THE VORTEX

AMERICAN CHEMICAL SOCIETY CALIFORNIA SECTION
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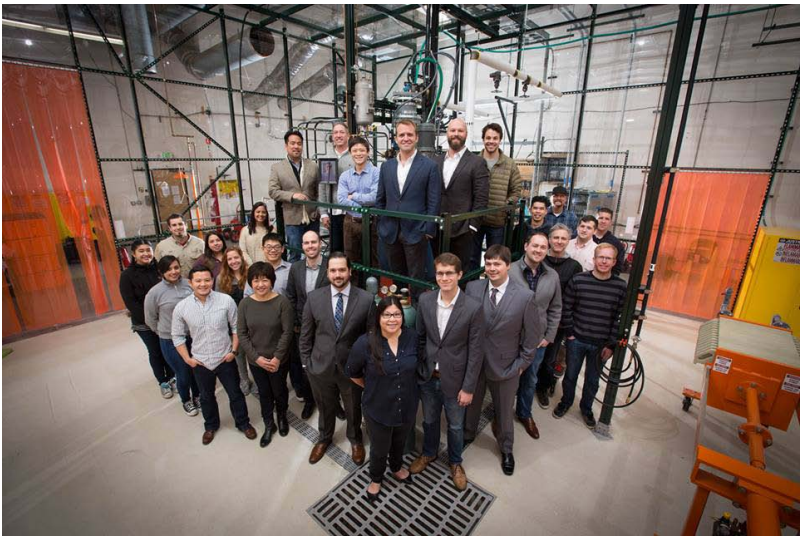

Origin Materials, a West Sacramento-based startup working on producing renewable water bottles. See page 2 for details on the company and presentation at the February Section Meeting.

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California Section, ACS February Meeting
"Conversion of Biomass to biobased-para-Xylene"
(A Formal Synthesis of Biobased-Polyethylene Terephthalate, bio-PET)

Speaker: Mako Masuno, Ph.D., Head of Research and Development at Origin Materials (formerly Micromidas)
Date: Thursday, February 22, 2018
Time: 6:00 – 6:50 pm. Social with light refreshments; 7:00 – 8:15 pm Presentation
Location: USDA 800 Buchanan Street, Albany
Cost: $10.00 ($5.00 for students) for light refreshments. No cost for presentation only.
Reseration: Please contact the CalACS office by email office@ calacs.org or 510-351-9922 by Monday, February 19, 018. You may prepay by mailing your check to Cal. Section ACS at 2950 Merced St. #225, San Leandro CA 94577 or with PayPal using our email address office@calacs.org. You may also pay at the door with cash or check (credit/debit not accepted at the door)

Abstract:

Conversion of Biomass to biobased-para-Xylene (A Formal Synthesis of Biobased-Polyethylene Terephthalate, bio-PET) Unsustainable, fossil based plastic—polyethylene terephthalate (PET)—dominates the current plastic bottle industry. Instead the plastic bottle industry desires to produce a bio-based PET bottle to improve the carbon footprint of their packaging. PET, a thermoplastic, is a product of the polymerization of mono ethylene glycol (MEG) and purified terephthalic acid (PTA). These two monomers are almost entirely sourced from fossil sources. While there are a few commercial efforts to produce bio-based MEG from ethanol, bio-based PTA remains unavailable in the market. PTA is synthesized commercially through the oxidation of isomerically pure para-xylene, and para-xylene is a product of oil refining.

Biography:

Mako Masuno, PhD is the Head of Research and Development at Origin Materials, a chemical company that converts biomass to specialty and commodity chemicals and resins. As Head of R&D, Dr. Masuno oversees the Chemistry, Analytics, and Safety and Compliance departments. His areas of expertise include natural product biosynthesis & biomimetic synthesis, pathway development and optimization, and structure/property relationships. Throughout his career, Dr. Masuno has scaled up active drug synthesis, natural product extractions, biopolymer synthesis, biomass processing, and distillation to the hundreds of kilograms engineering scale. In addition, he has an excellent knowledge of carbohydrate dehydration chemistry, having contributed to the design of Origin Materials furanics platform process and scale up to para-xylene production. He is one of the formative members of the NaturAll bottle alliance. The alliance, consisting of Nestle, Danone and Origin Materials are committed to developing 100% bio-based bottles.

Dr. Masuno currently has 14 publications, 7 patents, 9 pending patents, and 2 provisionally filed patent applications. He was awarded the ACS Sacramento Section Volunteer of the Year Award (2017), the Mathematics and Physical Science Dean's Graduate Prize in the College of Letters and Science in 2005 for excellence in teaching and research, the 4th European Conference on Marine Natural Product Participation Award (2004), R.B. Miller Award (2004), and the Bradford Borge Fellowship (2000-2002). Dr. Masuno received his B.S. in Chemistry from Westmont College and his PhD in Synthetic Organic Chemistry from the University of California, Davis.

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Chair's Message

Margareta Séquin

The year 2018 has started well for our section, with the January section meeting featuring a fascinating talk by Dr. Pawel Misztal on "Emission of microbial volatile organic compounds by bacteria and fungi". We hope you can join us again at one of our next monthly section meetings: Dr. Mako Masuno will present a talk on "Conversion of Biomass to biobased-para-Xylene (A Formal Synthesis of Biobased-Polyethylene Terephthalate, bio-PET)" (see also the announcement in this Vortex) on Thursday, Feb 22. Dr. Eva Nogales will give a presentation on "Cryo-Electron Microscopy to Visualize the Molecular Machinery Involved in Regulation of Gene Expression" on March 29, 2018.

Our section meetings feature a great variety of topics related to the chemical enterprise and are presented by speakers of diverse backgrounds. The gatherings are an opportunity to hear about newest findings and are an excellent place for networking with other chemists.

Our Women Chemists Committee (WCC) organizes several events that showcase the many different career paths available to chemists and particularly feature women that are working in them. We hope to inspire students as well as those seeking to change careers in a casual setting. The meetings consist of a talk, lunch, and networking.

Our tradition of supporting public outreach events continues: On Saturday, February 24, 2018, we participate again with activities at this year's Tri-Valley Expanding Your Horizons (EYH) conference at Diablo Valley College Campus in San Ramon. We will interact with 300 girls in grades 6-9 and show them how rewarding a career in math and science can be. Contact me at msequin @sfsu.edu if you would like to help us as a volunteer.

Our Section is an active participant in the Chemistry Olympiad. This year we anticipate that 21 high schools will be participating. Of the 259 expected students that will take the Local Exam, our Section will select the top 18 students to take the National Exam on April 21 at Las Positas College in Livermore. Each student who takes the Local Exam receives a certificate and letter of encouragement from our Section.

This describes just some of our activities. We are looking forward to see you at one (or more) of our events!

California Section
American Chemical Society

Women CHEMISTS Committee

All are welcome

Saturday, February 3, 2018

USDA Laboratory
800 Buchanan Street, Albany, CA 94710

Title

New and Emerging Issues in Environmental Health

Time

10:30 a.m.-11:00 a.m.
Snacks and coffee

11:00 a.m.
Discussion and lunch

Reservation

Please register (including lunch or for talk only) by email to office@calacs.org or by phone 510.351.9922. If mailing a check in advance, please make payable to: "California Section ACS" and send to Cal Section Office, 2950 Merced Street #225, San Leandro, CA 94577, postmarked no later than January 26, 2018.

Cost

Technical discussion is free
$15 lunch ($7 for students and the unemployed)

GINA M. SOLOMON, M.D., M.P.H.

About the Speaker

Gina Solomon is a Principal Investigator at the Public Health Institute, researching how California's Green Chemistry Laws could be enhanced to better protect the public from chemicals that may cause breast cancer. Dr. Solomon is also a Clinical Professor of Medicine at the University of California San Francisco (UCSF). She served as the Deputy Secretary for Science and Health at the California Environmental Protection Agency (CalEPA) from 2012–2017, and as a senior scientist at the Natural Resources Defense Council from 1996–2012. She was also the director of the occupational and environmental medicine residency program at UCSF and the co-director of the UCSF Pediatric Environmental Health Specialty Unit. Dr. Solomon's work has spanned a wide array of areas, including children's environmental health, reproductive toxicity, cumulative impacts, and the use of novel data streams to screen chemicals for toxicity. She has also done work in exposure science for air pollutants, pesticides, mold, and metals in soil, and on the health effects of climate change. She was involved in the aftermath of Hurricane Katrina, the Gulf oil spill, and the Chevron Richmond explosion and fire, and she successfully spearheaded regulations to improve refinery safety in California. Dr. Solomon has served on multiple boards and committees of the National Academies of Science, the EPA Science Advisory Board, and the National Toxicology Program's Board of Scientific Counselors. She also served as vice-chair of the EPA Board of Scientific Counselors Chemical Safety for Sustainability subcommittee. Dr. Solomon received her bachelor's degree from Brown University, her M.D. from Yale, and did her M.P.H. and her residency and fellowship training in internal medicine and occupational and environmental medicine at Harvard.

Abstract

New potential chemical exposures are emerging in consumer products and in small workplaces. At the same time, new technologies are emerging to identify and screen chemicals for exposure or toxicity. This presentation will focus on emerging issues such as 3D printing, laser cutting, preservatives in personal care products, and chemicals that impart stain and water resistance to products. New technologies include sensor networks and crowdsourcing of environmental monitoring data, non-targeted and semi-targeted biomonitoring, high-throughput and medium-throughput toxicology, and others. The field of risk assessment is also changing to adapt to these new data streams. All these new developments offer opportunities and challenges for discussion.

Directions

From I-80 W:
Take the Albany Exit, and make a left turn onto Cleveland Avenue at the stop sign. Parallel the railroad tracks, and stay on that road until the end, when you must turn left and drive past a USDA gate (on your right). You will reach a signal stop at Pierce and Buchanan; prepare to stop. Stay in the right lane because you will make a right turn very soon into the USDA driveway, where you will be met by a USDA representative for entrance to parking.

From I-80 E:
Take the Albany Exit, and exit toward the right at the top of the off-ramp. You will now be on Buchanan Street. Drive toward the signal stop at Pierce and Buchanan; prepare to stop. Stay in the right lane because you will make a right turn very soon into the USDA driveway, where you will be met by a USDA representative for entrance to parking.

A couple of links to driving directions and public transit options can be found on: https://www.ars.usda.gov/pacific-west-area/albany-ca/wrrc/

Upcoming Events

Math and Science Family Night- March 13, 2018-Thornton Jr HS- (6 to 8 pm)
Glorietta Elementary School Science Faire- March 21, 2018- (5pm – 7pm)

SEA Change Program Aims to Transform Diversity Efforts in STEM 24 January 2018

Andrea Korte

AAAS
AAAS NEWS

SEA CHANGE IS A NEW ASSESSMENT AND CERTIFICATION PROGRAM THAT SEEKS TO CREATE TRANSFORMATIVE INSTITUTIONAL CHANGE TO FOSTER DIVERSITY IN STEM. | UNIVERSITY OF WARWICK

AAAS is working with colleges and universities to create institutional systems to improve the outcomes and opportunities for underrepresented and underserved groups in science, technology, engineering and mathematics.

Under the new program led by AAAS, educational institutions commit to removing barriers to STEM achievement for women, minorities and people with disabilities through participating in a program of voluntary self-assessment.

"We have been able to advance in science and technology because of people, who generate ideas, who provide the creative spark that expands our economy and who ensure increased productivity as well as improved health, security and overall quality of life," wrote Shirley Malcom, director of AAAS' Education and Human Resources programs, and Paula Rayman, professor at University of Massachusetts Lowell and advisory board chair of the SEA Change program. "But our nation has so far failed to use all of the talent available to us."
Despite decades of progress, blacks, Hispanics and Native Americans are still underrepresented in STEM. Underrepresented groups make up 31% of the population, earn 21% of the bachelor's degrees in science and engineering and 13% of the doctorates in science and engineering and hold just 11% of jobs in science and engineering fields, according to Emilda Rivers of the National Center for Science and Engineering Statistics at the National Science Foundation.

A new study from the Pew Research Center also finds that underrepresented minorities report facing discrimination or isolation at work. In an interview with Pew, Malcom cited a 1976 study she co-authored which found reported feelings of isolation in STEM because of race – experiences which are still being reported today, she said. Sixty-two percent of black workers in STEM report facing racial discrimination at work, according to the Pew study, released Jan. 9.

DESPITE INCREASED REPRESENTATION OF BLACKS, HISPANICS AND NATIVE AMERICANS IN SCIENCE, THOSE GROUPS REMAIN UNDERREPRESENTED AMONG STEM DEGREE HOLDERS. | NATIONAL SCIENCE FOUNDATION

Although women earn more than half of bachelor's degrees in the United States, they are underrepresented among STEM graduates, particularly in physics, engineering and computer science, and hold just 30% of jobs in science and engineering fields, Rivers said.

One in nine scientists under the age of 76 reports having a disability, Rivers added.
To recruit, retain and advance the full range of talent, SEA Change – short for STEM Equity Achievement – calls upon colleges and universities to take an institutional approach, said Beth Ruedi, AAAS project director.

"This is about fixing the system. This is not about intervening on behalf of the people who the system has been negatively impacting," Ruedi said.

To participate in SEA Change, colleges and universities – or individual departments – gather data, including those related to institutional climate; develop goals and allocate resources to improve their metrics in a range of areas, such as recruit-

(continued on page 7)

Grilling Ghrelin and Loving Leptin (Part 2)

Bill Motzer

In Part 1 (January 2018 Vortex), I described the characteristics of ghrelin, a human growth hormone that regulates hunger. Because ghrelin is a peptide that stimulates appetite, it seems logical that another hormone should exist that suppresses appetite. In fact, there is one, and it's known as leptin (aka: the hormone of energy expenditure) derived from the Greek λεπτός or leptos meaning thin.

Leptin's discovery preceded that of ghrelin. In 1949, scientists at the Jackson Laboratory in Bar Harbor Maine, noted that a mutation in a non-obese mouse colony resulted in a strain of obese offspring. Further investigations indicated that this mutation had occurred in a hormone that regulated hunger and energy expenditure. In the 1960s, a second mouse obesity causing mutation was identified at the Jackson Laboratory by Dr. Douglas Coleman. In 1990, Drs. Rudolph L. Leibel and Jeffrey M. Friedman and their research teams at The Rockefeller Institute for Medical Research in New York City mapped the gene. In subsequent studies, Leibel's and Friedman's and other labs confirmed that the gene encoded a hormone that circulated in blood and that this hormone could suppress food intake thereby influencing body weight.

In 1994, Friedman and Leibel identified the specific producing gene with Friedman naming the new hormone leptin. This co-discovery has had a major role in our understanding of the mechanisms regulating body weight and the cause of human obesity. Subsequent studies conducted in 1995, confirmed that the gene encodes a hypothalamus leptin receptor that regulates hunger sensation and body weight.

Human leptin is a protein of 167 amino acids with one disulphide bond; it has a molecular mass of approximately 16 kilo-Daltons (kDa). Leptin is a four-helix bundle with one very short strand segment and two relatively long interconnected loops, consistent with a classification as a cytokine four-helix bundle. In humans, the Ob(Lep) gene (i.e., Ob for obese, Lep for leptin) is located on the 7th chromosome.

Leptin is produced primarily in white fat (adipose) tissue. But it's also produced by brown adipose tissue and in the placenta, ovaries, skeletal muscle, upper portion of the stomach (in the fundic glands where P/D1 cells occur that also produce ghrelin, and in gastric chief cells), mammary epithelial cells, and bone marrow. Produced leptin circulates in blood both in free form and as bound to proteins. Leptin, decreases your appetite and therefore, it is also called an appetite suppressor or satiety hormone. It does this by modifying appetite-regulating peptides, which are either appetite stimulating (orexigenic) or appetite suppressing (anorexigenic). Leptin therefore is an appetite suppressant, stopping you from overeating, increasing energy release, thereby making you more active.

Leptin is opposed by the actions of ghrelin, the "hunger hormone" (see Part 1, January 2018 Vortex), which is largely secreted by stomach cells. In healthy humans, ghrelin and leptin function interdependently. Both hormones act on hypothalamus arcuate nucleus receptors to regulate appetite achieving energy homeostasis. These chemicals maintain a balance and because leptin is largely secreted by your fat cells, it alerts your brain that you've had enough to eat and therefore you become less hungry. Of the two hormones, leptin seems to have a larger role in the bodies' energy balance and some researchers believe that leptin may regulate ghrelin.

Leptin levels are significantly lower in thin people and higher in overweight/obese people. Generally, the more fat you have, the more leptin is in your blood. This may seem counterintuitive, but many overweight/obese people have developed an insensitivity to leptin's appetite-suppressing effect; this is known as leptin resistance. What occurs in such people, is that when full, they don't stop eating, because their leptin fails

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ment and hiring of faculty, and matriculation and graduation rates of undergraduate and graduate students.

As the host organization, AAAS will manage the review and assessment of the project. Systematic transformation efforts of participating institutions will be appraised as part of the assessment, and institutions will be awarded bronze, silver or gold ratings for their efforts – similar to the rating system used to recognize and encourage energy-efficient buildings.

Institutions will not compete against one another, organizers said. Instead, SEA Change is a collaborative program, with bronze award metrics favoring those institutions that share their best practices with others, said Sarah Dickinson Hyams, the head of equality charters at Equality Challenge Unit, which administers a United Kingdom-based program on which SEA Change is based.

"We want everyone to succeed," Ruedi added. SEA Change is not about achieving particular numbers, organizers stressed. The higher education ecosystem in the United States is a complex one, with thousands of two- and four-year colleges, including women's colleges, historically black colleges and universities, tribal colleges and Hispanic-serving institutions. With different institutions starting from different baselines, applicants will instead develop their own goals.

SEA Change draws heavily from the experience of the Athena SWAN gender equality charter, established in the United Kingdom in 2005 to address the underrepresentation of women in science leadership roles. Since its implementation, Athena SWAN has increased the proportion of women on scientific committees and improved transitions for female postdoctoral researchers into academic posts, according to Equality Challenge Unit.

Initial stages of a U.S. version of the program began in April 2016, when AAAS convened a workshop with eight educational institutions to assess interest, identify challenges and collect initial data on gender, race and ethnicity and disability, leading to a December 2016 report.

An October 2017 workshop brought together representatives from institutions interested in submitting applications for the pilot round of SEA Change awards. Applications will be due in the fall of 2018, and awards are expected to be announced in early 2019.

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CLIMATE SCIENCE BASICS:

1. It's Warmin
2. It's us
3. We're sure
4. It's bad
5. We can fix it

(Thanks to Dr. Kimberly Nicholas for putting it so simply).

1. It's Warming.

Right now, annual global average temperature is about 1° celsius hotter than average, and we're already locked into at least another 0.5° of warming.
One degree celsius might not sound like a big increase in temperature, but it's the difference between life and death for thousands of people.

Earth has always had natural cycles of warming and cooling, but not like we're seeing now. The top five hottest years on record are 2016, 2015, 2014, 2013, and 2010.

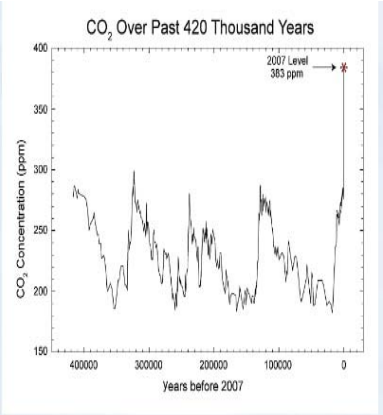
And rising temperatures do not only mean it's getting hotter. The Earth's climate is complex — even a small increase in average global temperature means big changes, with lots of dangerous side effects.

Monthly global average temperature relative to pre-industrial average
2. It's Us.
Human beings are causing climate change, largely by burning fossil fuels.

Rising temperatures correlate almost exactly with the release of greenhouse gases.

Before the 18th century, when humans in the industrial west began to burn coal, oil and gas, our atmosphere typically contained about 280 parts per million of carbon dioxide. Those are the conditions "on which civilization developed and to which life on earth is adapted."

Now, as the use of fossil fuels spreads through the world, the amount of carbon in the atmosphere is skyrocketing — we're now well over 400 parts per million CO_2 in the atmosphere.



CO_2 levels throughout history — note the sharp spike at the end. (source: Scripps Institution of Oceanography)

CO_2 levels throughout history — note the sharp spike at the end. (source: Scripps Institution of Oceanography)
3. We're Sure.
An overwhelming 97% of scientists agree that climate change is being caused by human greenhouse gas emissions. There is

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(Motzer Continued from page 6)

to stop their food consumption. If leptin is not working, then ghrelin levels may increase causing an increase in appetite resulting in the person consuming even more food. Consequently, the additional calories are stored as fat in a repeating cycle and the person continues to gain weight. The prevalence for leptin resistance seems to occur more in women than in men and we'll continue the discussion on leptin resistance in the next part.

On April 14, 2018 SCIENCE MARCHES ON

In 2017, more than one million people around the world gathered together in the largest event for science advocacy in history. In 2018, we unite again to hold our elected and appointed officials responsible for enacting equitable evidence-based policies that serve all communities and science for the common good.

More than 70 satellite events around the world have already registered to participate in the 2nd annual event.

From Washington D.C. to Abuja, Nigeria, science supporters across the globe are mobilizing. Events range from science expos and festivals to rallies and large-scale marches but they are united with shared goals.

March for Science events energize science advocates from multiple spheres to create tangible change and call for greater accountability of public officials to enact evidence-based policy that serves all communities.

For San Francisco: *https://actionnetwork.org/events/march-for-science-san-francisco*

For addition details on the various events: *https://www.marchforscience.com/*

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no meaningful debate about the basic science of climate change.

Scan of 1981 Exxon internal memo acknowledging the role of CO_2 emissions in climate change.

1981 Exxon internal memo acknowledging the role of CO_2 in causing climate change.

The finding that more CO_2 in the atmosphere will warm the climate dates back to the 1890s. Attacks on the credibility of climate science are perpetuated by vested interests, including the fossil fuel industry, which has pumped millions of dollars into creating uncertainty about our understanding of climate change.

The oil company Exxon knew about climate change's impact in the 1970s, and found out that action would impact their bottom line. As a result, they joined an industry-wide attack on the truth, creating a false debate that prevented action for decades. Now we know that Exxon, and other companies like Shell, have been taking actions to protect their infrastructure from climate change for decades — while fighting action to protect the rest of us.

It's also important to listen to indigenous, traditional and local knowledge. In many places of the world elders and community leaders are sharing their understandings of how ecosystems are changing.

If we pay attention to what scientists and frontline communities are telling us, instead of fossil fuel industry deceptions, the message is clear: Humans are causing the rapid onset of climate change, which is already bringing costly impacts across the world. The best way to stop it is by keeping fossil fuels in the ground.

4. It's Bad.

One degree of warming has already resulted in devastating impacts across the planet. If we pay attention to what scientists and frontlne communities zre telling us, instead of fossil fuel industry deception

Global grain yields have declined by 10% from heatwaves and floods connected to climate change, unleashing hunger and displacement. Over 1 million people living near coasts have been forced from their homes due to rising seas and stronger storms, and millions more are expected to flee in the coming years.

Climate change science has evolved rapidly in recent years and it is now possible for scientists to pinpoint the contribution that climate change is making to many extreme weather events or other impacts.

5. We can fix it

The basic facts of climate change are grim: 80% of fossil fuel reserves need to stay in the ground for us to stay below 2°C of warming and fossil fuel companies aren't going to do that without a fight.

Here's the good news:

A. We know exactly what we have to do keep fossil fuels in the ground and quickly transition to 100% renewable energy.

B. Renewable energy is getting cheaper and more popular every day. In fact, global carbon emissions have already started to slow due to the rapid growth of clean energy.

C. We're not alone — the worldwide movement to stop climate change and resist the fossil fuel industry is growing stronger every day.

350.org/science/

BUSINESS DIRECTORY

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SEARCHING FOR THAT SPECIAL JOB?

There are many companies and organizations searching for chemical and biochemical personnel to fill important jobs in their organizations.

- Companies for laboratory and management positions
- Universities & Colleges for teaching positions and laboratory personnel
- Hospitals for technical and research personnel

There are several web sites that may help you search for these open positions.

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

Gifts & Donations

The Sections has many outreach programs to help support science and chemistry in our community. A gift of $25 to our High School Chemistry Teachers programs helps support the teacher and school with Chemistry supplies and equipment. Call or email and find out how your valued contribution can be used. Donations to the California Section are tax deductible.

CALIFORNIA SECTION
AMERICAN CHEMICAL SOCIETY

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