THE VORTEX

AMERICAN CHEMICAL SOCIETY — CALIFORNIA SECTION
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September Meeting Speaker, Dr. Lynette Cegelski,
Assistant Professor, Department of Chemistry,
Stanford University

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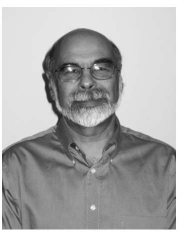

Chair's Message

Paul Vartanian

Chair's Message

Welcome back! I hope you have all had a great vacation season and the summer has been good to you. After passing through the Denver airport about 100 times in the past on business travel, I got to leave it for only the second time to visit Boulder and hike in Rocky Mountain National Park.

This fall we have some exciting things happening in the California Section. The September Section meeting will be on September 23, jointly with the Santa Clara Valley Section and feature Lynette Cegelski of Stanford University. Please see the announcement in the this *Vortex* for the details.

Through the efforts of Mark Frishberg and with the help of Eileen Nottoli, Alex Madonik, Bryan Balazs, and others, we have been fortunate to engage Professors Marvin Lang and Don Showalter for their chemical demonstration show during National Chemistry Week in October. Final arrangements are being made now so visit the California Section web site occasionally for the details. We hope to have the show at several sites within the Section territory. The Santa Clara Valley Section will also participate in hosting Lang and Showalter at a site in its territory. If you know any chemistry/science teachers who are not usually aware of Section activities, I encourage you to let them know of the show in their vicinity. As laboratory science is being limited by some schools because of its cost, we want to encourage teachers to use the resources available to have safe classroom demonstrations which help to make chemistry more interesting for students. We have had Profs Lang and Showalter present their show in the Section twice before and it never fails to be an exciting one for all, chemists and non-chemists alike.

The Section will hold its annual election in October. Please consider the candidates carefully and vote for your choices. Also on the ballot will be a referendum on a revision of the Section Bylaws. Most of the changes are our attempts to keep the Bylaws modern and/or in sync with the ACS. If you have any questions about the changes, please contact me at the Section office e-mail address (office@calacs.org) and we will explain the reasoning the Executive Committee had in mind behind the changes. Please put "Bylaw Question" in

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California and Santa Clara Valley Joint Section September

Speaker: Dr. Lynette Cegelski, Assistant Professor, Department of Chemistry, Stanford University
Title: "Macromolecular NMR for Drug Discovery"
Date: Thursday, September 23rd
Time: Networking: 6:30-7:00 PM, Dinner: 7:00 PM, Presentation: 8:00 PM (attending only the presentation is free)
Place: Elan Pharmaceutical's South San Francisco,180 Oyster Point Blvd (at the southwest corner of Oyster Point Blvd and Veterans Blvd, entrance is on the south side) South San Francisco
Cost $27 (Penne Pasta with choice of sauces, vegetables, chicken, garlic bread, cookies, sodas & waters, coffee) Dinner is free for students (high school, undergraduate, graduate) and 50% off for unemployed job seekers. The dinner service will be buffet style, and we need an accurate headcount prior to the event in order for the cover, the food charges as well as ensure that there is sufficient food for all.
Reservations: Please contact Julie Mason at the section office: office@calacs.org 510-351-9922 Deadline: Wednesday, September 15th

Biography:

Lynette Cegelski is an Assistant Professor in the Department of Chemistry at Stanford University. Dr. Cegelski received her PhD in Chemistry from Washington University, St. Louis, where she was trained as a solid-state NMR spectroscopist at the interface of chemistry and biology. She switched disciplines and was trained as a postdoctoral fellow in Molecular Microbiology and Pathogenesis at Washington University School of Medicine where she defined the importance of bacterial amyloid fibers in biofilm formation and identified inhibitors of amyloid and biofilm assembly. Dr. Cegelski is the recipient of a Burroughs Wellcome Fund Career Award at the Scientific Interface and began her appointment as Assistant Professor in the Department of Chemistry at Stanford in 2009. She is blending her expertise in biophysics, microbiology, and chemical biology to make discoveries regarding the fundamental chemistry of biological systems that will impact health and the environment and drive the development of new therapeutics to ameliorate disease.

Abstract:

The genomics and proteomics revolutions have been enormously successful in generating full genome sequences for an increasing number of organisms and in predicting and determining the structures of a steadily increasing number of proteins. In essence, these data provide crucial "parts lists" for biological systems. Yet, formidable challenges exist in generating complete descriptions of how the parts function and assemble into macromolecular complexes and how small-molecule inhibitors influence and inhibit assembly processes. My research program integrates chemistry and biophysics with chemical biology to investigate assembly processes in molecular and atomic-level detail to drive the discovery of new therapeutics. I will highlight the novel strategies we are developing using examples of taxol (determining the bio-active conformation of an anti-cancer drug), vancomycin analogues (mapping binding of antibiotics in intact cells), and bacterial amyloid inhibitors (developing novel anti-amyloid and anti-biofilm agents).

April Meeting Report

"Porphyrinic Pigments and Their Use in the Detection and Treatment of Diseases"

On Saturday, April 24, the Women Chemists Committee held a joint meeting with the ACS California Section at the Towers Conference Center at San Francisco State University. The highlight of the event was a most interesting, lively talk on "Porphyrinic Pigments and Their Use in the Detection and Treatment of Diseases", presented by Dr. Uschi Simonis, professor at San Francisco State University.

Dr. Uschi Simonis

With 12 million deaths projected for 2030, cancer is the leading cause of death worldwide and affects people at all ages. Due to the systemic toxicity of traditional therapies, new strategies are urgently needed for combating the disease. Such strategies may be found in photodynamic therapy (PDT). PDT is minimally invasive and uses for its mode of action a photodrug as the photosensitizer that is retained longer in malignant tissue than in healthy tissue. Upon its activation by light and energy transfer to tissue oxygen, reactive oxygen species are formed locally, among which singlet oxygen is a key cytotoxic agent causing localized destruction of tumor cells and/or the tumor neovasculature. Although regulatory-approved for the treatment of selected cancers, PDT remains underutilized in clinical practice. One of the reasons is related to their substantial drawbacks. PDT triggers cell death by necrosis causing severe tissue inflammation or deposits in the skin leading to painful and disfiguring photosensitivity. There remains an urgent need for the development of improved photodrugs.

After an introduction to PDT, Dr. Simonis presented the approach that her research laboratory is committed to prepare better photodrugs. To tackle the issues of inflammation and necrosis,Dr. Simonis designs the photosensitizers in her lab with the goal of targeting the cell's mitochondria. The importance of having the compounds localize to the mitochondria is due to the organelle's ability and role in initiating the programmed cell death pathway called apoptosis, which is known to be a clean, organized death without eliciting painful inflammation. She hopes the production and modification oftetraphenylporphyrins and pheophorbides with specific amino acid substituents will give rise to properties exhibiting greater solubility, uptake, and increased selectivity in cancer cells.

Margareta Sequin and Anna Jung

(Continued from page 3)

the subject line to help us identify your e-mail. Because a paper printing included with the ballot would run to more than 10 pages, the complete Bylaws will be on the web site with the revisions clearly identified.

Congratulations to the following ACS Fellows in the California Section.

Bryan Balazs
Jean Frechet
Enrique Iglesia
C. Bradley Moore
Daniel Neumark
Attila Pavlath
Elaine Yamaguchi

Paul Vartanian discovered another vortex during his visit to The Crucible in Oakland. The Section attorney is checking if there are any of our rights are being violated.

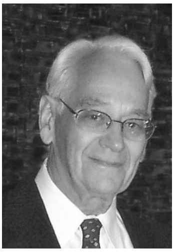
California Section Nominations

The California Section is soliciting candidates for terms of office beginning in January, 2011. The election will be held for the positions of Chair-elect, Secretary, Director, and three Councilors. If you wish be a candidate, please contact Eileen Nottoli, Chair of the Nominations and Elections Committee at enottoli@allenmatkins.com. State the position for which you wish to be a candidate. Candidates are allowed a 200 word biographical/statement write-up to be submitted to the membership with the election ballots. The deadline for responding for the 2010 ballot is September 20.

The California Section is looking for volunteers interested in both leadership and support roles. Our Section is active with programs to advance chemical education and careers. The Section has several elected officers, including a Chair, Secretary, Treasurer, Directors, and Councilors. Councilors attend the Council meeting at the spring and fall national ACS meetings and participate on various committees such as Project Seed, Education, Environmental Improvement, and Safety. Officers are elected by Section members in the fall.

We also have a number of committees as shown on our website. The Awards Committee heads up searches of deserving candidates for national ACS awards. There are several Educational subcommittees such as the Chemistry Olympiad and Chemistry Teachers. Government Affairs interacts with our California and federal legislators. The Program Committee identifies speakers for our Section meetings as well as organizes other meetings. The Minority Affairs and Women Chemists Committees have active programs in career development.

Please call any of our officers or committee chairs listed on our website (www.calacs.org) for more information on activities to match your interests. Please also call our office at (510) 351-9922 for information on attending any of the Executive Committee meetings or if you are interested in running for a Section office.



ELK-N-ACS

Evaldo Kothny

Carl Auer, The Innovator

Austrian chemist Carl Auer (1858-1929) was a student under the guidance or Robert Bunsen (1811-1899), the greatest chemist at that time. Bunsen, mostly known for the burner (1855) which was named after him but which was invented by Michael Faraday (1791-1867), was the mentor for Auer's most notable discoveries. Bunsen and Kirchhoff invented the spectroscope in 1859 which allowed a series of new applications and discoveries. Auer's fame started after he improved gas lighting in 1885, which led him to receive the nobility title of Freiherr von Welsbach, which means "Baron (of the castle) of Welsbach" located in the province of Carinthia in Austria. Thus this improved device received the name of "Welsbach mantle". Initially, a wad or fabric of ramie (later on of rayon) which was impregnated with zirconium nitrate and dried would burn away at the first ignition exposing a delicate structure of the oxide, which would emit a brillant light from a gas flame. Replacing Th for Zr improved the conversion of light from heat. Thorium had been previously discovered in 1828 by Berzelius. After a enduring experimentation, Auer improved the conversion of heat to light by activating the thorium oxide with 0.9% cerium oxide which maximized the light output and changed the emissivity from yellowish to greenish due to the spectral characteristic of Ce. Monazite, a mineral found in river sand, was ideally suited for the fabrication of the mantles, because it both contained thorium, cerium and other rare elements. These mantles are still being used in areas without electricity or for camping.

Carl Auer was also involved with the rare element separation which is alike that of the radioactive elements. It all started with heavy sand separated from ordinary river sand. Most people has heard of black sand left over after gold panning, so the inquiring mind of the chemists wondered about its composition.

The production of titanium, zirconium and hafnium from black sands accumulated in estuaries was described in the April 2007 *Vortex*. Some black sands also contain considerable amounts of Monazite, a heavy phosphate of rare elements and thorium. Just before WW1, 3000 tons of Monazite from black sands were processed to yield 150 tons of thorium nitrate. The content of thorium in Monazite is usually 3 to 5%.

Upon observation of Monazite in 1794, Gadolin, a Finnish chemist, concluded that it contains a new element which he called "Yttrium earth". Intrigued by curiosity, Berzelius (1779-1848) studied this mineral in 1803 together with Klaproth (1743-1817). While Berzelius discovered Thorium in 1828, both found another element which they called "Cerium earth". A student of Berzelius, Mosander (1797-1858), who became professsor of chemistry and mineralogy in 1832 in the Caroline Medical Institute in Stockholm took the task of purifying these two "earths" (the name of "earths" was used to distinguish stable oxides from metals). In 1839 and in 1843 Mosander was able to split them into 6 "earths": Cerium,, Lanthanum, Yttrium, Erbium, Terbium and Didymium.

Mosander was first interested in the Cerium earths. Shortly after separating the Cerium earths in 1839, he split them into Cerium proper and Lanthanum. Didymium was reported as a new element.

The second task for Mosander in 1843 was the investigation of the components of the "Yttrium earths" described by Gadolin in 1794. He found that it contained several elements of similar chemical behavior. Thus he separated them into Yttrium, Erbium, Terbium and Didymium. Intrigued by Didymium, Lecoq de Boisbodram, recognized Samarium as a component in 1879, whereas Marignac separated Gadolinium in 1880. The previously found Samarium fraction was impure and contained Europium as an admixture, an element discovered by Demarcay in 1896. Erbium was found to be a complicated fraction. After a laborious work by

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A Chemist's Conundrum: The Problems and Chemistry of Emerging Contaminants (Part 2)

Bill Motzer

In Part 1 (June 2010 Vortex), I discussed the definition of an emerging chemical contaminant (ECC) and also the history and characteristics of older ECCs. But what really determines if a chemical or class of chemicals should be designated as ECCs? The following list is a general outline, not necessarily occurring in any order, but with events generally beginning with item 1:

(1) Academic interest and research, including grant proposals and submissions, presentations at conferences and symposia and publications in peer reviewed journals. Generally for an ECC, research is conducted on a chemical's environmental transport media in air, soil or water, which includes solubility, soil distribution coefficients, extractability, *i.e.* into octanol, Henry's Law constant, and degradation half life. A substance's potential impact to these media may be defined.

(2) Analytical methodologies as established by the U.S. Geological Survey (USGS), the U.S. Environmental Protection Agency (USEPA), and the American Society of Testing and Materials (ASTM). In addition, sample collection protocols are established.

(3) Development of useful remedial technologies, particularly for recalcitrant chemicals and development of forensic chemical fingerprinting methods and/or age dating techniques.

(4) Widespread dissemination of information and/or misinformation about chemical properties, etc. by public media such as newspapers, magazines, TV and movies, and environmental groups with subsequent legislative demands.

(5) Significant interest by the legal community with subsequent litigation.

(6) Regulatory investigations including epidemiologic and health-based risk assessment studies. In California these may be conducted by the Department of Toxic Substances Control (DTSC) Office of Environmental Health Hazard Assessments (OEHHA). Establishment of drinking water NLs, PHGs, and MCLs by CDPH and USEPA

NEW ECCS

There are many new ECCs. Those of current interest to environmental chemists and regulatory agencies include bisphenol A (BPA) (used in polycarbonates), perfluorinated chemicals (e.g., perfluorooctane sulfonate and perfluorooctanoic acid; used in Teflon production),pharmaceuticals,and nanomaterials. The latter two are discussed in more detail below.

Pharmaceuticals and Personal Care Products (PPCPs) are a large class of mostly organic chemicals. Many PPCPs have been designated as ECCs because they are disposed or discharged to the environment on a continual basis from domestic and industrial sewage including septic systems, landfills, agricultural runoff, and wet weather runoff. Therefore, they have the potential of impacting (even at low concentrations in the ng/L range) surface and groundwater supplies. There are three general recognized classes:

(1) Pharmaceuticals: chemicals formulated into drugs for treatment of diseases (cure/mitigation) including chemopreventatives: i.e., chemicals that reduce chances of disease or slow its onset (e.g., tamoxifen for breast cancer), or those that enhance health or structural functioning of the human body (e.g., steroids and hormones). They also include diagnostic agents (e.g., X-ray contrast media such as gallium-67 citrate and osmium tetroxide), illicit and recreational drugs (e.g., heroin, cocaine, cannabis, methamphetamines), and veterinary drugs.

(2) Protective Care Products include cosmetics (e.g., hairsprays), fragrances (e.g., musks), soaps, detergents, insect repellants (e.g., DEET), sun-screen agents, skin anti-aging preparations, and disinfectants [e.g., triclosan or 5-chloro-2-(2,4-dichlorophenoxy)phenol].

(3) Nutriceuticals are bioactive chemicals

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contained in nutritional supplements.

PPCP production is worldwide in quantities ranging from kilograms to thousands of metric tons per year for some individual products. In the environment, some compounds are very persistent and recalcitrant (e.g., carbamazepine and primadone). Others will readily biodegrade (e.g., the sulfonamide antibiotics), while a few degrade by photolysis (e.g., gemfibrozil), and some have potential ecological impacts (e.g., steroids and hormones). PPCPs recently added as possible ECCs include acidic PPCPs (e.g., bezafibrate, clofibric acid, and naproxen), antiviral agents (e.g., acyclovir, nevirapine, and oseltamivir), and antidepressants such as Prozac. Current research is also focusing on environmental degradation products and metabolites because some of these may be more dangerous than the original PPCP.

Nanomaterials

Manufactured nanomaterials (MNMs) are a relatively new class of chemical compounds, and engineered materials or metals with particle sizes in the 1-100 nanometer (nm) range (1×10^{-9} m to 100×10^{-9} m). In comparison, a human hair is 80,000 nm in diameter, a red blood cell is about 7,000 nm wide, DNA about 2 nm to12 nm in width, and a water molecule is approximately 0.3 nm across. This "nanoworld" now includes several different substance classes, including:

(1) Carbon-based materials and structures such as C_{60} fullerene, which can be formed into carbon nanotubes.

(2) Metal-based substances such as nanogold, nanosilver, and nanometal oxides such as titanium oxide. These also include colloids and quantum dots, which are packed semiconductor crystals whose optical properties can change with size; they also have the ability to absorb light and re-emit it in different colors depending on the nanocrystal's size.

(3) Dendrimers are polymers constructed from branched units. A dendrimer's surface has numerous chain ends that can be designed to perform specific chemical functions. Also, dendrimers generally are spheres into which other molecules or atoms can be placed. This makes them useful for drug or perfume delivery.

(4) Bio-inorganic composites, such as titanum with attached DNA strands. These can be used to treat disease.

Several classes of MNMs are now globally manufactured in hundreds to thousands of metric tons per year. These include MNMs for structural applications (ceramics, catalysts, films and coatings, and composite metals), skin care products (metal oxides), information and communication technologies (nanoelectronic and optoelectronic materials, organic light emitters, and nanophosphors), biotechnology (drug delivery, diagnostic markers, and biosensors) and environmental technologies (nanofiltration and membranes). MNM are unique because in some ways, they tend to behave as new chemical substances. Two main factors distinguish MNMs from ordinary materials:

(1) They have relatively larger surface areas when compared to the same mass of material produced in larger form. For example, a 1.0 cm^3 cube has a surface area of 6 cm^2. This same cube separated into 1.0 mm cubes now has a surface area of 60 cm^2; but if further divided into 1.0 nm cubes, the total surface area becomes 60×10^6 cm^2. This may cause a relatively inert large-scale substance to become more chemically reactive in nanoscale form. Size reduction may also affect the material's strength.

(2) For some MNMs — particularly at the lower end of the scale — quantum effects can begin dominating the substances, affecting their optical, electrical, and magnetic behavior.

Once released into the environment, nanoparticles may also quickly change into larger particles by agglomeration processes. It is not known what the actual effects would be, but some researchers have hypothesized that MNM releases reaching groundwater could plug porous media rendering the aquifer useless for groundwater withdrawal.

Research and investigations on MNM detection and analysis, toxicity, environmental transport and fate remains in the initial

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CA-GALA Legislative Visits at State Capitol in Sacramento

Marinda Wu, Government Affairs Committee Chair, California Section

CA-GALA stands for the ACS's California Government and Legislative Affairs Committee that was formed to provide "leadership and a unified voice for ACS members within the state of California regarding science, technology, engineering and mathematics (STEM) education." CA-GALA has ACS members interested in government affairs from our Section but also Sections from Santa Clara Valley, Orange County, Sacramento, San Diego, San Gorgonio, and The Southern California Section. Natalie McClure of the Santa Clara Valley Section has chaired CA-GALA these past couple of years with help and support from ACS staff, James Brown and Kathryn Verona.

Recently ACS staff James Brown accompanied Natalie McClure, Bonnie Charpentier from the Santa Clara Valley Section and me to visit some legislator at our State Capitol. This was our first Legislative Summit with introductory meetings at our State Capitol for CA-GALA organized by ACS staff. Previously there have been some interactions with our state legislators through LAN (Legislative Action Network), CA-GALA letters, and staff work with partners such as CSTA (California Science Teachers Association). Sacramento Section member, Jan Hayes has testified on behalf of CA-GALA a number of times in Sacramento regarding STEM issues. We had three objectives with this first round of organized meetings with various state legislators: 1) We wanted to introduce ACS and CA-GALA since we are still considered very new players in Sacramento; 2) We wanted to discuss the STEM Legislative Task Force Resolution (ACR 88) and the ACS role in developing and advancing it; 3) We want to find out what the legislators think and need regarding STEM issues and learn how ACS might be of most help to them.

We spent June 29 meeting at the offices of the following state legislators: Senator Mark DeSaulnier, Assemblyman Jerry Hill, Assemblyman Tom Torlakson, Senator Mark Wyland, Assemblywoman Mary Hasyashi, and Senator Leland Yee. We met mostly with their staff but did get to meet and take photos with Assemblyman Tom Torlakson who was sponsoring the STEM Legislative Task Force Resolution (ACR 88). Our meetings with all these legislative offices were well timed since ACR 88 was coming before the Senate for approval later that week. In fact, it had already passed the House and was approved by the Senate a few days after our visits. The enactment of this legislation recognizes the "central role that STEM education plays in providing California students with the skills they need to succeed."

Our three basic objectives described above were accomplished. We also had lunch with the Executive Director of CSTA (California Science Teachers Association) and discussed how we can partner and work together.

CA-GALA is building coalitions with professional education organizations and other allies to work towards enactment of comprehensive STEM education legislation. This will ensure that STEM subjects are educational priorities and reflect the real value of these subjects to the future of California's students. See www.acs.org/policy for more information.

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stages. Such investigations and research by academia and industry are currently underway with annual growth at exponential rates. (A Google search using the key words "research and "nanomaterials" returned 210,000 hits.) Additionally, although the reporting media have not significantly focused attention to MNMs, regulatory agencies are becoming quite concerned recently installing web sites entirely devoted to nanomaterials and nanotechnologies (e.g., see DTSC's web site at: http://www.dtsc.ca.gov/TechnologyDevelopment/Nanotechnology/nanoport.cfm and USEPA's web site at: http://www.epa.gov/oppt/nano/.

In Part 3, I will discuss some additional ECCs that are now being researched and may be just reaching regulatory agency consideration.

2101 ACS recipients of the 50 year Member Awards
Shao Yuan, William Nicholson, Norman Jensen, John Hannah, and William Foshee

2101 ACS recipients of the 60 year Member Awards

Robert Lindblom, David Nethaway, Bacon Ke, Y. Gust Hendrickson, Charles Greene, and Glenn Fuller

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September Historical Events In Chemistry

Leopold May

September 1, 1873, B. Smith Hopkins, who was a researcher on rare earths, was born.

September 3-5, 1860, One hundred and fifty years ago during these dates, the Karlsruhe Congress, 1860, the first international meeting of chemists was held in Karlsruhe, Germany.

September 6, 1870, Frederick G. Donnan, a researcher in theory of membrane equilibria (Donnan Equilibrium), was born. He also did research in chemical kinetics.

September 9, 1858, One hundred and twenty-five years ago in 1885, Carl Auer von Welsbach, discovered neodymium (Nd, 60 and praseodymium (Pr, 59). He was a researcher on rare earths, discovered lutetium with Georges Urbain (Lu, 71) in 1907, and invented incandescent mantle (Welsbach Mantle or Auerlicht). He was born on this date.

September 12, 1897, Seventy-five years ago in 1835, Irène Joliot-Curie and her husband, Fredéric Joliot-Curie, were awarded the Nobel Prize in Chemistry in recognition of their synthesis of new radioactive elements. She was born on this date.

September 13, 1886, Robert Robinson, a researcher in plant pigments, alkaloids and phenanthrene derivatives, was born on this date. He was awarded the Nobel Prize in Chemistry. in 1947 for his investigations on plant products of biological importance, especially the alkaloids.

September 16, 1853, One hundred years ago in 1910, Albrecht Kossel, a researcher in chemistry of cells and proteins was awarded the Nobel Prize in Physiology or Medicine in recognition of the contributions to our knowledge of cell chemistry made through his work on proteins, including the nucleic substances. He was born on this date.

September 17, 1677, Stephen Hales, born of this date, studied the role of air and water in the maintenance of both plant and animal life, developed the pneumatic trough, and discovered that 'air' is released in decomposition of plant and animal substances.

September 23, 1915, John Sheehan, who synthesized penicillin-V in 1957, was born.

September 24, 1898, Howard Walter Florey, born on this date, did research on lysozyme and antibiotics. In 1945, he shared the Nobel Prize in Physiology or Medicine with Alexander Fleming and Ernst B. Chain for the discovery of penicillin and its curative effect in various infectious diseases.

September 26, 1754, Joseph-Louis Proust articulated the Law of Definite Proportions and was born on this date.

September 29, 1920, Peter D. Mitchell, researcher on chemiosmotic reactions and reaction systems, was born on this date. In 1978, he received the Nobel Prize in Chemistry for chemiosmotic theory and its contribution to the understanding of biological energy transfer.

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Marignac in 1878 and by Nilson in 1879, two more elements were discovered in Erbium, namely Ytterbium and Scandium. The left over Erbium was still impure. Cleve (also Soret and Delafontaine) in 1879 found that it contained Holmium and Thulium, and Lecoq de Bouisbodram in 1886 added Dysprosium to this list. Not totally satisfied with these results, Auer investigated the residues in 1885 and separated Didymium into Neodymium and Praseodymium. The Ytterbium fraction found by Marignac in 1878 was studied further by Urbain in 1905. Independently without any relationship to Urbain, also Auer worked on this substance in 1907. Both scientists discovered that the impurity consisted of Cassiopeium, later renamed Lutetium.

The effort for disclosing the composition of the 15 rare elements took a little over one century by about one dozen mineralogists, chemists, academicians and engineers.

Besides Monazite, rare elements are also contained in Bastnaesite (a fluocarbonate related to carbonatites, alkaline pegmatites and ultramafic volcanics), Xenotime, Samarskite, Thorite and a few others.

(To be continued)

2010 Petersen Award Recipient, Lee Latimer and his wife Bonnie Charpentier

Recipients of the California Section Hight School Teacher's Award
Jenelle Ball, (Chico High School), Lee Boyles, (Petaluma High School), Charles Greene,Randy Miller, and Cheyenne Ball

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- http://www.calacs.org/page.asp?id=22

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