THE VORTEX

AMERICAN CHEMICAL SOCIETY
VOLUME LXXIII NUMBER 6

CALIFORNIA SECTION
JUNE 2012

Our Volunteers at the Earth Day Celebration in Martinez

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THE VORTEX

Published monthly except July & August by the California Section, American Chemical Society. Opinions expressed by the editors or contributors to THE VORTEX do not necessarily reflect the official position of the Section. The publisher reserves the right to reject copy submitted. Subscription included in $13 annual dues payment. Nonmember subscription $15.

MAGAZINE OF THE CALIFORNIA SECTION, AMERICAN CHEMICAL SOCIETY

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Chair's Message

Jim Postma

One of the gems of the California Section is our Women Chemists Committee (WCC). (The National Women Chemist Committee may also be a gem, but I do not know as much about that group.) Currently Sheila Yeh and Elaine Yamaguchi head up our WCC but the list of those that contribute to the success of the group is quite long, including Marinda Wu (currently the President-Elect of the American Chemical Society), Sheila Kanodia, Trudy Lionel, and Margareta Sequin. I am sure there are many others as well.

One of the sparkling qualities of our WCC is the Science Café partnership that they have established with the Lafayette Library and Learning Center. Nearly each month a scientific presentation is held in the Library's modern facility. In May, George Matsumoto, the senior Education and Research Specialist at the Monterey Bay Aquarium Research Institute and adjunct professor at Monterey Peninsula College is the speaker on the topic, "Is There a Great Pacific Garbage Patch?" Past Cafés have included topics of "The Science of Steinway and Sound," "The Building of the Golden Gate Bridge" and "The Science of Chocolate."

The WCC also sponsors its own events. In March our own Margareta Sequin, emerita professor from San Francisco State University, led a tour of the East Bay Regional Parks Botanic Garden with a discussion of "The Chemistry of Plants: Perfumes, Pigments, and Poisons." This was a preview of Dr. Sequin's just-released book of the same title.

If you check out the national ACS website, you will see that it is appropriate to refer to our WCC group as the Award-Winning Women Chemists Committee, having been honored with ChemLuminary awards for outstanding events or overall performance in 2003, '05, '07, and '10.

If you are interested in getting involved (There are no gender requirements.) please contact Julie at calacs@earthlink.net.

The Vortex Takes a Vacation.

The staff of the *Vortex* wishes all a pleasant summer. The next issue will be in September. Visit the website, www.calacs.org for latest information on meetings and news.

Lou Rigali, Editor

The American Chemical Society honors those members who attain 50 and 60 years of membership.

The list of those in the California Section who have attained these honors this year includes:

50 Years	60 Years
Andre Bolaffi	Edgar J. Smutny
Gerald Bohm	Eugene Richard Bissell
Donald J. Stasi	Wataru Goishi
John Patrick Cummings	Richard B. Bahme
Jack Perkins Bell	Seymour J. Lapporte
Peter James Lingane	Charles Kezerian
Ronald R. Dueltgen	Frederick Baumann
Angelo A. Lamola	Wilton Howard Lind
Yulan Chang Tong	Walter G. Boyle
Marion H. O'Leary	Howard Charles Mel
James David Cleveland	Samuel Markowitz
Joseph Cerny	John E. Casida
Roy David Wood	Arthur Mendel
Rena Schonbrun	Jefferson C. Davis
John F. Heil	
Mary S. Tomita	
Robert S. Alwitt	
William D. Korte	

2012 Lloyd Ryland Outstanding High School Chemistry Teacher.

Heather Pereira is the recipient of the 2012 Lloyd Ryland Outstanding High School Chemistry Teacher. She teaches chemistry at Amador Valley High School in Pleasanton and has been a mentor to two past awardees. Beth Cutter, our 2011 Outstanding Teacher said the following:

"Heather is exceptionally dedicated to her students' learning, innovates on a regular basis and is highly involved in science education outside of the classroom. No matter what the circumstances are or the student's skill level in August, Heather firmly believes that each child can learn. She is deeply committed to improving the lives of her students by giving them access to high quality instruction and educational experiences. Heather embraces teaching all levels of students and works diligently to make the content understandable and interesting to all".

Heather is involved in numerous extracurricular science activities, including advising the Science For Youths (SciFY) and Students Interested in Medical Sciences (SIMS) clubs, organizing the school's Spring Science Extravaganza and hosting afterschool peer tutoring. Almost every day of the week there are students in Heather's room at lunch for the SciFY or the SIMS clubs. She actively coaches these clubs and supports them in their endeavors.

The Spring Science Extravaganza is a two-day event hosted by the Chemistry students for the elementary age students, grades K-3, in the district. The program consists of over 30 hands-on stations related to all areas of science. The Extravaganza requires a great deal of planning, organizing and creativity, all of which Heather is highly involved. The event is a highlight of the year for many of the students and the youngsters who join and have a truly amazing science experience.

2012 Earth Day

Sheila Kanodia

CalACS provided community outreach at the 2012 Earth Day Event in Martinez, CA. This annual festival at the John Muir National Historic Site brought together representatives of 47 groups to engage the public in celebrating both Earth Day and John Muir's birthday.

Hundreds of adults, children, and families attended. Volunteers working at the CalACS table during the day were Elaine Yamaguchi, Sandy Tillin, Aurore Etienne, Beth McClure, Lawrence Wiebe, Anne Frazer, and Sheila Kanodia. Alex Madonik provided materials for the hands-on demonstration. The Section designed a T-shirt that volunteers wore in order to promote the 2012 ACS Earth Day theme of "Reduce, Reuse, Recycle". The program developed by the ACS Committee on Community activities (CCA) as part of its Chemists Celebrate Earth Day (CCED) Program. Lou Rigali was instrumental in getting the designed T-shirts.

The response from visitors to the Cal ACS canopy location was positive. Outreach activities used the CCED Earth Day brochure as well as other conceptual aids including: 1. a paper home-model (available at http://www.energycenter.org/home) provided by the Center for Sustainable Energy, CA, which summarizes ways to reduce energy use at home, 2. an example of the reuse of items until the end of a product's useful life, after which it can be sent for recycling, 3. a plastics recycling hands-on demonstration of density characteristics for some recyclable plastics, and 4. a discussion of ways to be more environmentally conscious by choosing to use recycled materials, and how this relates to chemistry and the roles of chemists in society.

Crusty Chemistry

Bill Motzer & Jacques Guertin

This paper is not about baking the perfect pie crust but about the elemental composition of the earth's crust compared to the earth's surface. Geologists, and to some extent geochemists, prefer to report crustal chemistry as percent oxides of the elements. This is because they deal with many of the elements, such as silicon, that readily combine with oxygen forming silicates and metallic oxides. However, many chemists prefer to report the earth's composition as single elements. When a student asks, "What ís the most abundant element in the earth's crust?" a typical geologist answers that it ís silica because SiO_2 forms 57.6% of the crust. A chemist will view this from another perspective, that oxygen is the most abundant crustal element forming about 47% of the earth's crust and silicon ranks second with about 28% of the earth's crust. But, the earth's crust does not include the ocean which covers about 71% of the earth's surface. The following considers what happens to the elemental composition values if the ocean is included with the crust for a true earth surface composition.

Crust-Surface (includes ocean)-Elemental Composition

The elemental composition of the crust is well known. But, the earth's surface composition is not so well known. You see, besides the lithosphere (the earth's solid surface), the earth also includes an extensive hydrosphere (liquid surface, mostly the oceans, seas, and bays). The following exercise calculates (actually estimates) the earth's surface elemental composition when taking the ocean's composition into account. Only O and H are considered in this calculation because other elements dissolved in the ocean water are considered to be relatively unimportant.

The effect of the ocean depends on its mass compared to the crust's mass. So, the problem comes down to calculating the mass of the crust and the mass of the ocean.

The key equations are: volume of sphere (Vs), area of sphere (As), and volume of outer spherical shell (Vsh).

Vis = volume of inner sphere
r_a = radius of sphere
r_b = radius of inner sphere
π = 3.14159
d = density
m = mass
V = volume
m = dV
Vs = $4\pi r^3/3$
As = $4\pi r^2$
Vsh = Vs -Vis = $(4\pi r_a^3/3) - (4\pi r_b^3/3)$
= $(4\pi/3)(r_a^3 - r_b^3)$

NOTE: Vsh = (As)h where h = thickness of crust is not accurate because of earth's curvature. The error in using Vsh = (As)h is about 0.5% too large.

CRUST
Earth radius (ra) = 6,378 km
Crust thickness = 35 km
Crust density (dc) = 2.9 g/cm^3
Crust [O] = 46.6%
Crust [H] = 0.14%

Volume Crust (Vc)
Vc = $(4\pi/3)(r_a^3$ ñ $r_b^3)$
= $(4\pi/3)(6{,}3783 - [6{,}378 - 35]^3)$
= $(4\pi/3)(6{,}3783 - 6{,}343^3)$
= $(4\pi/3)(4{,}247{,}886{,}545)$
= 1.779E10 km^3

Mass Crust (mc)
mc = (2.9 g/cm3)(1.779E25 cm^3)
NOTE: 1 km^3 = 1015 cm^3
= 5.160E25 g
mass O = (0.466)(5.160E25 g)=2.405E25 g
mass H = (0.0014)(5.160E25 g) = 7.224E22 g

OCEAN
Earth radius = 6,378 km
Ocean depth = 4 km
Ocean density = 1.027 g/cm^3
Ocean [O] = 85.84%
Ocean [H] = 10.82%

Volume Ocean (Voc) NOTE: Ocean covers 71% of earth's surface
Voc = $(4\pi/3)(ra^3 - rb^3)(0.71)$
= $(4\pi/3)(6{,}378^3 - [6{,}378 - 4]^3)(0.71)$
= $(4\pi/3)(6{,}378^3 - 6{,}374^3)(0.71)$
= $(4\pi/3)(487{,}840{,}528)(0.71)$
= 1.451E9 km^3

Mass Ocean (moc)
moc = (1.027 g/cm^3)(1.451E24 cm^3)
NOTE: 1 km^3 = 1015 cm^3
= 1.490E24 g

(continued on page 9)

April Science Cafe Report

The California Section, ACS, and the Lafayette Library and Learning Center Foundation jointly sponsored a Science Café. In April, the program was presented by Howard and Sally Peters of the Santa Clara Valley Section on "Chocolate Food of the Gods". The Peters presentation is a well-researched history of chocolate, its chemistry, and its lore. Their talk is accompanied by samples of the main types of chocolate, white, milk, semi-sweet, and bitter sweet. They also passed around cacao beans, and chocolate nibs.

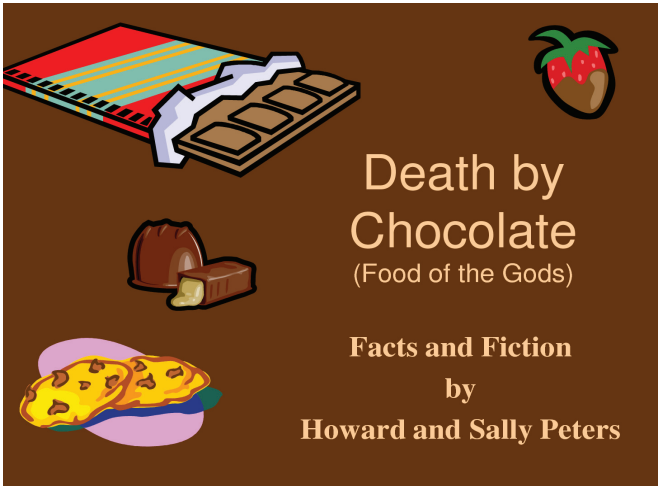
Chocolate - Food of the Gods

The history of chocolate was discussed. After its introduction to Spain from the Americas by the early explorers, the process was kept secret by monks and the supply regulated for only the aristocracy. Eventually the secret process was uncovered and the monopoly ended by explorers of other countries. The Dutch and Swiss are well known for their quality products, but most European countries developed chocolates in time. As a bit of trivia, the producers of the movie "E.T." offered the chocolate item to the Mars Company (a logical choice) for M&Ms. At the last minute, executives at Mars declined, and Hershey stepped in , with Reese's Pieces.

While both coffee and cacao contain caffeine, cacao contains theobromine, significant amounts of tryptophan and serotonin, and other active alkaloids. The bean pods are broken open and the pulp and beans are fermented. The chemical changes in this stage have not been well characterized. The fermented beans are then roasted, "conched", milled until they have been reduced to very small particles, less than 30 micrometers in size, to give the chocolate a smooth feel, and then the cocoa butter and solids content are adjusted to make the final product.

The various chocolate producers were discussed, Lindt and Nestle from Switzerland, Godiva, from Belgium, and Hershey, Ghirardelli, Guittard, and Scharffenberger, among others, from the U.S. Scharffenberger, now a part of the Hershey company, was an early benefactor of the Peters, providing samples to pass around when the talk was first developed. The talk ended with the raffle of a 10 pound bar of Guittard chocolate, a book on the history of chocolate, and, as third prize, a bag of jelly beans.

Their web site, with more information is at www.howard-peters.com/chocolate.ppt.



American Chemical Society

The Committee on Nominations and Elections (N&E) is announcing the slate of candidates who will appear on the fall 2012 ballot. They are:

Candidates for President-Elect, 2013

Dr. Thomas J. Barton, Distinguished Professor, Iowa State University, Ames, IA

Dr. Luis A. Echegoyen, Robert A. Welch Professor, University of Texas at El Paso, El Paso, TX

Candidates for Directors-at-Large, 2013-2015

Ms. Carol A. Duane, President, D&D Consultants & Mentor, Mentor, OH

Ms. Valerie J. Kuck, Retired, Lucent Technologies (Bell Labs), Murray Hill, NJ

Ms. Helen (Bonnie) A. Lawlor, Executive Director, National Federation of Advanced Information Services (NFAIS), Philadelphia, PA

Dr. Ingrid Montes, Professor, University of Puerto Rico, Rio Piedras Campus, San Juan, PR

Candidates for District I Director, 2013-2015

Dr. Thomas R. Gilbert, Professor, Northeastern University, Boston, MA

Dr. Neil D. Jespersen, Professor of Chemistry, St. John's University, Queens, NY

Candidates for District V Director, 2013-2015

Dr. John E. Adams, Curators' Teaching Professor of Chemistry, University of Missouri, Columbia, MO

Dr. Peter K. Dorhout, Dean, College of Arts & Sciences, Kansas State University, Manhattan, KS

According to ACS Bylaw V, additional candidates may be nominated by petition until July 15th, 2012. The final slate of candidates that will appear on the fall ballot will be announced after July 15 if there are any changes.

There should be no articles published covering their campaign or viewpoints or speaking engagements offered between now and the end of the election period in November, unless the opportunities are provided to all candidates for that office equally. This ban does not include N&E approved publication of scientific research articles, coverage of noteworthy scientific news events, or certain types of activities related to official governance duties. Extenuating circumstances will be reviewed by N&E on a case-by-case basis.

California Section Election – 2012

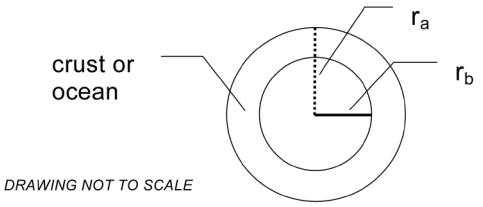
The California Section, ACS, will hold an election this fall for the following positions: Chair-elect, Secretary, Director, Members-at-Large, Councilors, and Alternate Councilors. All these positions are members of the Section's Executive Committee, and the first three positions are members of the Section's Board of Directors. If you have an interest in being a candidate for one of these positions or would like more information, please contact Paul Vartanian,(510) 763-0195, pfvartanian@gmail.com, a member of the Nominations and Election Committee, or Bryan Balazs, (925-423-5403 and bb@llnl.gov) the chair of the committee, by September 1, 2012.

(continued from page 6)

mass O = (0.8584)(1.490E24 g) = 1.2790E24 g
mass H = (0.1082)(1.490E24 g) = 1.6122E23 g
SURFACE OF EARTH
mass surface = mass crust + mass ocean
= 5.160E25 g + 1.490E24 g
= 5.309E25 g
mass surface element = mass element in crust + mass element in ocean
mass surface O = 2.405E25 g + 1.279E24 g = 2.533E25 g
mass surface H = 7.224E22 g + 1.612E23 g = 2.335E23 g
% surface [element] = 100(mass element)/(mass surface)
% [O] = 100(2.533E25 g)/(5.309E25 g) = 47.7%
% [H] = 100(2.335E23 g)/(5.309E25 g) = 0.44%

So how do these calculations compare with published data (table below)? Including the ocean for the earth's surface composition has a modest effect on the percent oxygen but a rather large effect (3 times greater) on the percent hydrogen. This is simply because the percent hydrogen in the earth's crust is quite small but much larger in the ocean, so the effect of the ocean on hydrogen is considerable.

So, now if someone asks, "what is the elemental composition of the earth's crust?" you can fire back, "with or without the ocean?" or, if someone asks, "what is the elemental composition of the earth's surface?" you can respond, "by surface, do you mean the crust and the ocean?" Either way, the answer is about 47% O, 28% Si, 8% Al, 5% Fe; accounting for 88% of the total.



Atomic Number	Element	Crust Alone Average in percent	Calculated Surface: Crust + Ocean percent
8	O	46.6	47.7
14	Si	27.72	
13	Al	8.13	
26	Fe	5.00	
20	Ca	3.63	
11	Na	2.83	
19	K	2.59	
12	Mg	2.09	
22	Ti	0.44	
1	H	0.14	0.44

Announcing The New California Section Webstore and Contest

The California Section has always had ambitious outreach programs for its Members and the local community. Every year grants and awards are given to schools and teachers to help defray costs. The Section would like to do more, especially with educational grants, because governmental funding continues to decrease for students of all ages.

One way to raise money and fund activities and programs is to sell products that may be of value to the Members of the Section. Quality of the product, what ever it is, must be good, reflect positively on the Section, preferably made in the US, and be competitively priced. Another important consideration is that the Section should not incur any expense, inventory cost, or increase in overhead for any sale.

The T-shirt is a nearly ideal product that can be easily decorated or personalized with a science or chemistry theme and that any of our Members, their families and friends may want to purchase. There are other products that would also fit into this category and some of those are shown on the attached link < http://calacs.deco-apparel.com/home > This is a preview of the proposed webstore. It provides an opportunity to visit and offer your suggestions as to product selection and designs.

Companies can also participate. Often companies purchase various products imprinted with their logo and message that are used at trade shows or as gifts to customers. There are many products such as flash drives, pens, key chains, etc. that can be imprinted usually in quantities of 25 or more. Also within a company, there may be a requirement for lab coats or other work apparel each with the company logo.

As a way to promote the new webstore, the Section announces a T-shirt, and mug decorating contest. Submit your ideas and designs to use on T-shirts and or mugs. The first 10 designs submitted and chosen will be given a free T-shirt and/or a mug with their design. The winner of the contest will be offered a royalty if the design is used. We welcome the help of any volunteer who would be interested in spending a few hours per month reviewing potential products and designs and also helping judge the contest.

Design a California Section Logo

A challenge is being made to the Members of the California Section to design or participate in the design of a Section logo. The California Section has not had an official logo. We have always used some aspect of the National logo. The current logo used by National is as shown which has to be used complete with text. In 2001 we used a combination of the ACS logo with the map of California in our Centennial celebration programs.

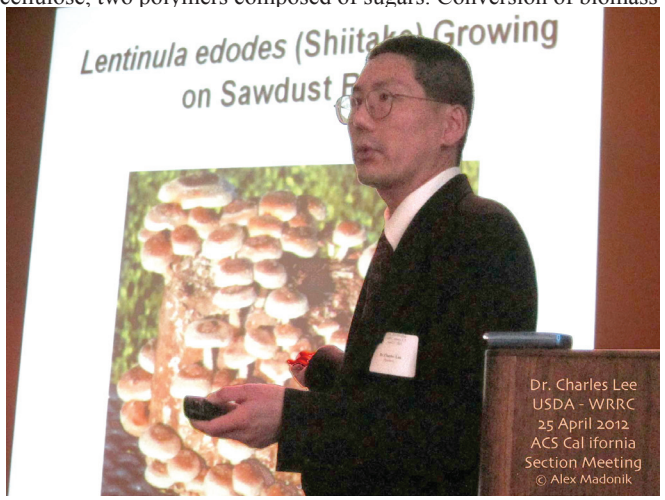
ACS Chemistry for Life®

The Executive Committtee feels it is time for the Section to have its own logo. The Section was started in 1901 and was the only ACS section in Califonia until Members voted for incorporating the Southern California area as a separate section in 1911. Later came further divisions that included Santa Clara, Sacramento, and San Joaquin. You can read more about the history of the Section on the website under “about us”.

Meet the challege and participate. Send your ideas to the Section office calacs@earthlink.net.

April Meeting Report "Development of Enzymes and Enzyme Systems by Genetic Engineering to Convert Biomass to Sugars"

Agricultural waste such as rice straw represents an enormous potential source for renewable fuels and chemicals, including precursors for plastics. This biomass consists largely of cellulose and hemicellulose, two polymers composed of sugars. Conversion of biomass to simple sugars is difficult because these two polymers are crosslinked to a network of lignin. At least six different enzymes are required to remove the branches from hemicellulose and break it down to simple sugars. Dr. Lee's group has found new, more efficient enzymes for this purpose by randomly cloning DNA obtained from soil, biomass, and the stomachs of ruminant animals. Thousands of clones can be tested simultaneously on large culture dishes, and this high-throughput screening method has been the key to finding useful new enzymes, determining the corresponding DNA sequence, and characterizing their activity. Dr. Lee's group has also created yet more efficient enzymes by a process that introduces random mutations and then selects colonies that grow under progressively more stringent conditions.



Alex Madonik

Safety in the Laboratory

The American Chemical Society's Committee on Chemical Safety has produced an excellent publication "Creating Safety Cultures" in the Academic Institutions. The final, approved version is available to download in PDF format at www.acs.org/safety . The full production version will be available in a few months.

The document provides guidance, suggestions, examples, and recommendations that will help strengthen the safety culture in two- and four-year undergraduate, graduate, and postdoctoral programs. It identifies:

- The best elements and best practices of a good safety culture.
- Specific recommendations that could be used by universities and colleges.
- Tools and resources that will help strengthen the safety culture.

June Chemical Anniversaries
Leopold May

June 2, 1787 Two hundred and twenty-five years ago, Nils G. Sefstrom was born on this date. He is one of the discoverers of vanadium (V, 23) in 1830.
June 3, 1960 Robert B. Woodward synthesized chlorophyll on this date.
June 5, 1951 The first paper on gas chromatography (GC), Gas-liquid partition chromatography: the separation and micro-estimation of volatile fatty acids from formic acid to dodecanoic acid, by A. T. James and A. J. P. Martin, was received on this date in 1951 and was published in *Biochem. J.* **1953**, *50*, 679-690.
June 8, 1916 Fifty years ago in 1962, Francis H. C. Crick shared the Nobel Prize in Physiology or Medicine with James D. Watson and M. H. F. Wilkins for their discoveries concerning the molecular structure of nuclear acids and its significance for information transfer in living material. He was born on this date and is a researcher on the double helix structure of the deoxyribonucleic acid (DNA) molecule.
June 9, 1862 Fifty years ago, Herbert B. Baker was born. He was a researcher on effect of water on chemical change and an authority on desiccating and poison gases.
June 10, 1906 Regina Schoental, who was born on this date, was a researcher on toxic pyrrolizidine (Senecio) alkaloids, fusarial mycotoxins, zearalenone, the trichothecenes, and other carcinogenic metabolites of Fumarium and other microfungi, estrogenic mycotoxins on the development of cancers and behavioral disorders, nitroso compounds from action of the oral and anorectal microflora, and on the activation of human immuno deficiency virus.
June 14, 1862 One hundred and fifty years ago, Johann Ulrich Nef was born on this date. He discovered the valence of carbon and did research on free radicals and transition state in organic reactions. He is known as "Father of Physical Organic Chemistry".
June 15, 1755 Antoine François de Fourcroy, who was born on this date, developed chemical nomenclature with Lavoisier and Berthollet. He described salts such as calcium chloride.
June 18, 1906 Maria Goeppert Mayer, who developed the shell model of the nucleus and did research in isotopes effect, was born on this day. She shared the Nobel Prize in Physics in 1963 with J. H. D. Jensen for discoveries concerning nuclear shell structure and Eugene Paul Wigner for his contributions to the theory of the atomic nucleus and the elementary particles, particularly through the discovery and application of fundamental symmetry principles.
June 20, 1931 Mary L. Good is a researcher in inorganic chemistry and industrial chemist. She served as President of ACS and was born on this day.
June 22, 1903 Harry Julius Emeléus, a researcher in inorganic chemistry and fluorine chemistry, was born on this date.
June 25, 1812 Two hundred years ago, Hermann von Fehling was born on this date. He discovered Fehling's solution as an oxidizing agent and as an analytical reagent for aldehydes and sugars and prepared phenyl cyanide. The composition of paraldehyde and metaldehyde was determined by him.
June 28, 1873 One hundred years ago, Alexis Carrel was awarded the Nobel Prize in Physiology or Medicine in recognition of his work on vascular suture and the transplantation of blood-vessels and organs. He was born on this date and did research on suturing blood vessels in organ transplants;
June 30, 1926 Paul Berg, researcher in recombinant deoxyribonucleic acid (DNA) was born on this date. He shared the Nobel Prize in Chemistry in 1980 for his fundamental studies of the biochemistry of nucleic acids, with particular regard to recombinant-DNA with Walter Gilbert and Frederick Sanger for their contributions concerning the determination of base sequences in nucleic acids.

Women Chemists Gather for First Meeting of 2012 at the Regional Park Botanic Garden (RPBG) in Tilden Park: Pigments, Perfumes and Poisons

E.S. Yamaguchi and S.W. Yeh

It was a bright sunny day on 3/3/12, perfect for the first meeting of the Women Chemists Committee of the California Section for 2012. With speaker Dr. Greti Sequin, a former WCC chair, and two other volunteer docents, all 40 attendees packed into the Visitor Center for coffee and cookies (baked by the co-chairs, Sheila and Elaine, and volunteer Sandra Tillin) before the lecture. The Regional Parks Botanic Garden (RPBG) is a botanical garden devoted to California native plants. It was founded in 1940 and comprises ten acres. The RPBG is divided into the various geographic sections of the state and their plant habitats.

Greti, a natural product chemist by training, has written a book on this meeting's topic in her retirement from San Francisco State University where she worked as a chemistry professor.

Her talk began with a photo of the California poppy, now in bloom at the RPBG. California poppy is not the type gathered for the drug trade in Afghanistan, the latter containing the alkaloids morphine and codeine that are part of opium. Yet, all types of poppies contain some types of opiates (generally alkaloids found in opium) that are part of the plants' defense systems. This was the beginning of a natural product chemist's delight.Then Greti showed a photo of Jimson weed (Datura wrightii), a California native plant. It too contains alkaloids and is poisonous. Some of you may recall the painting by Georgia O'Keeffe of the same plant.

Have you heard of Mormon tea, a tea that has a mild stimulating effect? It is derived from the green Ephedra, a desert plant. Well, if you have ever taken sudafed, it contains pseudoephedrine hydrochloride, which may result in sleeplessness in addition to relieving sinus congestion. The alkaloid ephedrine found in Ephedra is also a bronchial dilator.

The Dutchman's pipe vine was in bloom in the garden, with its curiously shaped blossoms (like "Dutchman's pipes"). The plant contains the toxic alkaloid aristolochic acid. Caterpillars of the pipevine swallowtail feed on the leaves of the plant, but are unharmed by the toxins and obtain chemical protection from the plant defenses. The emerging pipevine swallowtail butterflies still contain the chemical defenses, similar to the Monarch butterfly story. Once the butterflies emerge, they contain the toxin which helps keep predators away. Tiny gnats entering the pipe-shaped flowers get stuck in them and buzz wildly, pollinating the flowers in the process. Gnats and larvae of swallowtail butterflies have learned to live with this vine in perfect harmony.

The discussion of the soap plant was particularly fascinating; in addition to the obvious use as soap, the natives used this plant to capture fish. Instead of using hook and lines, natives made a mash of the plant's bulbs and put it into streams where there were fish. Saponins (glycosidic steroids and triterpenes) stunned the fish, but did not harm the natives who just picked up the fish for dinner. What a fish story!

The California Bay trees were in full bloom. They grow well in our Mediterranean climate. When their leaves are crushed they release strong, typical bay leaf odors, dominated by volatile monoterpenes like myrcene. The Turkish Bay leaves from related trees are sold as essential herbs in the grocery stores.

Speaking of terpenes, Greti showed many terpene-derived structures that function either as poisons, perfumes or pigments in plants. Composing the structures, plants follow distinct pathways in Nature's biosyntheses. Geraniol, one of the numerous compounds that give roses their wonderful smell, is a volatile monoterpene. This topic led to plant odors as attractants and was followed by plant pigments, such as the terpenoid carotenoids (orange carrots, tomatoes), flavonoids (yellow onions), tannins (brown fall leaves and tree barks), anthocyanins (red and blue

(continued from page 14)

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pigments in most plant families, famous from changing colors according to the pH in red cabbage). Blue hound's tongue flowers, in bloom at the RPBG, illustrated both the light purple of emerging flowers and the dark purple colors of older blossoms, typical of anthocyanin pigments, in flowers of the same plant. Betalains are pigments found in only a few plant families; they provide for example the colors of red or yellow beets and of bougainvilleas. Most importantly, green chlorophylls a and b make photosynthetic processes possible that in turn are at the origin of plants' production of the perfumes, pigments, and poisons—and of oxygen and the primary metabolites that humans and animals need to be alive.

After the lecture we split up into three groups and went on docent-led tours in the RPBG to view the live plants. There was the red-flowered California fuchsia in full bloom in my tour. This plant would attract hummingbirds. Greti showed us the giant Sequoia tree of the Sequoia National Park area. When you touch its bark, it feels like a sponge, very elastic, and not sticky with resins. When there is a forest fire, the cones open to release the tiny seeds, but the resin-free trees do not burn down. Greti pointed out that the RPBG has many volunteer gardeners and docents who keep the RPBG looking beautiful. One feels as though one traveled the whole state in just a few hours!

After the tour, we enjoyed a comfortable, bring-your-own picnic outside the Visitor Center.

Thank you to all who made this meeting a success!

"The Chemistry of Plants: Perfumes, Pigments, and Poisons A discussion" by Professor Emerita Margareta Sequin San Francisco State University

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