THE VORTEX

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Best Holiday Wishes

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THE VORTEX

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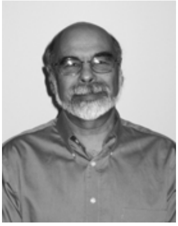

Chair's Message

Paul Vartanian

There have been a great many activities going on in the California Section this year and I hope you were able to take part in some of them. These activities could not happen if not for the dedication of a small number of active members who put in the time and effort to make our programs some of the best in the ACS. We always need volunteers to assist these programs or develop new ways we can engage our members. If time is short with you, money, in the form of dues or contributions, is always welcome. Only about two-thirds of the California Section members pay their dues and the extra money, if we got 100 % participation, would make a big difference in our ability to do more.

Our National Chemistry Week activities this year were very well attended and we thank the Santa Clara Valley Section for collaborating with us in bringing Profs. C. Marvin Lang and Donald Showalter here for chemical demonstration shows. Eileen Nottoli and Mark Frishberg organized these events for the Section. Alex Madonik made our NCW Week extend for a few more days through his organization of the Family Science Night at Claremont Middle School in Oakland.

Our Women Chemists Committee continues its strong programs under Greti Sequin and Trudy Lionel. Along with the Science Cafes, organized by Marinda Wu (a member of the ACS Board of Directors) Section meetings organized by Bryan Balazs, we have had a great variety of evening and Saturday programs for you to attend. We had an Earth Day activity at the Muir House in Martinez that Sheila Kanodia helped with among the other activities she participates in.

We gave out our first Community College Chemistry Faculty Teacher Award this year through the efforts of Peter Olds, Joe Ledbetter, and Kent Campbell. The recipient was Galen George of Santa Rosa Junior College. He, and our two High School Award recipients Jenelle Ball, Chico High School, and Lee Boyes, Petaluma High School, are examples of the high quality teachers we hope all students are fortunate to have.

The year 2011 is the International Year of Chemistry and Attila Pavlath and Lisa Aguirre are beginning the effort in this area for the Section. Attila has a web site, www.chemistryinyourlife.org, with materials that can be used

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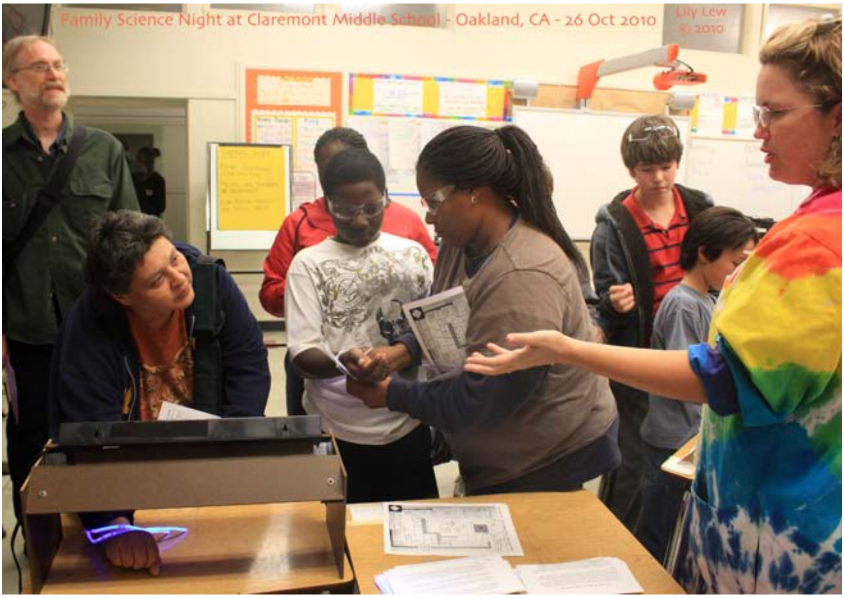
Family Science Night

Alex Madonik

The California Section (www.calacs.org) of the American Chemical Society celebrated National Chemistry Week with Family Science Night at Claremont Middle School in Oakland, CA, on Tuesday 26 October 2010. This event continues our unbroken tradition of outreach to local schools that dates back to 1997. Over 200 Claremont students and family members crowded into the gym for the opening show, featuring music by the Scientific Jam and chemistry demonstrations by Chair-Elect Bryan Balazs. After the show, visitors explored a dozen hands-on activities, including old favorites such as Slime, Liquid Nitrogen Ice Cream, Colored Flames, a pH Workshop plus pH Indicators and Dry Ice, Desert Reptiles, UV-color changing beads, Aromas from Plants, a DNA base-pairing game, and molecular models. They were equally enthusiastic about new activities such as Ancient Ink from ferrous sulfate and tea. It was a night to remember for kids of all ages.

California Section Chair-Elect Bryan asking for volunteers during Family Science Night

Chair-Elect Bryan Balazs whips up some Elephant's Toothpaste



Margaret Elliott demonstrates UV color-changing beads during Family Science Night

Mixing dry ice and pH indicators during Family Science Night

WCC October Meeting Report

At the Oct 20, 2010 WCC program, Cheryl Martin, a former Vice President at Rohm and Haas, provided career insight with her talk "With a Foundation in Chemistry Anything is Possible!" A few of the points discussed in detail are summarized.

Career development is an ongoing process that starts with self-evaluation.

Establish mentors and sponsors from both within and outside your profession.

While we all network to some degree, it is important to expand and make networking part of an ongoing process.

Finally be open to unplanned opportunities

Section Election Results

Chair-elect	James Postma
Secretary	Michael Cheng
Director	Don MacLean
Member-at-Large	Linda Wraxall
Councilors	Elaine Yamaguchi, Bryan Balazs, Paul Vartanian
Alternate Councilors	Rollie Myers, James Postma
Bylaw Revision	Passed

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to help in public outreach. If your company is planning an activity for the year, or if you would like information on the IYC, please contact us.

Our officers do a great job in keeping the Section on track in all the areas we need to be compliant. Igor Sobolev and Will Kuo keep the books in order and Michael Cheng makes sure all the forms are filed with the ACS on time. Julie Mason in our office covers everything, from helping to arrange Section and committee meetings to paying our bills on time. The *VORTEX* and our new web site look was converted to electronic form by Lou Rigali and Doug Henry.

Our Trustees, led by Alex Mihailovski, continue to manage our trust funds in a prudent and successful manner. The Western Regional Meeting, scheduled for the Fall of 2013, is being organized by Neal Byington and Lee Latimer. This takes a lot of planning and they could use help to make the meeting successful. Al Verstuyft continues to organize our participation in the International Chemistry Olympiad with success. Jim Postma has the Sub-section activities in Chico going well and he will be the Section Chair in 2012. Project SEED, with Elaine Yamaguchi, Glenn Fuller, and others, had a very successful program with the students it supported in the summer program.

I am sure I have failed to mention significant contributors to the California Section's success in 2010 as it is difficult, even as Chair, to keep track of everything which we do. Being able to see the scope of all we do during a year makes me very proud of our volunteers. I particularly wish Bryan Balazs the best as he assumes the office of Chair in 2011.

On behalf of all our officers and the *Vortex* staff, we wish you all the best in the coming year. I hope your holiday season is filled with joy. And, while it comes from the Christmas wish, I think this thought is ecumenical enough to apply generally - Peace on Earth and Goodwill to Everyone.

The First Chemists

(Part 1)

Bill Motzer

The recent spate of excellent TV programs on The Discovery and History channels on ancient Egyptian civilizations has captivated many of us. I've been intrigued by recent archeological discoveries that the pyramids were not built by slaves but were constructed by freemen - artisans who were perhaps recruited for their engineering expertise. They lived in small towns quite close to the pyramids and were provided with all of the amenities of life: lodging, good food, beer, and proper burial that included mummification. (An excellent video of this program: Building the Great Pyramid -BBC/National Geographic can be downloaded from YouTube.)

Although these programs spotlight the ancient Egyptian's expertise in engineering (i.e., the pyramids, dams, canals, and temples), agriculture, and astronomy, there is virtually nothing describing their knowledge of chemistry. What is even more intriguing is that the ancient Egyptians were probably the first chemists: in fact the root word (etymology) for chemistry is believed to have its origins in that the ancient Egyptians were known as "the "Khemet." In Arabic this became (al)chemy; translated into Greek - Khemeiea, in Latin - chimista, and finally in English - chemistry. To the ancient world, the Egyptians were masters of the "art" of chemistry.

So do recent archeological finds tell us that the ancient Egyptians were the first chemists? Did they have an inkling of chemical characteristics of their world? For answers to these questions, one method is to examine the pigments that they used in their paints because painting (for almost all ancient to modern cultures) is a reflection on how that culture perceives their world. From about 12,000 BCE through pre-dynastic Egypt (~5500 BCE)* most pigments found in caves and rocks were made from natural materials - mostly derived from plants. Then in about the Fourth Dynasty of the Old Kingdom (~2600-2480 BCE), a unique pigment appeared on limestone sculptures and a variety of cylinder seals and beads; this pigment became more widespread in the Fifth Dynasty (~2480-2320 BCE) and it was widely used in decorating tombs, wall paintings, furnishings, and statues. By the New Kingdom (~1570 BCE) it began to be more widely utilized in the production of numerous objects such as cylinder seals, beads, scarabs, inlays, pots and statuettes. In antiquity it was famous - sought out by rulers and royalty - and became known as Egyptian blue. After the fall of the Egyptian Empire (332 BCE), it continued to be manufactured and used throughout the Greco-Roman period (332 BCE-395 CE). Its use died out in the fourth century CE, when the secret of its manufacture was lost, not to be rediscovered until modern times.

The ancient Egyptians left no written information in their papyri texts about the manufacture of Egyptian blue. If there were written documents, they may have been destroyed during one of their dark ages, such as the one that occurred between 1206 and 1150 BCE (also known as the Bronze Age collapse). Alternatively it may have been lost during the rule of the Roman Emperor Diocletian in 290 CE who passed a decree providing for the destruction of works and ancient books on alchemical arts and on gold and silver manufacture to prevent gold and silver makers from amassing riches that could help in organizing revolts against the empire. Additionally, many ancient Egyptian books may have been destroyed during the several destructions of the ancient Library of Alexandria (third century BCE until the Roman conquest of Egypt in 48 BCE). Egyptian blue was first described by Roman writer, architect and engineer Marcus Vitruvius Pollio (born 80-70 BCE, died after 15 BCE), where he referred to it as coeruleum but incorrectly stated that it was invented in Alexandria. Vitruvius indicated that it was made by mixing sand, copper fillings and natron. However, he left out lime which is a major component in the manufacture of Egyptian blue. Theophrastus (371 to 287 BCE)

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gave the pigment the Greek term kyanos, which may have referred to the gem stone lapis lazuli. At the beginning of the 19th century CE, there was a renewed interest in learning more about its manufacture when it was investigated by Sir Humphry Davy in 1815 and others such as W.T. Russell.

Modern forensic analytical techniques of Egyptian blue pigment were recently employed in investigations and experiments by scientists and archaeologists such as Dr. H. Jaksch, a mineralogist at the Petrographisches Institute der Universitat Heidelberg (Germany) and his colleagues. In 1983, they completed a systematic study of several hundred pigment samples discovering that Egyptian blue was most likely manufactured in a multistage process. Their analysis showed that the ingredients in Egyptian blue most likely began with mixtures of the minerals malachite, quartz (silica sand), and calcite (most likely from limestone) that were then heated to produce Egyptian blue, which they identified as a synthesized version of the mineral cuprorivaite - a calcium-copper tetrasilicate. The following equation describes this reaction:

$$\underset{\text{(malachite)}}{Cu_2CO_3(OH)_2} + \underset{\text{(quartz)}}{8SiO_2} + \underset{\text{(limestone)}}{2CaCO_3} \rightarrow \underset{\text{(syn. cuprorivaite)}}{2CaCuSi_4O_{10}} + 3CO_2 + H_2O$$

Cuprorivaite is an interesting mineral having only recently been identified and named. It occurs as minute bright blue crystals in hydrothermal (hot spring) deposits in volcanogenic areas such as those on Mt. Vesuvius. The ancient Egyptians may or may not have been aware of it; most likely what they were trying to reproduce was the dark blue of the gemstone lapis lazuli or the brilliant blue of the mineral azurite [$Cu_3(CO_3)_2(OH)_2$], which is a very common weathering product of copper deposits.

Of course the ancient Egyptians had no knowledge of the periodic table or chemical formula. What they probably did was use a process of trial and error recording results as recipies similar to that described by Dr. Jaksch, et al.:

The mixture was then heated to melting. The melting temperature was tightly controlled by the amount of plant ash flux or alkali salts added and did not exceed 742° C. The copper silicate melt was then rapidly cooled, thus producing a glass-bearing cake rich in cuprorivaite crystals. After cooling, the cake was ground and heated several times to accomplish a high degree of reaction and hence a good quality pigment.

The recipe changed somewhat during the 18th Dynasty reign of Thutmosis III (1490-1436 BCE), when bronze filings were added at the start of the mix, leading to significant improvement in overall pigment quality. This technological innovation was employed until Roman times.

In Part 2, I'll discuss more about Egyptian blue's manufacture and where the ancient Egyptians may have obtained its component materials.

* Note: all Dynastic dates are approximate because of the on-going debate in archeology concerning historical chronologies versus radio carbon-based chronology (e.g., Science, 2010, v. 338, pp 1489-1490 and 1554-1557.)

Chemistry - Colorful and Fun in 2010

Alex Madonik

The California (www.calacs.org) and Santa Clara Sections (www.scvacs.org) of the American Chemical Society celebrated National Chemistry Week with a special program, "Chemistry - Colorful and Fun in 2010", at eight venues in Northern California. Professors Marvin Lang and Donald Showalter of the University of Wisconsin, Stevens Point, thrilled audiences from Santa Cruz to Chico with their world-famous demonstrations. From the cryogenic magic of liquid nitrogen, they progressed to color changes and clock reactions at room temperature, and finally to flames and explosions when various combinations of fuel, air, and ignition meet in bottles or balloons. Among the nearly 800 attendees were many local chemistry teachers, who left with new ideas and new connections with the ACS and their colleagues.

Professors Lang and Showalter complete a colorful titration of Milk of Magnesia at St. Mary's College, Moraga, CA

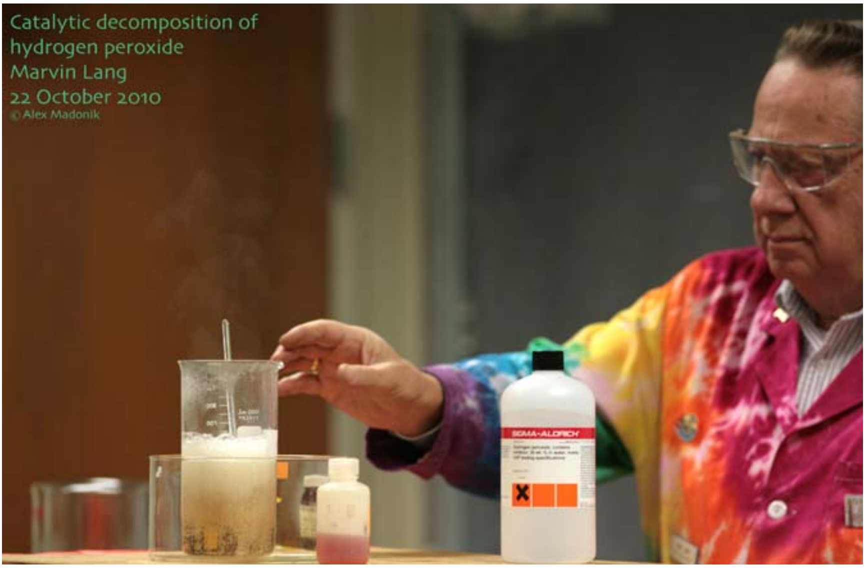
The complete list of venues

University of California, Santa Cruz - Sunday, October 17, 2010, 2:00 pm
St. Mary's College, Moraga, CA - Monday, October 18, 2010, 7:00 pm
California State University, Chico - Tuesday, October 19, 2010, 7:00 pm
California State University, Sonoma - Wednesday, October 20, 2010, 7:30 pm
Dominican Univ. of California, San Rafael - Thursday, October 21, 2010, 7:00 pm
California State Univ. East Bay, Hayward Campus - Friday, October 22, 2010, 6:00 pm
Exploratorium, San Francisco - Saturday, October 23, 2010, 10:30 am
California State University, San Jose - Saturday, October 23, 2010, 2:00 pm.

Marvin Lang freezes a balloon in liquid nitrogen, and then watches it re-inflate as it warms to room temperature, during the chemistry show at California State University East Bay

Don Showalter and a transparent Dewar flask full of liquid nitrogen, during the chemistry show at California State University East Bay

Don Showalter ignites balloons full of helium, hydrogen, and hydrogen plus air



Marvin Lang watches as the catalytic decomposition of hydrogen peroxide takes off

Nobel Prizes in 2010 Involve Chemicals

Leopold May

The Nobel Prize in Chemistry 2010 was awarded for the palladium-catalyzed cross coupling reactions in organic synthesis. It was awarded jointly to Richard F. Heck, 79, who is retired from the University of Delaware and living in the Philippines, Akira Suzuki, 80, Professor Emeritus of Hokkaido University in Sapporo, Japan, and Ei-Ichi Negishi, 75, Professor of Purdue University for more efficient ways of linking carbon atoms together to build complex molecules. Cross couplings involve reaction between two chemically distinct partners allowing control over both halves of the resulting molecule. Cross coupling reactions often involve aryl, alkenyl, or alkyl halides or pseudo-halides as one reaction partner with a much greater variety in the other reaction partner. This cross-coupling has vastly improved the possibilities for creating complex molecules, for example, natural products. One reaction is the Suzuki-Miyaura cross coupling of 1-aryltriazenes and boronic acids catalyzed by the polymer-supported Pd-NHC catalyst. For the discovery of the all carbon graphene molecule, the Nobel Prize in Physics was awarded to two Russian-born scientists, Andre Geim, 51, a Dutch national and Konstantin Novoselov, 36, a dual citizen of Great Britain and Russia. They first worked together in the Netherlands before moving to the University of Manchester, Great Britain, where they reported isolating graphene in 2004. By applying Scotch tape to graphite, they pulled off thin flakes that consist of one, several, or many layers of graphene. To locate the rare one-layer flakes, they deposited the layers on a silicon dioxide substrate of just the right thickness. When they shone light on the substrate, they were able to distinguish the one-layered graphene by its interference fringes. Graphene may find use as a sensor for gases and should find many applications in the electronic industry.

Cell Phone Spectrometer

University of Illinois chemistry professor Alexander Scheeline wants to see high school students using their cell phones ...as an analytical chemistry instrument.

Many schools have a very limited budget for instruments and supplies, making spectrometers cost-prohibitive for science classrooms. Even when a device is available, students fail to learn the analytical chemistry principles inherent in the instrument because most commercially available devices are enclosed boxes. Students simply insert samples and record the numbers the box outputs without learning the context or thinking critically about the process. “Science is basically about using your senses to see things - it’s just that we’ve got so much technology that now it’s all hidden,” Scheeline said.

So Scheeline set out to build a basic spectrometer that was not only simple but inexpensive. For a light source, Scheeline used a single light-emitting diode (LED) powered by a 3-volt battery, the kind used in key fobs to remotely unlock a car. Diffraction gratings and cuvettes are readily available from scientific supply companies. The entire setup cost less than $3. The limiting factor seemed to be the photodetector to capture the spectrum for analysis.

“But everybody has a cell phone, and almost all phones have a camera,” Scheeline said. “I realized, if you can get the picture into the computer, it’s only software that keeps you from building a cheap spectrophotometer.” He wrote a software program to analyze spectra captured in JPEG photo files and made it freely accessible online, along with its source code and instructions to students and teachers for assembling and using the cell-phone spectrometer. It can be accessed through the Analytical Sciences Digital Library. Scheeline wrote a detailed account of the cell-phone spectrometer and its potential for chemistry education in an article published in the journal Applied Spectroscopy. To contact Alexander Scheeline, e-mail scheelin@illinois.edu.

December Historical Events In Chemistry

Leopold May

December 1, 1743: Martin H. Klaproth, who discovered cerium with J. Jacob Berzelius and William Hisinger, was born on this date. He also discovered zirconium in 1789, uranium from pitchblende in 1789, and chromium (discovered previously by N. L. Vauquelin in 1797).

December 3, 1886: Karl Manne Georg Siegbahn, who was a researcher in x-ray spectroscopy, was born on this date. In 1924, he was awarded the Nobel Prize in Physics for his discoveries and research in the field of X-ray spectroscopy.

December 6, 1835: One hundred and seventy-five years ago, Rudolf Fittig was born on this date. He synthesized organic compounds, e.g., lactones, with B. C. G. Tollens; synthesized toluene; discovered diphenyl, phenanthrene, 1872, and coumarone, 1883.

December 7, 1810: Two hundred years ago, Theodor Schwann was born. He named and investigated pepsin, 1836, coined the word metabolism; discovered the striated muscle of the upper esophagus and the myelin sheath of peripheral axons, called Schwann cells; and was the founder of modern histology.

December 8, 1878: Eugene C. Bingham, who was born on this date, was a researcher on plastic flow and viscosity.

December 10, 1967: "Project Gasbuggy", the world's first commercial experiment with nuclear mining under the New Mexico desert, was started on this date.

December 12, 1960: Fifty years ago, it was announced at meeting of American Nuclear Society that the first pure compound of californium (Cf, 98) was synthesized.

December 13, 1935: Seventy-five years ago on this date, F. Victor Grignard died. He developed the magnesium reagent used in organic chemistry and was awarded the Nobel Prize in 1912 for the discovery of the so-called Grignard reagent, which in recent years has greatly advanced the progress of organic chemistry; shared the prize with Paul Sabatier who received it for his method of hydrogenating organic compounds in the presence of finely disintegrated metals whereby the progress of organic chemistry has been greatly advanced in recent years. He was born on May 6, 1871.

December 16, 1929: Bruce N. Ames developed the Ames Test, an indicator of carcinogenicity of chemicals that measures the rate of mutation by a chemical in bacteria. He was born on this date.

December 17, 1908: Fifty years ago, Willard F. Libby was awarded the Nobel Prize in Chemistry for his method to use carbon1 4 for age determination in archaeology, geology, (syn. cuprorivaite) geophysics, and other branches of science. He was born on this date.

December 19, 1949: Berkelium was discovered by ion exchange chromatography at University of California, Berkeley on this date.

December 22, 1903: Haldan K. Hartline, who was born on this date, performed single-fiber analysis of the optic responses of the vertebrate retina. He was a researcher in night vision in humans. He shared the Nobel Prize in Physiology or Medicine in 1976 with G. Wald and R. Granit, for discoveries concerning the primary physiological and chemical visual processes in the eye.

December 23,1829: Paul Schützenberger, a researcher in physiological chemistry, was born on this date. He prepared cellulose acetate in 1865 with Laurent Naudin.

December 25, 1761: In 1791, Rev. William Gregor discovered titanium and also analyzed minerals. He was born on this date.

December 25, 1904: Gerhard Herzberg, researcher on the electronic structure and geometry of molecules and free radicals using spectroscopy, was born on this date. In 1971, he received the Nobel Prize in Chemistry for his contributions to the knowledge of electronic structure and geometry of molecules, particularly free radicals.

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