is important that we understand both their toxicity at very low concentrations and the risks associated from degradation if they are inadvertently discharged. These will be discussed in Part 3.

Functional Group	Example of Indicator Compound
(A) Hydroxy Aromatics	Acetominophen, Benzyl salicylate, Bisphenol A, Estrone, Hexyl salicylate, Isobutylparaben, Methyl salicylate, Nonylphenol, Oxybenzone, Propylparaben, Salicylclic acid, Triclosan, Clorfibric Acid
(B) Amino/Acylamino Aromatics	Sulfamethoxazole, Atorvastatin, Triclocarban
(C) Nonaromatics with carbon double bonds	Acetyl cedrene, Carbamazepine, Codeine, Hexylcinnamaldehyde, Methyl ionine, OTNE, Simvastatin hydroxyl, Terpineol
(D) Deprotonated Amines	Atenolol, Caffeine, Diclofenac, EDTA, Erythromycin-H2O, Fluoxetine, Metoprolol, Nicotine, Norfluoxetine, Ofloxacin, Paraxanthine, Pentoxifylline, Trimethoprim
(E) Alkoxy Polyaromatics	Naproxen, Propranolol
(F) Alkoxy Aromatics	Gemfibrozil, Hydrocodone
(G) Alkyl Aromatics:	Benzophenone, Benzyl acetate, Bucinal, DEET, Dilantin, Dibutyl Phthalate, Diphenhydramine, Gala- zolide, Ibuprofen, Indolebutyric acid, Primidone, Tonalide
(H) Nitro Aromatics	Musk ketone, musk xylene

Tri-Valley Science and Engineering Fair (TVSEF)

Lawrence Livermore National Laboratory has announced plans to expand the Tri-Valley Science and Engineering Fair (TVSEF) it has sponsored for the past 15 years.

The fair, affiliated with the Intel Corporation, has served students in Alameda County so successfully that it has become a model for fairs within neighboring communities.

Because of this success, the Intel Corporation has expressed a desire to expand its current affiliation with the Tri- Valley to include the entire county. As a result, over the past few months, Intel has worked with the Laboratory and the community to create an Alameda County Science and Engineering Fair (ACSEF), to be held March 20-22, 2012 at Chabot College in Hayward.

While other science fairs in the state have struggled to continue or have declined in participation, TVSEF numbers have steadily grown, making it a hallmark of science education excellence.

During the past 15 years, some 6,195 students have participated -- an impressive growth from its first year (1997) of 125 students.

Several of the science fair participants have gone on to careers in science, technology, engineering and math (STEM) fields. At least one is now an employee at the Stanford Linear Accelerator Center, a DOE national lab.

The new ACSEF would be run by a Board of Directors from the community, chaired by retired San Ramon Valley Unified School District science teacher Patti Carothers. The ACSEF will allow participation for all middle and high-school age students within Alameda County -- to include the cities of Alameda, Albany, Ashland, Berkeley, Castro Valley, Dublin, Emeryville, Fremont, Hayward, Livermore, Newark, Oakland, Piedmont, Pleasanton, San Leandro, San Lorenzo, Sunol and Union City.

The transition to the ACSEF will offer an expanded, larger countywide event, including growth opportunities for the Tri-Valley students who already participate, and an open door for new students who have not yet had access to an Intel-affiliated science fair.

With the Lab's help and that of the Intel Corporation and others, the Intel and California State Science Fair-affiliated ACSEF will provide a level of scientific outreach that has long been missing from Alameda County.

ACSEF pledges to help students gain perspective of the world through science, critical thinking, leadership and creative problem solving. Educators are encouraged to get their students involved in the ultimate S.T.E.M (Science Technology, Engineering and Mathematics) experience.

For further information and details about how to get involved as a student participant, fair volunteer, judge, or to make a donation, visit the ACSEF Website or contact the fair Director Patti Carothers at 925-426-7879 or by email.

ACS Webinars™

Learn more and register at www.acswebinars.org

Thursday, January 19, 2012 2pm-3pm EST

Dr. Susan Ebeler, of the University of California, Davis returns to discuss the chemistry behind the fizz and flavor of your favorite celebratory drink.

Thursday January 26, 2012 2pm-3pm EST

Join Dr. William Wood, of Humboldt State for a discussion on "What can we learn from "skunk musk" and how nature uses these noxious chemicals'.

January Historical Events In Chemistry

Leopold May

January 1, 1852 Eugène A. Demarçay, who was born on this date, discovered europium from samarium magnesium nitrate in 1901 and gave spectroscopic proof of the discovery of radium. He did vacuum studies of volatility and low temperatures followed by high temperature spark spectra.

January 2, 1889 Roger Adams, a researcher in organic chemical synthesis, was born on this date. He directed 184 doctoral theses.

January 4, 1891 Henry H. Dow prepared bromine from brine n this date.

January 7, 1794 Eilhardt Mitscherlich who did research on crystalline structure, catalysis,and benzene and its derivatives, was born on this date. He also discovered isomorphism.

January 9, 1868 Sören P. L. Sörensen, who was born on this date, is lnown as the "Father of pH", He did research on proteins, amino acids, and enzymes.

January 10, 1923 Chemical and Engineering News was started on this day as the bimonthly News Edition of Industrial and Engineering News. It was changed to CEN in 1942 and became weekly on January 6, 1947.

January 11, 1875 Frederick M. Becket, an inventor in electrochemistry and electrometallurgy, was born on this date. He received more than one hundred patents covering a wide range of electric furnace and chemical products, notably ferro-alloys, calcium carbide, and special chromium steels.

January 12, 1912 Konrad E. Bloch, who waas born on this date, was a researcher on cholesterol and fatty acid metabolism. He shared the Nobel Prize in Physiology or Medicine in 1964 with Feodor Lynen for their discoveries concerning the mechanism and regulation of the cholesterol and fatty acid metabolism.

January 13, 1780 Pierre J. Robiquet, who discovered asparagine with Nicolas-Louis Vauquelin, was born on this date. He also measured the codeine content of opium.

January 14, 1851 Ludwig Claisen, who developed reactions such as the condensation of esters and the rearrangement of allyl vinyl ethers, was born on this day.

January 15, 1784 Henry Cavendish presented the quantitative composition of water before Royal Society on this date.

January 17, 1706 Benjamin Franklin, who was born on this date, was a researcher in electricity; an inventor, a statesman, and described marsh gas to Priestley.

January 18, 1861 One hundred and fifty years ago, Hans Goldschmidt was born. In 1893, he discovered the alumino-thermite process (Goldschmidt Process) and patented it in 1895. He was interested in producing very pure metals by avoiding the use of carbon in smelting but realized its value in welding.

January 22, 1936 Seventy years ago, Alan J. Heeger was born on this date. He shared the Nobel Prize in Chemistry in 2000 with Alan G. MacDiarmid and Hidaki Shirakawa for their discovery and development of conductive polymers.

January 23, 1929 Twenty-five years ago in 1986, John C. Polanyi shared the Nobel Prize in Chemistry with Dudley R. Hershbach and Yuan T. Lee for their contributions concerning the dynamics of chemical elementary processes. He was born on this date and is a researcher using infrared chemiluminescence to follow excited reaction products.

January 26, 1881 Claude S. Hudson, who did research in the chemistry of sugars, was born on this date.

January 27, 1865 August F. Kekulé presented his benzene structure to Société Chimique, Paris on his date.

January 28, 1843 Henry C. Bolton, who was a writer and bibliographer of the history of chemistry, was born on this date. He studied the action of organic acids on minerals.

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ACS News Release:

Orinda chemist elected 2013 president of world's largest scientific society

WASHINGTON— Marinda Li Wu, Ph.D., chemist, founder and president of Science is Fun! in Orinda, Calif. has been elected 2013 president of the American Chemical Society (ACS), the world's largest scientific society. She will serve as president-elect in 2012, president in 2013, immediate past-president in 2014 and as a member of the ACS Board of Directors from 2012 to 2014.

Wu founded "Science is Fun!" in 1993 to introduce young students to the joys of science and she actively works in public outreach to promote science education and awareness with the general public.

An ACS member since 1971, Wu has served in various leadership roles and has chaired numerous Society committees and task forces. She has served on the ACS Board of Directors since 2006 and was chair of the California Section in 2001.

Wu received a B.S. cum laude with distinction in chemistry from Ohio State University in 1971 and a Ph.D. from the University of Illinois in 1976. She holds seven U.S. patents.

Developing innovative ways to better equip chemists and chemistry students for today's competitive work environment will be a priority during her term in office, Wu says.

Considering the globalization of the chemistry enterprise, Wu emphasizes the importance of engaging in more meaningful dialogue with sister societies worldwide. Her connections in Asia, Europe, and South America will enable her to help ACS build beneficial relationships in the Society's international endeavors.

"I will actively work with leaders from industry, small business, academia, and government to explore the supply and demand of jobs and how ACS can better help with retraining and professional growth," she said. "I have worked for years to increase awareness among legislators and the general public of the importance of science literacy, education, and R&D. Working together; we can improve the U.S. business climate and rebuild our jobs base."

Wu is the recipient of numerous awards for her service to ACS and the community. She helped spearhead a successful partnership between the Lafayette Library and Learning Center Foundation (LLLCF) and the California ACS Section to bring a popular monthly Science Cafe program to the general public in local communities.

The first Asian American chemist to be elected president of the American Chemical Society in its 135-year history, Wu also serves on the Chinese American Chemical Society's Board of Directors.

She resides in Orinda with her husband. They have a grown son, daughter and son-in-law.

The American Chemical Society is a nonprofit organization chartered by the U.S. Congress. With more than 163,000 members, ACS is the world's largest scientific society and a global leader in providing access to chemistry-related research through its multiple databases, peer-reviewed journals and scientific conferences. Its main offices are in Washington, D.C., and Columbus, Ohio.

(Editor's note: offical press release from the ACS)

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January 31, 1881 Irving Langmuir, who was born on this day, did research on surface chemistry. He received the Nobel Prize in 1932 for his discoveries and investigations in surface chemistry. He introduced gas-filled tungsten lamps and the use of atomic hydrogen blowpipe for welding. He and Gilbert N. Lewis evolved the electronic theory.

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