

The Nexus



Connecting & Expanding the Global Green Chemistry and Engineering Community

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Could Green be the color of your future?

Dear Green Chemistry Enthusiast:

Earlier this month, I had the pleasure of talking about careers in green chemistry and engineering as part of the American Chemical Society's [Careers Industry Forum](#) – a monthly teleconference that takes place on the 2nd Thursday of each month. I always welcome the opportunity to talk about green chemistry, but I'm particularly thrilled whenever the venue affords time for questions and answers. So I was very pleased with the format of the Careers Industry Forum.

In my opinion, there has never been a better time than right now for chemists and chemical engineers to consider pursuing "green" research (academic, industrial, government, etc.). There is a sustainability tsunami sweeping the globe and we need to ride the crest of the incoming waves or risk being left in the wake. What is driving this world-wide movement toward sustainability? Here are just a few elements that I think are propelling it.

There are 6.7 billion people on this planet today and that is expected to increase at least 50% by 2050. Many of these people live in developing nations. It's estimated that 1.3 billion do not have access to safe drinking water. On top of that, food is a big challenge.

With today's modern and often instantaneous communications, especially the Internet, no matter where a person resides, most are acutely aware of the opportunities available for a better quality of life. At the same time, some of our global neighbors look around at their environments and see things are changing, but, unfortunately, not necessarily for the better. A prime example is the demand for energy, water, food, transportation, and raw materials; the quantity of these resources that are needed to support a better quality of life has already exceeded the sustainable capacity of our planet. That's the bad news. Here's the good news:

There are numerous opportunities for us to create new materials

**Don't Miss the
Opportunity to Join us for
the Upcoming 13th Annual
GC&E Conference**

Attendance at the upcoming conference, June 23 – 25, 2009, in College Park, Maryland, is expected to reach 400 or more. ***If you can only attend one conference this year, this one will give you the best return on your investment.*** Please check the website for the seven different tracks developed around the Grand Challenges. You also won't want to miss Keynote Speakers, Dr. Len Sauer, VP, Global Sustainability, The Procter & Gamble Company on June 24th, and Jean-Michel Cousteau, Founder and President, Ocean Futures Society, and Executive VP, The Cousteau Society, on June 25, or the talks by winners of this year's Presidential Green Chemistry Challenge Awards.

Please visit www.GCandE.org for more information.

****NOTE: Early- Bird registration has been extended through May 13, 2009.***

Make this premier event your choice for 2009!

and technologies that will not have an adverse impact on human health and the environment. Those opportunities lie in the philosophy, principles, and practice of Green Chemistry and Green Engineering.

To put it mildly, I am excited about green chemistry and engineering job opportunities. To be sure, the current economic situation has caused the global enterprise to slow down, and the chemical enterprise is part of this integrated network.

Since the recession began in December of 2007, more than 5.1 million jobs have been lost in the US; almost 2/3 of them in the last five months. Along with the job-cutting, there has been a significant decrease in hiring in the chemical enterprise for both chemists and chemical engineers during this time. The same symptoms are being felt around the world. The situation is further exacerbated by merger and acquisition activity. Companies typically freeze hiring while they evaluate and eliminate redundancies. Since I started my career in the chemical world 30 years ago, I have experienced several economic world cycles, some worse than others, but the fact of the matter is, downturns are part of our now global economy. Those who keep a positive attitude (and that is important), hone and keep their skills up to date, and build their networks tend to do much better when the cycle turns upward again.

Those who persist will be well positioned to fill the need for growth in areas such as environmental chemistry – expected to grow 5 percent in the next 5 years; material sciences – expect to grow 9 percent; and pharma and biotech – expected to grow anywhere between 11 percent and 16 percent. Green energy is also a growing enterprise.

Many of the opportunities in green chemistry and engineering are still being defined. There are more than 80,000 chemicals in commerce today. Dr. John Warner, CEO of the Warner Babcock Institute, estimates that perhaps 10 percent are known to be safe and maybe another 25 percent that can be "greened". That means we still have to figure out how to replace or to make the remaining 65 percent safe and the production processes green. That is a huge opportunity for chemists and engineers. In fact, I believe there are Nobel prize opportunities awaiting many of you.

There is a bit more good news: the economic signals that have been reported recently suggest we may have reached the bottom. Make no mistake; it will be a long and slow climb back. But, it will happen. One of my favorite expressions is, "Success is perseverance for one more minute." It separates winners from those who also ran.

Sustainably yours,
Dr. Robert Peoples
Director, ACS Green Chemistry Institute®
b_peoples@acs.org



Congratulations!



Robert Peoples, Ph. D., Director of the ACS Green Chemistry Institute® has been selected as a member of California's new Green Ribbon Science Panel. The 27-member panel will provide advice and be a resource for the state's Green Chemistry initiative, aimed at removing or reducing toxic chemicals in products sold in California.



Among others named to the panel are **John Warner, Ph.D.**, a member of the ACS Green Chemistry Institute® Governing Board, and **William Carroll, Ph. D.**, former ACS President and a current



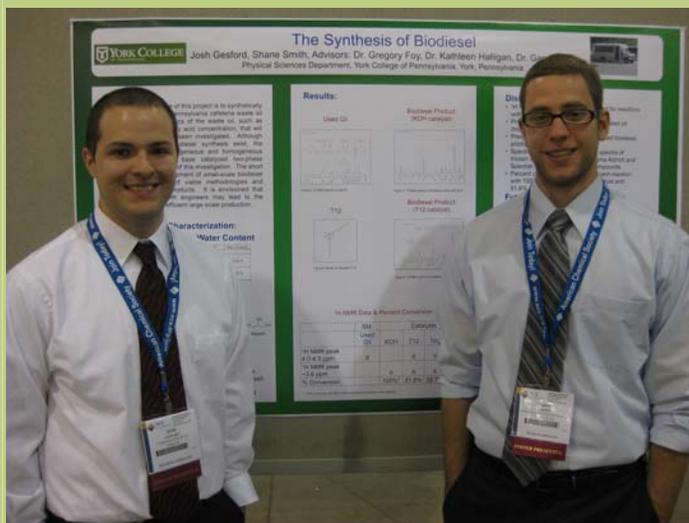
Member of the ACS Board of Directors. Click [here](#) to see the full article announcing the members of the Green Ribbon Science Panel.

Green Chemistry Student News & Views

Article by Dr. Jennifer Young

The spring ACS National Meeting— held this year in Salt Lake City from March 22-26 — typically draws many students because of the student awards, technical programming, and the timing of the conference. Each spring, the undergraduate student affiliate chapters of the ACS are rewarded for their activities of the previous academic year. This time in Salt Lake City, over 1000 excited undergraduate students celebrated and cheered as their chapters received awards! Among the awards presented, twenty six chapters won the Green Chemistry Chapter Award, for having completed at least three green chemistry activities during the 2007-2008 academic year. Another big draw for undergraduate students is the Undergraduate Research Poster Session, with over 800 (!) posters at this spring meeting.

I put on my "reporter's hat" and talked with several students in Salt Lake City. I made my way through the sea of posters during the Undergraduate Research Poster Session to find poster #755. I had met Josh Gesford and Shane Smith last December at York College of Pennsylvania when giving a seminar on their campus on bio-based chemicals and fuels, and I wanted to catch up with them. Their poster highlighted their research on the synthesis and characterization of biodiesel that they made from waste cooking oil from the cafeteria. Their ultimate goal is to supply the campus vehicles with renewable biodiesel fuel. They were excited to have the opportunity to attend the meeting in Salt Lake City and to attend talks on bio fuels and related topics.



Josh Gesford (left) and Shane Smith (right) from York College of Pennsylvania

I saw this biodiesel theme repeated again and again at the meeting. In the Joe Breen Green Chemistry Student Poster Session held during Sci-Mix, two students from Bridgewater State College in Massachusetts were showing their research on biodiesel. On the analytical side, Julianne Martell's research developed several methods for analyzing the purity of biodiesel produced from the campus's waste vegetable oils. Equally important, the poster of Amanda Bragan demonstrated the feasibility of producing biodiesel from waste vegetable oil through cost-benefit and SWOT analyses.



Quick Links

[ACS Green Chemistry Institute®](#)

[Registration for the 2009 Green Chemistry & Engineering Conference](#)

[ACS GCI Pharmaceutical Roundtable](#)

[U.S. EPA Green Chemistry](#)

[Warner Babcock Institute for Green Chemistry](#)

[Center for Green Chemistry & Green Engineering at Yale](#)

[Green Chemistry at the University of Oregon](#)

[Environmental Health News](#)

[Presentations from the 12th Annual Green Chemistry & Engineering Conference](#)

[ACS Main Page](#)

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Be sure to select "ACS Green Chemistry Education & Outreach"

Many campuses are beginning sustainability efforts, and a common element is the conversion of the campus's waste cooking oil into biodiesel to fuel campus vehicles. Students can relate to the topic easily and see the connections between chemistry, engineering, economics, renewable energy, and sustainability. Doing a research project on biofuels can lay a strong foundation in research techniques, synthesis, analysis, collaboration with other school departments, and even in understanding the bigger picture of sustainability, as it has for the students I talked with.

"GREEN CHEMISTRY, A HUMAN ISSUES PROJECT"

**BY: MESHEL MORK,
UNDERGRADUATE CHEMISTRY MAJOR
EDGEWOOD COLLEGE CLASS OF 2009**

A human issue is defined as a serious problem that challenges our personal values and society as a whole. The human issues studies program at Edgewood College is an academic program designed to bring together college values by linking student educational experiences' to real, personal, and community-based issues. This project provides students with a platform to develop their values as emerging educated professionals. A human issues project must promote deep learning, reflective practice, and community engagement.

The completion of a human issues project is a unique graduation requirement for all Edgewood College students. As a chemistry major, I was interested in how I could fulfill this requirement and incorporate my chemistry education. To answer this, my advisor proposed an independent study project on a topic I was unfamiliar with, green chemistry. I began to read the literature and even had the opportunity to attend the 234th ACS National Meeting and Exposition in Boston, Massachusetts. This conference was my first experience at a professional meeting; it was truly awe-inspiring. The symposiums and poster sessions were wonderful and they provided me with a basis to propose a green chemistry human issues project.

I evaluated the College general chemistry laboratory curriculum for green alternatives. The way in which laboratories are taught was restructured to promote inquiry-based student learning. The overall outcome of the project increased student awareness of chemical hazards, enabled a reduction in waste, provided a safer work environment, reduced expenses, and promoted discussion of the student's environmental impact, all while upholding course education standards.

My green chemistry project has helped me grow as both a chemist and a professional. It provided me with the opportunity to give my first professional poster presentation at the 237th ACS National Meeting & Exposition in Salt Lake City, Utah. It was an amazing experience. This project has given me direction and purpose; after graduation I will pursue a graduate education in environmental chemistry. Overall, my human issues project has done more than shape my system of values; green chemistry has shaped my life and future career.

FACTOIDS



86% of plastic bottles used in the United States end up in landfills, taking up to 1,000 years to biodegrade.
[source Gaia]

Transporting bottled water consumes approximately 1.5 million barrels of fossil fuel per year [source Gaia]

Since 1955, urban and suburban development have increased by 300% while populations increased only 75%. [source Cambridge University Press, *The State of the Nation's Ecosystems*]

Forests provide 1/3 of the world's drinking water
[source, Yale School of Forestry & Environmental Studies]



The "green" side of SciFinder®

An hour-long e-seminar on how to use SciFinder® to search for "greener" research processes will be offered on May 13 and 19, 2009. Registrants can choose from one of four sessions being offered: one on May 13; three on May 19.

SciFinder is the sophisticated research discovery tool from CAS® (Chemical Abstracts Service), which allows scientists to quickly search CAS' vast databases.

These databases provide access to more than 16 million single- and multi-step reactions, more than 1 billion predicted property values, and more than 2 million experimental properties.

SciFinder also allows you to search the CAS REGISTRYSM database, patent records, and sequences combined from CAS and GenBank databases.

CAS databases contain a wealth of information related to green chemistry technologies and developments. SciFinder gives researchers the ability to search all the databases with a simple click of a mouse from anywhere in the world via the Web.

The e-seminar will give tips on how to search the literature for green chemistry technologies, explore green discoveries in patents, and find syntheses that use green reagents and solvents. You'll also learn how to use SciFinder to alert you to new green findings.

Registrants can submit questions at any time during the e-seminar. To register for one of the four sessions, go to <http://www.cas.org/support/scifi/index.html> and click on "e-Seminars list."

To see a short demonstration of how SciFinder can be used to search for information on green research related to fashion, check out the SciFinder podcast, "[Finding Information on Green Fashion: Not Your Mother's Little Black Dress.](#)"

Green Chemistry Movement Sprouts in colleges, companies



Research Grants in Green Chemistry

In 2007 and 2008, the ACS Green Chemistry Institute® (ACS

FACTOIDS



The world lacks potable drinking water for 2 billion people and that number is increasing daily [source CSIRO]

Use cold water for hand washing. Every 10 degree drop in H₂O temperature saves you 3% - 5% on water heating costs. Most faucets spit out 2 gallons per minute while you're waiting for the water to warm up. With hand washing, the friction and the soap are what really get your hands clean. As far as water temperature goes, you'd have to rinse your hands in boiling water to actually kill germs. [source, Ideal Bite, November 26, 2007]

GCI sponsored a green chemistry grant program with funds allocated from the ACS Petroleum Research Fund (PRF). The activities funded by the program were for green chemistry research or education to be conducted in accordance with the PRF Trust Agreement, and grants were made to nonprofit institutions of higher education in the United States and other countries in response to proposals. The funded activities had to meet three criteria:

1. Be related to the petroleum field, such as focusing on petroleum and alternative energy sources as well as petroleum and alternative feed stocks and materials and the range of synthetic, analytical, computational, physical, and other chemistry and engineering issues;
2. Advance scientific educational and fundamental research; and
3. Have strategic importance or broad applicability, with high potential impact in a sector or broad potential applicability to the chemical enterprise.

Following a rigorous peer review process, decisions by the ACS GCI Governing Board, and approval by the ACS Board Committee on Grants and Awards, eight grants were awarded in December 2007 with funding beginning in February 2008; five grants were awarded in June 2008. At this time, the grant program has been discontinued for 2009 and beyond.

Awarded in 2007

- Jonathan Ellman, University of California at Berkeley
 - Method to Recover and Recycle the Asymmetric Amine Synthesis Reagent tert-Butanesulfonamide
- George John, City College of New York
 - Biosurfactants and Soft NanoMaterials from Renewable Resources: A Green Chemistry Approach
- Christopher Kitchens, Clemson University
 - Surface-Functionalized Composite Membranes for CO₂ Capture from Flue Gas and Methane Streams
- Lisa McElwee-White, University of Florida
 - Metal-Free Oxidative Carbonylation Reactions
- Horacio Olivo, University of Iowa
 - Environmentally Benign Organocatalyzed Chemoenzymatic Oxidations
- Christopher Roberts, Auburn University, (coPI Juncheng Liu)
 - Green Synthesis and Processing of Cobalt Nanocrystals of Controlled Size and their Deposition onto Carbon Nanofibers/ Nanotubes Using CO₂ Expanded Liquids: Novel Fischer-Tropsch Synthesis Catalysts for Clean Fuels Production
- Aaron Sadow, Iowa State University
 - Atom Economy in Hydrocarbon Functionalization: Synthesis of Yttrium Amido Alkyl Complexes for Hydromethylations
- Robert A. Weiss, University of Connecticut
 - Synthesis of PLA Ionomers

Awarded in 2008

- Carlos Afonso, Instituto Superior Tecnico, Lisbon, Portugal
 - Preparative one-pot solvent free resolution-separation of rac-sec-alcohols based on reusable biocatalyst and fatty ester as temporary acylating agent

FACTOIDS



Over the past 20 years, the acreage per person for new housing almost doubled in the US. [source American Farmland Trust]

A new mattress, new couch, new kitchen cabinets, fresh paint or new carpeting, and pads can increase the VOC's (volatile organic compounds) in a house by up to 70% for over one year or more causing headaches, sickness, and unexplained respiratory or auto immune illness.

[source, LiveGreenLiveSmart]

Vacuum the coil on your refrigerator. This could shave 6% off your power bill.

Install a low-flow-showerhead. Save 18% off your water bill.

Plug your TV, computer, cable box, stereo and game console into smart power strips. Save 10% off your power bill.

Turn your thermostat up two degrees higher than you normally keep it in the summer. Or install a digital thermostat and program it to conserve energy when you're away or asleep. Saves 10% to 15% off your heating/cooling bill.

- Mary Kirchhoff, American Chemical Society
 - 2008 Summer School on Sustainability and Green Chemistry
- Christopher Martin, Lamar University
 - OGRE Labs (Organic Green Renewable Experimental Laboratories)
- Alan Shusterman, Reed College
 - Synthesis and Characterization of New Fe-TAML® Oxidation Catalysts Containing Alkyloxy and Aryloxy Substituents
- Costas Tsouris, Georgia Institute of Technology
 - Utilizing electrochemical impedance spectroscopy and neutron imaging to better understand transport characteristics of fuel cells

Seven of the grants awarded in 2007 are two-year grants and have just reported on the first year of research activities. Of particular note are three publications on research supported by the ACS GCI-PRF grants.

- Praveen Kumar Vemula and George John, "Crops: A Green Approach toward Self-Assembled Soft Materials," *Acc. Chem. Res.*, **2008**, 41 (6), pp 769–782.
- Phillip A. Shelton, Yue Zhang, Thi Hoang Ha Nguyen and Lisa McElwee-White, "NaIO₄-oxidized carbonylation of amines to ureas," *Chem. Commun.*, **2009**, 947–949.
- Andrew J. Ro, Samuel J. Huang, R.A. Weiss, "Synthesis and properties of random poly(lactic acid)-based ionomers," *Polymer*, **2009**, in press.

Other Principle Investigators reported on manuscript submissions for publication and presentations of their research at conferences.

Stay tuned for future updates on these ACS GCI-PRF granted research and education projects in a future issue of *The Nexus*. Additionally, a special session on funding for green chemistry research is being planned for the 13th Annual Green Chemistry and Engineering Conference.



GREEN NEWS WORTH SHARING

CHEMICAL SUPPLIERS ROUNDTABLE EXPLORATORY MEETING

June 24, 2009, in College Park, Maryland

Representatives from chemical supplier companies are encouraged to attend an exploratory meeting of the ACS GCI Suppliers Roundtable on the evening of June 24th at the Marriott Inn and Conference Center, College Park, Maryland, in conjunction with the 13th Annual Green Chemistry & Engineering Conference. The meeting is intended to introduce the concept of the Suppliers Roundtable and explore founding principles such as

FACTOIDS



It is estimated that it takes 70,000 trees to produce the Sunday Edition of the *New York Times*

Today, the vast majority of American households have safe drinking water, and receive annual reports on the quality of their drinking water. [source, US EPA]

Driving Tips

- ❖ Clean oil and properly inflated tires increase fuel mileage up to 15%.
- ❖ Lighten your trunk. Every 100 pounds eats up an extra mile per gallon.
- ❖ Observe posted speed limits. Each 5 mph increase above 60 is an additional 10 cents a gallon.
- ❖ Accelerate smoothly and brake gradually. Aggressive driving can lower your gas mileage by 33% at highway speeds.
- ❖ Use air conditioning selectively. Operating an air conditioner in hot weather can increase fuel consumption by more than 20 percent in city driving.

[source: Global Green U.S.A.]

a mission and strategic priorities. The ACS GCI Suppliers Roundtable would be similar in structure to the [ACS GCI Pharmaceutical Roundtable](#) and the [ACS GCI Formulator's Roundtable](#) launched in 2005 and 2009, respectively. Both are partnerships with companies within the industrial sector focused on addressing specific needs to facilitate the integration of green chemistry & engineering in the respective industry. If you represent a chemical supplier and are interested in participating in the development of the ACS GCI Suppliers Roundtable, please contact Julie Manley at j_manley@acs.org to learn more.

GC&E 2009 conference adds special tours

NOTE: Early bird registration extended to May 13

Organizers for the 13th Annual Green Chemistry & Engineering Conference, June 23-25, in College Park, Md., have added two special post-conference tours to the options menu for attendees.

On Friday morning, **June 26**, conference attendees have a choice between two outings:

- ❖ a private behind-the-scenes tour of the U.S. Bureau of Engraving and Printing in Washington, D.C., and
- ❖ a tour of the Blue Plains Advanced Wastewater Treatment Plant (AWTP), which treats water for Washington, D.C., and parts of Maryland and Northern Virginia.

The engraving and printing guided tour includes presentations on plate-making, currency printing, and the wastewater treatment plant. The minimum age for the tour is 18. A photo identification and closed-toe shoes are required. The facility is NOT wheelchair accessible.

The Blue Plains AWTP is the largest advanced wastewater treatment facility of its type in the world. The guided tour includes overviews of the basic treatment processes – including “denitrification” – from the time the water enters the plant, to the removal of bio solids, to the eventual discharge of the water.

Cost for either of the tours is \$10 per person.

Earlier, the organizing committee provided another incentive for people to attend the conference by extending the deadline for early-bird registration to May 13. Early-bird registration offers attendees a saving of anywhere from \$60 - \$160.

The conference features seven separate tracks based around the National Academy of Sciences' 2006 report, **“Sustainability in the Chemical Industry: Grand Challenges and Research Needs.”**

- ❖ Visit www.gcande.org to register, reserve housing, view this year's technical program, and register for one of the special tours.

FACTOIDS



Americans could save close to \$8 billion on energy costs by replacing each home's five most frequently used light fixtures (or the bulbs in them) with ENERGY STAR qualified fixtures and/or bulbs. As an added benefit, the yearly reduction in greenhouse gases would be equivalent to eliminating the emissions from nearly 10 million cars.

[source:
HOMEDEPOT.COM/ECOOPTIONS]

- ❖ You can install aerators on your faucets in a matter of seconds
- ❖ Water use will be reduced up to 50% without any drop-off in performance

[source:
HOMEDEPOT.COM/ECOOPTIONS]

VOTE EARTH

This year's **Earth Hour** on March 28 was transformed into the world's first global election, between Earth and global warming.

Earth Hour began in Sydney in 2007 when 2.2 million homes and businesses switched off their lights for one hour. By 2008, the message had grown into a global sustainability movement, with 50 million people switching off their lights. Global landmarks such as the Golden Gate Bridge in San Francisco, Rome's Coliseum, the Sydney Opera House, and the Coca Cola billboard in Times Square all stood in darkness.

The GC3 Meeting, hosted by Staples in Broomfield, Colorado occurs the first week of May, 2009.

Green Chemistry and Commerce Council Innovators Roundtable: Opportunities and Challenges in a New Era

The **GC3** was formed in 2005 following *Sustainable Business and Safer Chemistry through the Supply Chain: An Innovators Roundtable* hosted by the Lowell Center for Sustainable Production and the Darden School of Business at the University of Virginia. The GC3 provides an open forum for participants to discuss and share information and experiences relating to advancing green chemistry and design for environment as it pertains to sustainable supply chain management.

Chemicals, alone or in combination, are the platform upon which key elements of the global economy have been built, and have been incorporated into millions of products used every day. Many chemicals may have inherently harmful characteristics that can impact ecological and human systems as they are used throughout supply chains.

A growing number of companies are discovering that the approaches of green chemistry and Design for Environment (DfE) allow for a transition to safer alternatives. The Green Chemistry and Commerce Council provides open conversation about the challenges to and opportunities for this successful transition.

For more information, visit the GC3 website:
<http://greenchemistryandcommerce.org/home.php>



The ACS GCI Pharmaceutical Roundtable celebrates 4 years!

Article by Julie B. Manley

The [ACS GCI Pharmaceutical Roundtable](#) began in 2005 as GCI's first industrial roundtable. Four years later, it is a demonstrated model of how industry can effectively work together pre-competitively to overcome barriers in green chemistry implementation. With a mission to catalyze the integration of green chemistry and green engineering in the pharmaceutical industry globally, the Roundtable focuses on informing and influencing the research agenda, developing tools to help scientists make greener decisions in process design, educating current and future scientists, and collaborating globally. A few highlights from the work over the years include:

- Membership has increased from 3 member companies in 2005 to 12 currently. There has also been a 100% member retention rate.

In 2009, Earth Hour was taken to the next level, with the goal of 1 billion people casting their vote for Earth. Unlike any election in history, it is not about what country you're from, but instead, what planet you're from.

VOTE EARTH is a global call to action for every individual, every business, and every community – a call to stand up and take control of the future of our planet.

For students staying in the D. C. area over the summer months, finding a job may be easier than expected. Mayor Fenty has announced that his **Green Summer Job Corps is looking to hire college students and graduates for supervisory positions.** The program will place 800 youth in a variety of green-collar jobs. Projects will provide students with the opportunity to gain experience in environmental education, youth advocacy and urban sustainability. With two programs underway from June 18 to August 21, college students will get the chance to choose their level of environmental involvement. The Green Summer Job Corps is run by the District's Department of the Environment. Applications are being accepted until all positions are filled. To apply, visit www.green.dc.gov/summer

- Since 2007, the ACS GCI Pharmaceutical Roundtable Research Grant has funded \$650,000 in academic research addressing the [12 key green chemistry research areas](#), as identified by the Roundtable. Since the inception of the grant, 105 research proposals have been received from 71 universities around the world.
- The Roundtable and representatives of the National Institute of General Medical Sciences (NIGMS) have held informative, productive discussions on topics of common interest. One of the [NIH Challenge Grant](#) topics identified the development of chemical methodologies and tools to promote green chemistry and engineering innovation into drug discovery, development, and production.
- The Roundtable has developed a reagent selection guide and is in the final stages of a solvent selection guide which are resources for scientists to use as they develop greener processes. This work is also helpful in our collaboration with Chemical Abstracts Service to support the incorporation of green chemistry considerations into their product line.
- Approximately 50 students from the UK and Belgium have participated in the EU Green Chemistry Student Workshop developed and led by members of the Roundtable.
- To facilitate benchmarking, the Roundtable clearly defined process mass intensity. Results from benchmarking have shown that solvents contribute more than half of the mass intensity of a given active pharmaceutical ingredient. In 2009, the Roundtable is using this knowledge to focus on the development of greener solvents.

Please see the [2008 Year in Review](#) for the highlights of last year's work, and we look forward to continuing this progress in 2009 and beyond. Special thanks goes to the member companies in the Roundtable for their commitment to green chemistry and the Roundtable: AstraZeneca, Boehringer Ingelheim, Codexis, DSM Pharmaceutical Products, Eli Lilly and Company, GlaxoSmithKline, Johnson & Johnson, Merck & Co., Inc., Novartis, Pfizer Inc, Schering-Plough, and Wyeth.

For more information about the ACS GCI Pharmaceutical Roundtable or to inquire about membership, go to www.acs.org/gcipharmaroundtable or e-mail gcipr@acs.org.

Green chemistry could aid in production of Taxol

"Pharmaceutical companies could reduce the steps involved in making Taxol while cutting chemical byproducts."

That's the opinion of Kevin Walker, an assistant professor of chemistry, biochemistry and molecular biology at Michigan State University. His green chemistry research to find a way for cleaner, more efficient production of Taxol was spotlighted this month in a news release issued by the University. Walker's work involves enzymes that assemble the Taxol molecule in Taxus plants.

- ❖ Read the full story at <http://news.msu.edu/story/6141/>.

Green Chemistry could boost Michigan economy

Michigan's tumbling economy could get a big boost from green chemistry, according to some experts. In 2006, the state established the Michigan Green Chemistry Program, which has a five-year action plan in place to build awareness, a green chemistry information clearinghouse, and the future of the program.

The program is stressing the importance of science and engineering students in institutions of higher education, says one state official. Another official says the public's knowledge of green chemistry is essential, but adds that a lot of people are not familiar with it.

A symposium hosted by the Green Chemistry Program is planned for September to bring the state's green chemists together for discussion and lectures.

See full story [here](#).

Spring – Renewal, Growth, and New Beginnings



Story by Linda Pirrone

Ah, spring. The season of renewing, regenerating, recycling, reusing and re-purposing? If you are observant, there are many signs of life emerging from a dormant stage as the tender bright green buds burst from the warmer earth and seek the sustenance to grow and flourish.

On April 22, 1970, Senator Gaylord Nelson of Wisconsin created the first Earth Day. An estimated 20 million people nationwide attended festivities that day. It was a grassroots explosion, leading eventually to national legislation such as the Clean Air Act and the Clean Water Act. We celebrated Earth Day this April 22nd, to raise awareness of the steps we can take to be more responsible citizens of Earth. U.S. First Lady Michelle Obama planted an organic garden on the White House grounds. Some of us planted trees, performed clean up from our littered public spaces, and celebrated in our own way our rededication to doing our part for our communities. This spring, something very special happened to those who remember the spring rite of passage of outdoor music festivals such as Woodstock.

The Grateful Dead band members realigned and reunited for a musical tour which began in early April and will conclude mid-May. ***What does this have to do with "green" chemistry, you may ask?*** One of the family members of The Grateful Dead, "Hippie Bill" (Bill Garbe), has taken his marching orders from a Mother and Father who raised him with the mantra,

"Eat it up, wear it out, let it do, or do without."

Hippie Bill founded the "Green Team" a small, but dedicated group who commit to gathering all trash and recyclable materials after each concert and ensuring that once sorted, all recyclables

Measure Your Carbon
Footprint

<http://www.carbonfootprint.com/>



are properly recycled. (They have even transported recyclables to the next venue on their tour to ensure their contribution does not go directly to a landfill.)

This current tour was one of the “Greenest” the group has ever had, because of the efforts of the dedicated Green Team members who believe (in the words of Hippie Bill) that:

“This is our home. You don’t trash your home.”

The band booked hotels with written and established sustainability policies. The majority of lights used in the massive onstage displays were L.E.D. lights. The buses to haul equipment, lights, and personnel, were running mostly on bio-based fuels. One of the issues the band faced was finding service stations to refuel, but for the most part, they maintained their commitment to bring their unique harmonies both musically and environmentally to each venue lucky enough to book their sold-out shows. This group is a musical tribe that created their success by providing a “real good time” for everyone who gathers to experience their shows.

During the Washington, D.C., show, I had an opportunity to speak with Ed Stack, the manager of Washington, DC’s 9:30 Club who said many of the musical groups on tour now have “green” and sustainable riders included in their contracts. He said even in the worst economic times, the music industry has done well, but musicians and their management are more aware now that they have a responsibility to set an example and consume responsibly to ensure that future generations will enjoy “a real good time” in a world where we have left them with sustainable resources so they too can flourish, responsibly.

Sustainability research and development issues are an important part of all of our lives and as chemists and chemical engineers, we will discover and invent the methodology to clean, refresh and sustain our world. We are surrounded by other citizens of Earth who in their own, focused actions are joined with all of us to impact the world we leave for future generations.

Thank you, Grateful Dead, Hippie Bill, and your “Green Team” for a real good time and for your efforts to prepare a better world for our children and grandchildren.



Welcome!

- ❖ **Novartis, Welcome to the ACS GCI Pharmaceutical Roundtable.**
- ❖ **The ACS GCI Formulator’s Roundtable welcomes new members:**
 - **Access Business Group**
 - **Bissell Homecare**
 - **Johnson & Johnson Consumer Companies**
 - **JohnsonDiversey**
 - **Rug Doctor**
 - **S. C. Johnson & Son**
 - **Seventh Generation**
 - **Zep**



Is Opportunity Knocking?

St. Olaf College, in Northfield, Minnesota, is pleased to announce that applications are being accepted for a one-year postdoctoral fellowship in green chemistry, starting date negotiable but no later than September 1, 2009. The WM Keck Foundation Green Chemistry Postdoctoral Fellowship at St. Olaf College will involve 0.5 FTE teaching at St. Olaf College, most probably in the first-year curriculum, and 0.5 FTE research in the area of green chemistry or green chemistry education research. Applicants must have a Ph. D. in chemistry or chemistry education research by the time employment starts. More information regarding this position and St. Olaf College can be found at

<http://www.stolaf.edu/offices/doc/jobs/jobpostingschemterm.html>

Inquiries relating to this position should be addressed to Bob Hanson, hansonr@stolaf.edu (507)786-3107



ACS GCI International Chapters SPOTLIGHT ON INDIA

Article by Dr. R.K. Sharma

The Indian Chapter of the ACS Green Chemistry Institute® is working for Green Chemistry education and outreach activities in India by:

- Building a Network for exchange of expertise, discussion and knowledge between industrialists and academicians.
- Preparing and disseminating the teaching materials on Green Chemistry for school, college and university levels, with the simultaneous design of laboratory experiments for these levels as well.
- Designing and organizing training workshops.

Recently a Green Chemistry Network Centre (GCNC) was established by the chapter under the recommendation of a panel of world leaders headed by Professor Paul Anastas (known as a father of Green Chemistry), which is working for the development and implementation of Green Technologies in India. The Chapter received 2005, 2006 & 2007 IUPAC CHEMRAWN

ACS GCI-DEN grants for carrying out Green Chemistry Networking in India and for organizing a training workshop. To strengthen Green Chemistry Networking in India, GCNC recently organized the Third INDO-US S&T Forum Workshop on Green Chemistry on January 7-9, 2008, at Delhi. This Workshop was organized with the following specific aims and objectives:

- Provide the **necessary foundation** for establishing an ongoing initiative on Green Chemistry into the country's educational system.
- Assist in building a **Green Chemistry Educational capacity** in India by 'training the trainers'.
- Focus on **Real-World applications** of Green Chemistry along with building **Industry-Academia-Government partnership**.
- Identify areas where **scientific collaboration** between U.S. and Indian scientists can take place for sustainability, ranging from fundamental research to Real-World Application.
- Build programmes for **development and utilization of renewable based technologies** – solar cells, wind power, biofuels, biomass combustion.

The workshop witnessed an overwhelming participation by industry, academia and the Government.

A stepping stone in the endeavors of GCNC was the release of a monograph on Green Chemistry Experiments in this workshop. The Green Chemistry Task Force, created by the Department of Science & Technology, Government of India for the furtherance of Green Chemistry Education & Research in India, recently invited the in-charge of this chapter (Professor R.K. Sharma) to prepare a Green Chemistry Experiment Manual. The Chapter has been instrumental in getting Green Chemistry courses introduced at the Bachelor's level in University of Delhi. More interesting educational initiatives taken are in the form of value based short-term courses on Green Chemistry that incorporate laboratory experiments, case studies, etc. contribute in the furtherance of the much needed science.

Professor Paul T. Anastas and Professor John C. Warner are helping this centre to popularize Green Chemistry in India. The Chapter is organizing a Workshop on Green Chemistry in Real World Practice for educators and scientists on May 9, 2009, at the University of Delhi. GCNC along with a GCNC awarded Industry (Newreka Green Synth Technologies Pvt. Ltd.) are also organizing the **4th Indo-US Workshop on Green Chemistry for industries in December 2009** at Mumbai.

Recently **GCNC received a major grant** from the Ministry of Textiles, Government of India, for setting up a GCNC Laboratory for Research & Development, Standardization, Training and Certification.



Photographs of the inaugural and valedictory functions of the 3rd Indo-U.S. S&T Forum Workshop on Green Chemistry. In this workshop, Union Minister of Mines and Union Minister of New and renewable energy participated along with Member Secretary central pollution control board, Chairman Green Chemistry Task Force of Government of India, Director Indo-US S&T Forum, Professor John C. Warner and Dr. Jennifer Young.





Upcoming Events

- ❖ **May 10-12: Analytical and Computational Techniques for Enabling Green Platform Technologies**, Center for Green Materials Chemistry, Oregon State University and University of Oregon. This workshop will feature sessions on:
 - inorganic cluster synthesis
 - analytical methods (focusing on TEM, NMR and atom probe measurements, among others)
 - computation/modeling

Please join us for our next workshop. Web site: www.greenmaterials.uoregon.edu Contact Lucy Biggs for more information lbiggs@uoregon.edu Phone: 541 346 2233

- ❖ **May 19-20: For [Greener By Design 2009](#)**, in San Francisco, we have enlisted some of the best leaders and strategists to share their stories of product innovation, design techniques and the many ways green product development can drive business value. Among them, hear the Senior Director of Business Strategy and Sustainability of **Wal-mart** discuss rolling out a product scorecard to its 60,000 suppliers, how the Director of Environmental Technology Strategy at **Microsoft** is addressing product energy efficiency and be inspired by the co-founder and Chief Greenskeeper of **Method** Products as he shares his company's winning strategy for green design that doesn't scream "green." Want to sponsor, exhibit, or know more? Please contact Erin Brody at 203-403-9012 or ebrody@globalexec.com
- ❖ **May 21-22: 3rd Bioplastics Markets**, Guangzhou, China. NatureWorks' Asia Pacific sales manager Peter Clydesdale and European environmental affairs manager Erwin Vink will be presenting on the bioplastics market outlook and responsible marketing.
- ❖ **MAY 27 DEADLINE: Call for Proposals: THE NEW GREEN ECONOMY, NCSE Conference**. The National Council for Science and the Environment (NCSE) is pleased to request your participation at the 10th National Conference for Science, Policy and the Environment: **The New Green Economy: Aligning Science, Education, Markets and Systems for Sustainability** to be held January 20 – 22, 2010 at the Ronald Reagan Building and International Trade Center in Washington, DC.
<http://www.ncseonline.org/conference/greeneconomy/>
- ❖ **June 3-5: Sustainable Fragrances for Cleaning Products 2009**, Washington, D.C.
www.sustainablefragrances2009.com
- ❖ **June 16: 6th Green Chemistry and the Consumer Symposium**, Kings Manor, York, UK, for more information <http://www.york.ac.uk/res/gcg/gogreen/index.htm>
- ❖ **June 23-25: 13th Annual Green Chemistry & Engineering Conference**, College Park, Maryland. Theme **"Innovating for the Future: Progress on the Grand Challenges in the Chemical Enterprise."** Keynote

speakers include Len Sauers, VP, Global Sustainability, The Procter & Gamble Company, and Jean-Michel Cousteau, Founder and President, Ocean Futures Society and Exec. VP, The Cousteau Society. www.gcande.org

- ❖ **July 22-30: Summer School on Green Chemistry and Sustainable Energy**, Colorado School of Mines. For more information: www.acs.org/greenchemistry/education
- ❖ **August 9-12: First International Congress on Sustainability Science and Engineering**: *Where science and engineered technologies meet the needs of society*, organized by the AIChE's Institute for Sustainability, will be held in Cincinnati, Ohio.
- ❖ **September 9-11: 8th Green Conference**. An International Event that will be held in Zaragoza, Spain. The corresponding website for more information is: <http://8gcc.unizar.es/>

Greetings!

I hope you have enjoyed this issue of *The Nexus*. As we welcome spring in Washington, D.C., I welcome your feedback and suggestions for enhancements to this newsletter. You will notice a number of articles included in this issue. We are attempting to provide a wide spectrum of information from articles as brief as "cliff notes" to full-blown accounting for the PRF research monies awarded for green and sustainable solutions to global issues.

If you have photos of your events, or content ideas for future issues, please share them with me; if space allows, they could appear in an upcoming issue. I look forward to hearing from you.

Our next issue will focus on the 2009 Green Chemistry and Engineering Conference and will be sent in two months.

Warm regards,
Linda Pirrone ACS GCI Writer/Editor *The Nexus* l_pirrone@acs.org

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