JANUARY 18, 2010

C&EN

CHEMICAL & ENGINEERING NEWS

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VOLUME 88, NUMBER 3
JANUARY 18, 2009

C&EN

CHEMICAL & ENGINEERING NEWS

Serving the chemical, life sciences, and laboratory worlds

COVER STORY

2010 CONGRESSIONAL OUTLOOK

Climate change, plant security, and food safety will compete for Congress' attention this year. PAGE 10

QUOTE OF THE WEEK

"I'd compare patient advocacy to fuel. If you take fuel and refine it, it can add enormous power."

JONATHAN JACOBY, HEAD, RARE PROJECT PAGE 21

NEWS OF THE WEEK

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GOVERNMENT & POLICY

SCIENCE & TECHNOLOGY

ACS NEWS

ACS NATIONAL AWARDS

THE DEPARTMENTS

COVER: *Fresco by Constantino Brumidi (1865) in the U.S. Capitol dome. Architect of the Capitol*

& THIS WEEK ONLINE

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CALENDAR UPDATE

C&EN's latest list of meetings and events for the chemical community in 2010 is available at pubs.acs.org/cen/html/calendars.

PLUS: Check out a collection of safety letters submitted by readers at www.cen-online.org/safety.

CHEMICAL SAFETY: TRIMETHYLSILYLACETYLENE EXPLOSION

WE WOULD LIKE to report an explosion that occurred in our laboratory last year while performing an oxidative coupling of trimethylsilylacetylene (TMSA) in a Glaser-Hay reaction. The explosion ruptured the 2-L reaction flask and seriously injured a researcher.

This reaction has been routinely used in our and many other laboratories to prepare 1,4-bis(trimethylsilyl)butadiyne-1,3 on a large scale (>100 g), and no dangerous or unusual behavior was previously noted.

The procedure involves purging oxygen through a solution of TMSA in acetone in the presence of a copper(I) chloride:tetramethylethylenediamine complex catalyst at room temperature as described by Andrew B. Holmes et al. (*Org. Syntheses* **1993,** *Coll. Vol. 8,* 63). The authors of the procedure recommend a safety shield as a general precaution while working with flammable materials in the atmosphere of oxygen, although no hazard was ever encountered. In this incident, the explosion occurred as soon as we started adding the solution of catalyst in acetone to the reaction.

We have consulted with the pioneer of this reaction (Allan S. Hay) and the submitting author of the procedure (Holmes) and considered various scenarios to explain the explosion. Ignition of acetone/TMSA vapor by the external sources was hardly possible as the flask was well sealed and the outgoing gases were passed through a dry-ice condenser (lowering the vapor pressure below the explosive concentration) and brought to the back side of the fume hood through a 1-meter hose.

The reaction temperature (5 °C) was noted by the researcher a few seconds before the explosion, thus ruling out unexpected reaction exothermy. The autoignition of the vapor on a hot stirring adapter (possibly heated by rotation-induced friction) was refuted, because joint lubrication was checked before setting up the experiment, and it would have required achieving an unrealistic temperature of greater than 300 °C. Also, the explosion occurred upon adding the first few drops of copper catalyst, which makes crystallization of the explosive intermediate—copper bis(trimethylsilylacetylide)—highly improbable.

We speculate that a discharge of static electricity between the syringe needle and the digital thermometer inside the flask is the most likely cause of this explosion. A digital thermometer connected to a stirring hot plate (IKA) was used in the reaction, and a plastic syringe with a long metal needle was introduced through the same neck. An induced static voltage on the syringe through friction from handling (often observed in Montreal winter indoors while walking or even simply sitting) could then cause a sufficient differential potential on the needle for a discharge spark to occur close to the metallic body of the digital thermometer. The oxygen-rich atmosphere lowers the ignition energy and makes even a weak spark sufficient to cause a fire.

The incident emphasizes once more the potential danger of mixing oxygen gas with flammable solvents or reagents. More important, introducing two conductors into a flask brings a risk of static electricity discharge between the conductors, which is dangerous whenever a flammable solvent is used without inert gas. As wired metal-gauge digital thermometers are used more often in synthetic practice, precautions must be taken to avoid their contact with other metallic (conducting) parts inside the reaction flasks.

Dmitrii F. Perepichka
Shehzad Jeeva
Montreal

A WARY CRAFTER

I RECENTLY STARTED sewing items from oilcloth, the material used in the 1950s and 1960s for picnic tablecloths and the like. As with so many other things from "the good old days," oilcloth is enjoying a renaissance among crafters. It is available in many patterns and colors from a number of online fabric stores as well as chain stores catering to those of us who enjoy sewing.

While innocently "surfing" among the many websites and blogs by and for people like me, I was amazed to find that there are some real concerns regarding the use of oilcloth for food-contact applications, especially its use for lunch bags. The

Continued on page 4

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1155—16th St., N.W., Washington, DC 20036
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Canadian GST Reg. No. R127571347
Volume 88, Number 3

Congressional Outlook

THIS WEEK'S cover story is C&EN's annual "Congressional Outlook," which surveys many of the important issues of interest to the chemistry enterprise that will (or will not) be addressed by Congress in the coming year. C&EN's entire Government & Policy Department staff, headed by Assistant Managing Editor Susan Morrissey, contributed to the feature.

With Democrats firmly in control of Congress and President Barack Obama in the White House, one would expect that many pressing science, technology, and environmental issues would receive attention from the second session of the 111th Congress.

However, 2010 is an election year, and it won't be many months before congressional attention moves from issues to campaigning. Additionally, as the government and policy staff point out: "Topics familiar from the first session will continue to dominate congressional activity. That means health care, Wall Street financial reform, and economic-stimulus-related legislation all will again compete for congressional attention. Being added to the agenda this year is the reauthorization of the USA Patriot Act."

Partisan gridlock will also contribute to stymieing progress on issues like energy and climate change, revamping the 1976 Toxic Substances Control Act, passing permanent chemical plant security legislation, modernizing U.S. food safety laws, and reforming patent laws. That's too bad because all of these issues are critical to the health of the U.S. economy and environment and to the security of the nation.

Progress on energy and climate-change legislation is not only about protecting the environment, for example. It's also about U.S. competitiveness and U.S. jobs. "We need cap and trade as a road map to make sure resources are going to the right places," Charles O. Holliday Jr., former chairman and chief executive officer of DuPont, told C&EN at a World Resources Institute briefing. In the marketplace for clean energy, Holliday said, "China is a leader, and they see this coming. When clean energy markets open up, they are going to beat us. Our advantage is we are fast and entrepreneurial, but we need market signals to move that way. This is a revolution, and it won't happen for us without a market."

In the area of homeland security, to take another example, the current plant security regulatory program will expire in October. The battle lines here center on how legislation will deal with "inherently safer technology" (IST). If implemented in a ham-handed fashion, IST could prove to be a nightmare for the chemical industry.

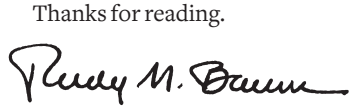
ON A DIFFERENT matter, many of you will receive in the coming days an e-mail from ACS CEO and Executive Director Madeleine Jacobs in which she asks you to complete a 13-question survey about yourself. The survey has questions such as the following:

- Which best represents your employer?
- Which best represents your current title?
- What is the highest academic degree you have received?
- What category best describes your field of research?

This demographic survey of ACS members is of great importance to the ACS Membership & Scientific Advancement Division and the Publications Division, in particular C&EN. As Jacobs notes in her letter, "As we plan for the future, we want to ensure that all of our ACS programs are relevant to the needs and interests of our members. To that end, it is imperative that we have up-to-date demographic information on our members. Knowing where our members work, what areas of science they work in, and other important information will assist the ACS leadership, technical divisions, local sections, and committees in launching new programs, evaluating existing membership benefits, and conducting strategic short- and long-range planning."

Such information is also of great importance to C&EN in having a strong audit statement on which to base our advertising rates. Advertising revenues, remember, are what pay for the journalism you have come to rely on from C&EN. Please take five minutes or so to complete the questionnaire and return it today.

Thanks for reading.



Editor-in-chief

Views expressed on this page are those of the author and not necessarily those of ACS.

LETTERS
continued from page 2

problem seems to hinge upon the vinyl used to coat the cotton "web" that is printed with the pattern. Of course, the vinyl coating is the feature that makes oilcloth so attractive to use in lunch bags because it is moisture resistant. Children 12 and under are considered to be at the greatest risk—exactly the group most likely to use lunch bags!

Other fabrics, such as "laminated cotton," PUL (which I believe is an acronym for polyurethane laminates), and even rip-stop nylon are also suspected as being hazardous when used in direct contact with food. Built (builtny.com) is a brand of very attractive neoprene-based lunch bags and other items. The company says neoprene is safe, but after reading your article on leachates from packaging I don't know what to think (C&EN, Aug. 31, 2009, page 11).

The underlying motive for sewing and using these articles for lunch bags is to minimize the millions of single-use plastic and paper bags used to package foods to take to school and work. As virtuous as it might be to limit disposables, however, I don't want to replace one hazard with another.

Would lining an oilcloth lunch bag would make it safe for use? Can these fabrics be used to sew aprons, placemats, and other products that are used with food, but not directly to package it?

I contacted the Department of Agriculture but was referred to the Food & Drug Administration because the USDA apparently is concerned "only" with the safety of the food itself (for example, *Escherichia coli* in meat) and not the packaging. I have yet to reach anyone at FDA.

Thanks in advance for any advice you can give me. I never would have expected my sewing hobby to lead to such concerns!

Opal Rosenfeld
Minneapolis

EMPLOYMENT OF CHEMISTS

I'M WRITING ABOUT the article "Shipping Drug R&D Abroad" (C&EN, Oct. 12, 2009, page 16). I'm 22, and I graduated from college in May and went straight on to graduate school. What upsets me is that I chose chemistry specifically with the hopes that one day I could work in drug R&D. I also chose science because I believed it was stable and actually quite beneficial. If I had known it would be like this, I would have just tried to become a pop star!

I'm worried about the future of R&D in the states, even if the professionals quoted in the article aren't. Given the bad economy, recession, layoffs, and now outsourcing, it seems like young adults don't have a chance.

Even if jobs were to become available, I'm quite certain we'd be at the end of everyone's list to interview. It seems painfully obvious to me and everyone I know: No one will hire us if we have no experience, and we can't get experience because no one will hire us.

Science is obviously the way of the future. If you have to go abroad to find R&D talent, doesn't that mean there isn't a talent pool in the U.S.? And if we have a talent pool of experienced R&D scientists, aren't inexperienced scientists going to falter and fall to the side? I fear that we'll fall behind in science because absolutely no opportunities are being offered.

When the outsourcing hype dies down, then what? We try again here? How can we be certain that we will have anyone qualified to do the work? When I graduate in two years, I don't think anything will have turned around. I just don't think anyone should be surprised in two, five, or 10 years when we need R&D in the U.S. and turnout is less than stellar.

Tisha Hutchinson
Piscataway, N.J.

M. MATELICH really hit it in his letter, "Boys and Science Education" (C&EN, Sept. 28, 2009, page 7), which also confirmed the article titled "Vanishing Plants" the previous week (C&EN, Sept. 21, 2009, page 21). In it, we read that DuPont (Itypalon), Dow (Solution Vinyls), Celanese (formic acid), and Nova (SMA copolymers) have all closed plants that were domestic producers, leaving a number of chemists to join the unemployment ranks. In addition, supplies of those chemicals now have to be brought in from foreign sources. This goes along with the pharmaceutical industry slowly outsourcing R&D.

In the past 50 years, we've seen a slow erosion of U.S. manufacturing capacity and greater dependence on foreign suppliers. This leads to two questions: Will we really need any chemists in the future, and will the U.S. economy be able to survive to any major degree as an almost 100% service and almost 0% manufacturing economy?

We may well be entering an era when employment of chemists becomes a corporate luxury.

Bob Weiner
Northbrook, Ill.

C&EN news of the week

JANUARY 18, 2010 EDITED BY WILLIAM G. SCHULZ & KIMBERLY R. TWAMBLY

FRESH START FOR PHARMA

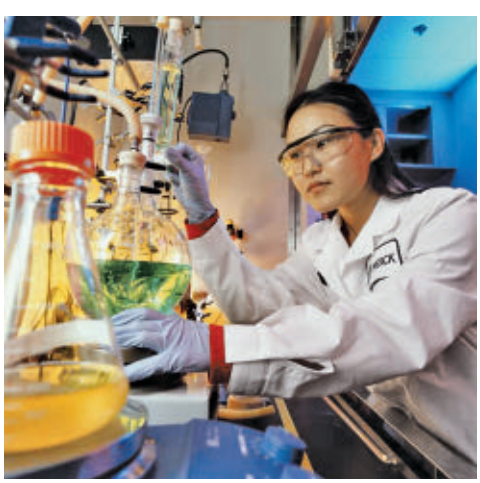
OUTLOOK: Despite challenges, drug firms were upbeat at the JPMorgan Healthcare meeting

LIFE SCIENCES EXECUTIVES attending the annual JPMorgan Healthcare Conference in San Francisco last week exuded optimism that their industry is moving beyond a trying period. Smaller companies were hopeful that the financial turmoil has subsided, and bigger firms were keen to show they are getting back to business after a wave of consolidation.

"A year ago, the pessimism was at every level," said Steven R. Gullans, managing director of Excel Venture Management, which invests in small life sciences firms. Biotech entrepreneurs couldn't raise money, bankers were worried about their jobs, and venture capitalists were wary of financing companies that may not produce a return for years, if ever, he said.

Today, the capital markets seem to be coming back. And although the biotech crowd has thinned in the past year, investors predict that the modestly healthier financial climate will allow some of the survivors to go public this year.

Meanwhile, big pharma still faces many of the same challenges it did before the crisis: patent expirations, fewer product launches, and shrinking health care budgets, to name a few. But companies presenting at the conference seem to have accepted those hurdles and are focused on new and improved strategies to overcome them.



MERCK

Merck is consolidating research after its purchase of Schering-Plough.

To that end, Pfizer and Merck & Co. talked up the efficiency of new R&D operations resulting from their 2009 acquisitions of Wyeth and Schering-Plough, respectively.

Martin Mackay, president of PharmaTherapeutics R&D at Pfizer, noted at the conference that a portfolio review now under way will ultimately reduce the number of molecules in development at the firm by 25%. At the end of the process, Pfizer expects to be running a combined R&D operation with a budget on par with what Pfizer alone spent before the merger.

Peter S. Kim, president of Merck Research Laboratories, said his firm's combined portfolio should be at "the right size" by the end of the month. Before Merck closed on its purchase of Schering-Plough in November, the companies had already begun preparing to consolidate their pipelines, drawing up a dossier on the scientific, competitive, and financial merits of each molecule. Since the merger, Merck has held two weekend-long meetings to separate the winners and losers, with an equal number of cuts coming from each side, Kim said.

At the conference, nearly every big pharma company highlighted a strategy in emerging markets, which are important growth opportunities for both branded and off-patent products. In the years ahead, more than 50% of growth in the drug industry will come from those regions, noted Sanofi-Aventis CEO Christopher Viehbacher.

Several firms' strategies for emerging markets include pushing into the generics business. In the past year, Pfizer, Sanofi-Aventis, and GlaxoSmith-Kline have all bought generics firms in countries with growth potential to jump-start business there.

But some pharma executives suggest the industry should advance that strategy with caution. For example, although Roche has earmarked developing countries as an area of growth, Chief Financial Officer Erich Hunziker noted that the firm is "committed to some, but not all" regions. He suggested that it would be tough to guarantee financial control over acquisitions in some of the more challenging markets.

Eli Lilly & Co.'s primary objective in emerging markets is to sell products from its existing portfolio, said CEO John C. Lechleiter. To help accomplish this goal, the company has doubled its presence in China, adding 1,000 people on the ground to promote Lilly medicines. Unlike some of its peers, "we don't intend to build a generics business in emerging markets," Lechleiter said.

Big-pharma executives at the conference also acknowledged that the days of launching products with incremental benefit to patients are over. "In today's world of shrinking health care budgets, we can no longer get money for medicines with little or no value," Lechleiter said.—LISA JARVIS

LILLY

Lechleiter

SANOFI-AVENTIS

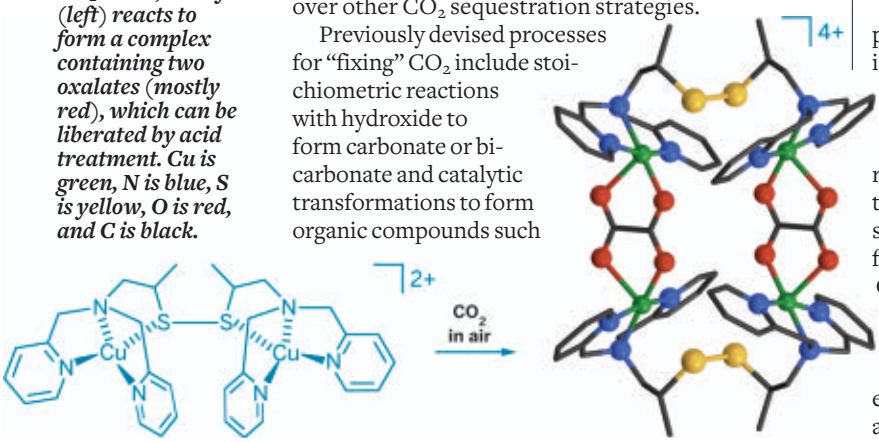
Viehbacher

NEW WAY TO 'FIX' CO_2

ELECTROCATALYSIS: Process converts CO_2 in air into the useful organic feedstock oxalate

IN A STUDY with implications for addressing global warming, researchers have devised a new way to remove the greenhouse gas CO_2 from air and form a useful organic feedstock in the process (*Science* **2010,** *327,* 313). The technique is still at the demonstration stage but has promising advantages over other CO_2 sequestration strategies.

Previously devised processes for "fixing" CO_2 include stoichiometric reactions with hydroxide to form carbonate or bicarbonate and catalytic transformations to form organic compounds such as formaldehyde and methanol. Catalytic conversion is more efficient and practical for large-scale use, but current catalysts can't be used on CO_2 in air because they also reduce oxygen, which is present in air at vastly higher levels than CO_2. In addition, they are unselective, creating mixtures of organic products.



In the presence of CO_2 in air, catalyst (left) reacts to form a complex containing two oxalates (mostly red), which can be liberated by acid treatment. Cu is green, N is blue, S is yellow, O is red, and C is black.

Inorganic chemist Elisabeth Bouwman of Leiden University, in the Netherlands, and coworkers have now developed a catalyst that reacts with CO_2 from ambient air to form a single product: oxalate, a useful feedstock for production of methyl glycolate and other organic compounds. After the reaction, the catalyst is regenerated electrochemically at a very low reduction potential, meaning it is unusually favorable energetically.

The process won't ameliorate the global warming problem right away—and maybe never will. "Our study is purely fundamental, and the findings will need a lot of additional work before they could possibly be applied in an industrial setting," Bouwman notes.

Nevertheless, "it's amazing" that this catalyst reduces CO_2 preferentially over oxygen and that the electrochemical step requires so little energy—suggesting that "the catalyst's structure is almost perfectly matched to the reaction it's driving," comments Clifford P. Kubiak of the University of California, San Diego, a specialist in CO_2 conversion. Compared with other ways to remove CO_2 from air, converting the greenhouse gas to oxalate catalytically, efficiently, and selectively "is near the top of the desirability rankings," he says.—STU BORMAN

QUESTIONED DEALS IN EUROPE

PHARMACEUTICALS: European Commission seeks to vet settlements for payoffs to generic drugmakers

EC

Kroes

THE EUROPEAN Commission (EC) has asked several pharmaceutical companies to submit the details of patent settlements with generic drugmakers to determine whether payments made to generics firms to delay the introduction of low-priced alternatives to brand-name drugs have hurt consumers.

The inquiry follows a report published by the EC in November 2009 claiming evidence that pharmaceutical companies have engaged in a variety of practices, including payoffs to generics competitors, that diverted as much as $4 billion in savings that would have resulted from timely introduction of generic drugs in Europe.

"Patent settlements are an area of concern, not least if there are situations where an originator company pays off a generic competitor in return for delayed market entry," says Neelie Kroes, the EC commissioner for competition. "We need to monitor this type of agreement in order to better understand why, by whom, and under which conditions they are concluded."

Although the EC isn't specifying which companies were asked for documents, a separate EC press release says a formal antitrust investigation is under way at the Danish company Lundbeck concerning deals that may hinder the entry of generics competition to the firm's citalopram, an antidepressant.

The monitoring program in Europe follows action in the U.S. to address similar deals between brand-name drug companies and generic drug companies (see page 22). The health care bill approved by the House of Representatives last year includes an amendment prohibiting payoffs to generics firms (C&EN, Aug. 10, 2009, page 8). The Senate is now considering a proposal for a similar ban as Congress hammers out final health care legislation.

Patent attorneys in the U.S. and Europe tell C&EN that the vetting of patent settlements is complicated by an inherent tension between antitrust law, which guards against monopolies, and patent law, which establishes short-term monopolies.

"You have patents on one hand, competition on the other," says Neil Jenkins, an attorney with Bird & Bird in London, noting that his firm represents both brand-name drug firms and generic drugmakers. "Where the balance is at the moment is considered fair enough."—RICK MULLIN

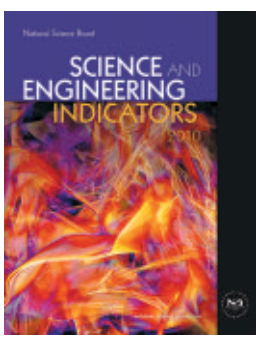
ASIA RISING

SCIENCE INDICATORS: China and other Asian nations strengthen their positions in research and engineering

SCIENTIFIC RESEARCH and high-technology industries continue to shift geographically from the U.S. and Europe to Asia, according to the latest edition of the "Science & Engineering Indicators" (SEI) from the National Science Foundation. Rising industrial nations such as China and South Korea are becoming increasingly important as technology manufacturers, research centers, and science educators, the report finds.

SEI 2010, the massive volume of quantitative data on the U.S. and international science and engineering enterprise, was compiled by NSF's Division of Science Resources Statistics. It provides a factual and policy-neutral description of the scope and vitality of the global science and engineering enterprise.

"The take-home line from this report is that science and technology is no longer the sole province of the rich, developed nations," Rolf F. Lehming, director of the indicators project, said at a briefing on the report. "Science has been democratized and moved all over the world. This brings many competitive elements into play, and the results are very difficult to foresee."



NSF

The U.S. continues to hold its position of science and technology leadership in the world, the report finds. But this position is eroding in many areas because of the rapid increase in capabilities by Asian nations and the efforts by the European Union to boost its competitiveness.

The changes are evident in data on R&D spending. Advancing Asian nations, including China, India, South Korea, and Taiwan, spent a total of $338 billion on R&D in 2007, approaching the $369 billion spent by the U.S. and far more than the $263 billion spent by the EU, the report states. The rate of growth in R&D spending is also much higher for Asian nations, about 10%, compared with 5% for the U.S. At this rate, total Asian R&D spending can be expected to surpass that of the U.S. in a few years, if not already.

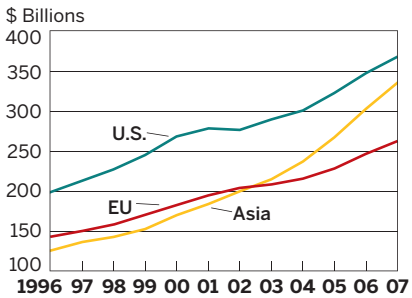
The data also show that peer-reviewed journal articles are increasingly coming from China, especially in the physical sciences and engineering (C&EN, Jan. 11, page 35). But patent activity is changing much more slowly, with the U.S. still receiving about half the patents awarded by the U.S. Patent & Trademark Office and China and Asian nations posting only small increases.

The most dramatic shift is in the manufacture and export of high-technology products, including computers, pharmaceuticals, and scientific equipment, which had previously been dominated by the U.S. and Japan. Twelve years ago, for instance, China produced almost no computers, but by 2007 it was making nearly 40% of the world's supply.

The continued strong growth by China and other Asian nations is the biggest surprise in this year's report, Lehming said. "We had been reporting on the consolidation of these trends, but now they seem so much more solid," he said.—DAVID HANSON

GLOBAL R&D EXPENDITURES

Asia has surpassed EU's and is approaching U.S.'s spending



NOTE: Asia includes China, India, Japan, Malaysia, Singapore, South Korea, Taiwan, and Thailand. EU includes all 27 European Union countries.
SOURCE: "Science & Engineering Indicators" 2010

AUTO SHOW Dow's presence in Detroit marks deepening involvement with cars

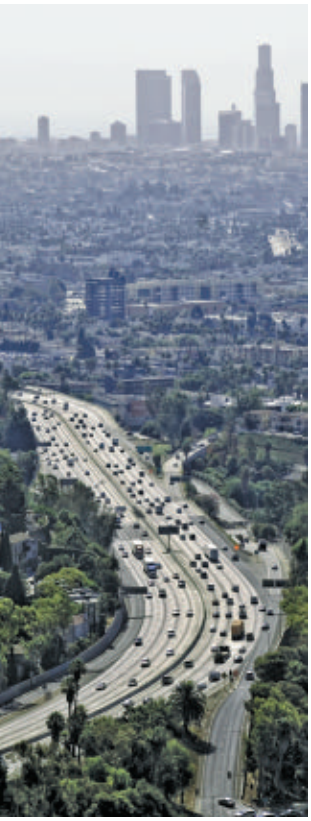
At the North American International Auto Show, which opened last week in Detroit's Cobo Center, one expects to see big pavilions dedicated to Ford, General Motors, and Chrysler. But this year, another Michigan firm has a big presence: Dow Chemical.

Marking the first time a non-auto manufacturer is part of the show's main floor, Dow is sponsoring the Electric Avenue exhibit, where it also has a booth. The 37,000-sq-ft exhibit features nearly 20 electric vehicles. Some of these are flamboyantly avant-garde, such as the 39-inch-wide Tango 600, made by Spokane, Wash.-based Commuter Cars (shown). Others are relatively staid, such as the Leaf, a lithium-battery-powered four-door vehicle that Nissan plans to build in Tennessee in 2012.


COMMUTER CARS

Dow Kokam, Dow's lithium battery joint venture with TK Advanced Battery, has a display in the show's EcoXperience section. The venture is planning to spend $600 million—$161 million of it from the federal government—on a battery facility in Midland, Mich., by 2011.

When Dow agreed to sponsor the exhibit last fall, its involvement in batteries was an important motive, says Peter A. Molinaro, a vice president for government affairs. But Dow products such as fluids and polymers also play a role in making cars more fuel efficient, Molinaro notes. "When you think of what it is going to take to transform this automotive industry and the way we transport people, chemistry is really a key enabler," he adds.—ALEX TULLO


DREAMSTIME

RATCHETING DOWN OZONE

EPA: Proposal would strengthen national air quality standard

EPA IS PROPOSING to tighten the nation's air quality standard for ground-level ozone, a move that could carry a big price tag for industry while delivering large health benefits to Americans.

The proposed standard would limit ground-level ozone to between 0.060 and 0.070 ppm, strengthening the current standard of 0.075 ppm set by EPA in 2008 under the Bush Administration.

EPA estimates that the proposal would cost between $19 billion and $90 billion to implement and would yield health benefits of between $13 billion and $100 billion.

The proposed standard, issued on Jan. 7, is identical to the range that the agency's Clean Air Scientific Advisory Committee in 2006 said would provide an adequate margin of protection for millions of people susceptible to respiratory illnesses.

"Using the best science to strengthen these standards is a long-overdue action that will help millions of Americans breathe easier and live healthier," EPA Administrator Lisa P. Jackson says.

Endorsing the plan are the American Lung Association and other health and environmental groups.

"If EPA follows through, it will mean significantly cleaner air and better health protection," says Frank O'Donnell, president of Clean Air Watch, an environmental group.

Many industry groups are opposing the proposed standard, saying it will be too expensive to meet. "There is absolutely no basis for EPA to propose changing the ozone standards promulgated by the EPA administrator in 2008," the American Petroleum Institute says.

If finalized, the proposed standard would require state and local regulators to clamp down on ozone-forming emissions from industry and vehicle traffic.

"State and local air quality officials are fully aware of the daunting challenges implementation of such new standards will pose," says S. William Becker, executive director of the National Association of Clean Air Agencies. "However, as stewards of the air that citizens of this nation breathe, we stand ready to face, and overcome, those challenges."

EPA has scheduled three public hearings in February on the proposed rule.—CHERYL HOGUE

CLEAN ENERGY

WINDFALL: Chemical firms win recovery-act tax credits for new plants

A NUMBER of chemical and materials companies received some happy news from the Internal Revenue Service. As part of a $2.3 billion tax credit program under the American Recovery & Reinvestment Act of 2009, they have been awarded tax breaks designed to spur manufacturing in the clean-energy sector.

Hemlock Semiconductor—a joint venture of Dow Corning, Shin-Etsu Handotai, and Mitsubishi Material—will get the largest credit: $141.9 million to expand a polysilicon plant in Hemlock, Mich. In second place with a $128.5 million credit is the North American branch of Wacker Chemie, Hemlock's German rival, for a polysilicon plant in Charleston, Tenn. Both plants will supply raw material for traditional photovoltaic solar cells.

DuPont, Dow Corning, PPG Industries, and Dow Chemical will receive tax credits for materials, including films and coatings, used in the manufacture of solar cells. Dow will also get a $17.8 million credit for producing solar building products, including its Powerhouse Solar Shingles, to be manufactured in Midland, Mich.

Not all the credits target solar. Biocatalysts maker Novozymes will get a $28.4 million credit to produce enzymes for cellulosic ethanol at a facility in Blair, Neb. Carbon fiber and composites firm Hexcel will enjoy an $8.1 million boost for its wind blade materials facility in Windsor, Colo. Transportation and building equipment firms are also receiving credits.

In announcing the credits, President Barack Obama highlighted December's weak jobs report, saying, "Building a robust clean-energy sector is how we will create the jobs of the future—jobs that pay well and can't be outsourced." He also identified energy security, combating climate change, and competition from China as driving the need for tax credits.

But the tax credits may not create permanent employment, warns Robert Nolan, principal at NanoMarkets, a technology analysis firm. "They're taking tax money and funneling it to businesses that don't necessarily use capital in an efficient manner. What happens when the money runs out?" he asks. He also sees a risk that the incentives could stimulate overcapacity in some industries. Market watchers say this is already a threat for polysilicon (C&EN, Nov. 9, 2009, page 28).—MELODY VOITH

TAX CREDITS

Lion's share of top five awards goes to producers of solar materials

	TAX CREDIT ($ MILLIONS)	PLANT LOCATION	OUTPUT
Hemlock Semiconductor	$141.9	Hemlock, Mich.	Polysilicon for solar cells
Wacker Polysilicon	128.5	Charleston, Tenn.	Polysilicon for solar cells
DuPont	50.7	Circleville, Ohio	Polyvinyl fluoride solar films
Novozymes	28.4	Blair, Neb.	Enzymes for cellulosic ethanol
Dow Corning	27.3	Hemlock, Mich.	Monosilane for thin solar films

NOTE: Top five chemical projects winning clean-energy tax credits. **SOURCE:** White House

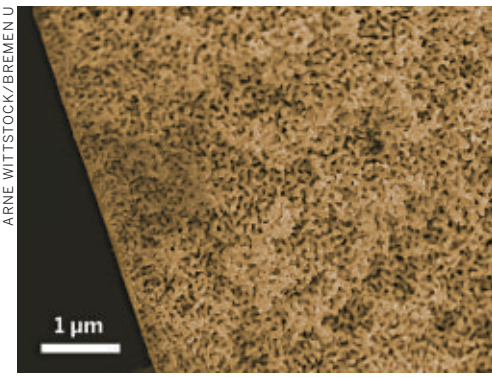
FINDING GREEN IN GOLD

MATERIALS: Precious metal in nanostructured form mediates oxidations selectively

A NOVEL NANOPOROUS gold material prepared by removing silver from a gold-silver alloy selectively catalyzes production of an industrially important compound under mild conditions, according to a team of researchers in Germany and the U.S. (*Science* **2010**, *327*, 319). The study further broadens gold's rapidly growing repertoire of catalytic reactions. It also could help efforts to replace industrial chemical processes with less hazardous and "greener" ones.

In just the past few years, gold's reputation as an inert noncatalytic metal has undergone a complete makeover, as several research groups have found a number of reactions—including various types of oxidations—that are catalyzed by gold in nanostructured form. Nonetheless, commercial applications have been impeded by gold's slowness to dissociate oxygen—a key step in oxidations—and the tendency of nanoparticles to agglomerate under typical reaction conditions. That process quickly shortens the lifetimes of supported catalysts such as gold, which is usually dispersed on the surfaces of solid oxides.

The new catalyst may provide a way around those problems. By treating a gold-silver alloy with nitric acid, the researchers formed a stable, unsupported monolithic gold catalyst composed of a three-dimensional network of nanoscale ligaments. The team, which includes Arne Wittstock, Volkmar Zielasek, and Marcus Bäumer of Bremen University, in Germany; Harvard University's Cynthia M. Friend; and coworkers, found that at low temperature and 1 atm of oxygen, the nanoporous material catalyzes oxidative coupling of methanol to yield methyl formate. That compound is used commercially as a solvent and blowing agent and as a precursor to formic acid and dimethylformamide. It is prepared industrially in a process that uses carbon monoxide, methanol, caustic base, and metallic sodium.



ARNE WITTSTOCK/BREMEN U

Treatment with acid converts a silver-gold alloy into the nanoporous gold catalyst shown in this SEM image.

At room temperature, the gold-catalyzed reaction is 100% selective but runs sluggishly, the team reports. Raising the temperature to just 80 °C speeds up the reaction, increases methanol conversion several-fold, and only slightly reduces selectivity—producing about 3% CO_2, according to the researchers. They note that the catalyst remained stable and active during tests that ran continuously for periods ranging from days to weeks. In addition, on the basis of experiments comparing a series of de-alloyed samples, the team concludes that a small fraction of residual silver enhances the gold catalyst's reactivity by promoting oxygen dissociation.

"It is tempting to assume" that results from this type of gold catalyst with residual silver may be better than those from pure gold catalysts used before in oxidation reactions, Claus H. Christensen of Danish catalyst manufacturer Haldor Topsøe and Jens K. Nørskov of the Technical University of Denmark note in a commentary about the work. Further research is needed, but this advance may move green gold catalysis closer to industrial applications, they say.—MITCH JACOBY

CHEMOTAXIS Acidic droplet solves maze

In the scientific world, solving mazes used to be the dominion of experimental psychologists. Now chemists are getting in on the action, but they've swapped the traditional lab rat for a drop of liquid. A team led by Northwestern University chemistry professor Bartosz A. Grzybowski has shown that an acidic droplet can successfully navigate a complex maze (*J. Am. Chem. Soc.*, DOI: 10.1021/ja9076793).

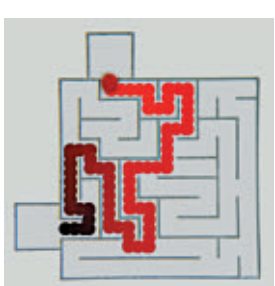
"I personally find most exciting that such a simple system can exhibit apparently 'intelligent' behavior," Louisiana State University chemistry professor John A. Pojman comments. "This approach may be useful as a pumping method for microfluidics or a way to convert chemical energy to mechanical motion in small devices. I am eager to see if they can generalize it to other types of gradients," he says.

The droplet, composed of 2-hexyldecanoic acid in either dichloromethane or mineral oil, travels several centimeters through a maze with a pH gradient. The pH is high at the maze entrance and low at its exit. Once in the maze, the droplet travels toward the lower pH, and in doing so, Grzybowski notes, it always finds the shortest path through the maze.

Acid-base chemistry and surface tension are what drive the drop. "The interfacial reaction between the acid in the drop and the base in the channel creates convection rolls or 'swirls,' " Grzybowski explains. "The fluid mechanics plays out such that the swirl facing lower pH is more pronounced, and so the drop is effectively pushed in this direction."—BETHANY HALFORD

MAZE MANEUVERS

A droplet travels through a maze with a pH gradient. In the overlaid image, black drops show early times, red ones are later. Watch the droplet solving the maze at *C&EN Online.*



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CONGRESSIONAL OUTLOOK FOR 2010

Climate change, chemical regulation reform will vie for **CONGRESS' ATTENTION**

GOVERNMENT & POLICY DEPARTMENT, C&EN WASHINGTON

AS THE SECOND SESSION of the 111th Congress gets under way this week, the Democrats continue to control majorities in the Senate and the House of Representatives, as well as the White House. This situation typically translates into lots of congressional action, but during this election year, activity will be tempered.

Topics familiar from the first session will continue to dominate congressional activity. That means health care, Wall Street financial reform, and economic-stimulus-related legislation all will again compete for congressional attention. Being added to the agenda this year is the reauthorization of the USA Patriot Act, congressional staff point out.

Such priorities will leave little time for members of Congress to dig into other big Administration priorities such as climate-change legislation. The just-reached Copenhagen Accord adds pressure on Congress to complete its work on a bill defining U.S. policy in this area.

Other important science and technology issues that were on the 2009 agenda will be vying for Congress' attention again this year. For example, Congress will continue its debate on legislation setting permanent chemical plant security regulations, improving food and drug safety policies, and reforming the decades-old chemical regulation law.

The following is C&EN's annual analysis of what to expect from Congress in the coming months.

ENERGY & ENVIRONMENT. Legislators returning to the Capitol this week face a maze of climate-change legislative options. To complicate matters, Congress is unlikely to even squarely face the issues because other more pressing legislation will draw members' attention far from the debates needed to sort out climate-change proposals.

Most of the climate action, when it oc-

"We need cap and trade as a road map to make sure resources are going to the right places."

curs, will be in the Senate, where climate-change legislation is currently stuck.

Last June, the House cleared its 1,200-page climate bill (H.R. 2454) that included a cap-and-trade program that would reduce carbon dioxide emissions by 83% from 2005 levels by 2050. Although the bill gives away enough pollution allowances so that utilities, chemical companies, and other CO_2 emitters would feel little pain for a decade, it still cleared by a thin seven-vote margin (C&EN, July 6, 2009, page 8).

Matters are much more intense in the Senate. Six committees have jurisdiction over energy and climate-change provisions, and any controversial bill will need 60 votes to overcome a likely filibuster.

In June 2009, one of those committees, the Senate Energy & Natural Resources Committee, cleared S. 1462, which includes a host of incentives to encourage renewable energy development and energy efficiency. However, it does not touch the thorny elements of climate change, such as cap and trade or CO_2 reduction targets.

In November 2009, the Environment & Public Works Committee cleared its climate-change bill (S. 1733) on an 11 to 1 vote, with no Republican vote, and without a single Republican attending the bill's markup. The 950-page bill includes CO_2 reduction targets and other difficult provisions. The lone "no" vote came from Democrat Max S. Baucus (Mont.), who objected to a process selected by committee leadership to clear the bill without amendments (C&EN, Nov. 9, 2009, page 13).

Four committees have yet to act, and much will turn on Baucus' Finance Committee, which will write the cap-and-trade provisions.

Also in November, Senate Majority Leader Harry M. Reid (D-Nev.) announced that once the other four committees act, he will merge all the committee-passed bills into a single package and bring it to the floor. However, all action has stopped, and it appears unlikely that climate-change legislation can garner the 60 votes needed to become law.

Into this void has stepped the troika of Sens. Lindsey O. Graham (R-S.C.), Joseph I. Lieberman (I-Conn.), and John F. Kerry (D-Mass.), who have introduced their own approach to climate-change legislation. With few details, the three issued a "concept paper" to President Barack Obama on Dec. 10, 2009, on the eve of the Copenhagen climate-change talks.

The four-page framework includes CO_2 reduction targets along the lines of the House and Senate bills, as well as an endorsement of cap-and-trade provisions. It also urges great support for nuclear energy, domestic oil production and refining, and coal use. It is unclear when an actual bill would be written or how these conflicting provisions could be woven into a bill. However, the proposal by three senators coming from opposite political poles has sparked interest that maybe there is a way to break the Senate's climate-change logjam.

Surveying the landscape, the American Chemistry Council (ACC), a chemical industry trade association, singled out two areas of particular interest to chemical companies: ensuring that adequate free CO_2 allowances are set aside to allow chemical companies to adjust to operating in a carbon-constrained global environment and making sure climate legislation does not result in greater use of natural gas, which chemical companies use for feedstock and fuel.

The trade association also seeks to delay a push by the Environmental Protection Agency to regulate CO_2 under the Clean Air Act, which the agency recently proposed (C&EN, Dec. 14, 2009, page 7).

ACC Chief Executive Officer Calvin M. Dooley noted during a December 2009 briefing that the chemical industry is divided over support for cap and trade but unified in opposition to EPA's use of the Clean Air Act to regulate CO_2 emissions. Instead, ACC is seeking a one-year delay to block EPA from developing these regulations, which is similar to a recent proposal by Sen. Lisa Murkowski (R-Alaska). She intends to seek passage of such an amendment early this year, congressional staff say. The provisions are likely to be added to legislation raising the debt ceiling for the national government or may be offered as a stand-alone resolution.

Meanwhile, several Democratic senators, primarily from states hard hit by unemployment and led by Sens. Sherrod C. Brown (Ohio), Maria E. Cantwell (Wash.), and Debbie Stabenow (Mich.), have introduced bills to spur clean-energy technologies and jobs with or without a climate-change bill. The bills are likely to be fashioned into an overall jobs bill, which Obama wants to see passed early in the year. The senators see a close tie between clean-energy technologies, jobs, and greenhouse gas reductions.

Others question the impact of this approach. Jonathan Lash, head of the environmental think-tank World Resources Institute (WRI), speaking at a press briefing, applauded the "positive clean-energy incentives" and the jobs that will be created through these bills, but said they are

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not enough. "This won't get us the deep reductions in greenhouse gas emissions we will need over the next 40 years to fight climate change," he said.

He was supported by Charles O. Holliday Jr., former chairman and CEO of DuPont, who also was attending the WRI briefing. "We need cap and trade as a road map to make sure resources are going to the right places," Holliday told C&EN.

He predicts heated global competition for clean energy. "China is a leader, and they see this coming," he says. "When clean-energy markets open up, they are going to beat us. Our advantage is we are fast and entrepreneurial, but we need market signals to move that way. This is a revolution, and it won't happen for us without a market."

CHEMICAL REGULATION. Congress is expected to work on legislation this year to revamp the federal statute that governs the manufacture of chemicals. That law is the 1976 Toxic Substances Control Act (TSCA).

The Obama Administration is calling for reform of TSCA, and in September 2009, it laid out concepts that it wants Congress to incorporate in a recast version of the chemical control law (C&EN, Oct. 5, 2009, page 9).

Several major chemical industry trade organizations support modernization of TSCA, including ACC, the Soap & Detergent Association, and the Consumer Specialty Products Association. Meanwhile, a growing number of environmental and health groups and health care companies are calling for revision of TSCA. States are jumping on the TSCA reform bandwagon, too, with 13 calling for Congress to update the law.

The various factions generally agree on the need to revamp TSCA and endorse the idea that commercial chemicals need safety assessments of their various uses. But they diverge on which standards EPA should employ to determine safety, primarily over whether the agency should use a precautionary rather than risk-based approach.

In 2009, the House and Senate held hearings on the need for TSCA reform. Although several members of Congress have shown interest in a bill to update TSCA, none has introduced legislation.

In the House, Reps. Henry A. Waxman (D-Calif.), chairman of the Energy & Commerce Committee, and Bobby L. Rush (D-Ill.), chairman of that panel's Commerce, Trade & Consumer Protection Subcommittee, have said they plan a bill. An aide for the committee tells C&EN that Waxman remains focused on the need for TSCA reform but has not yet decided when his panel will work on legislation.

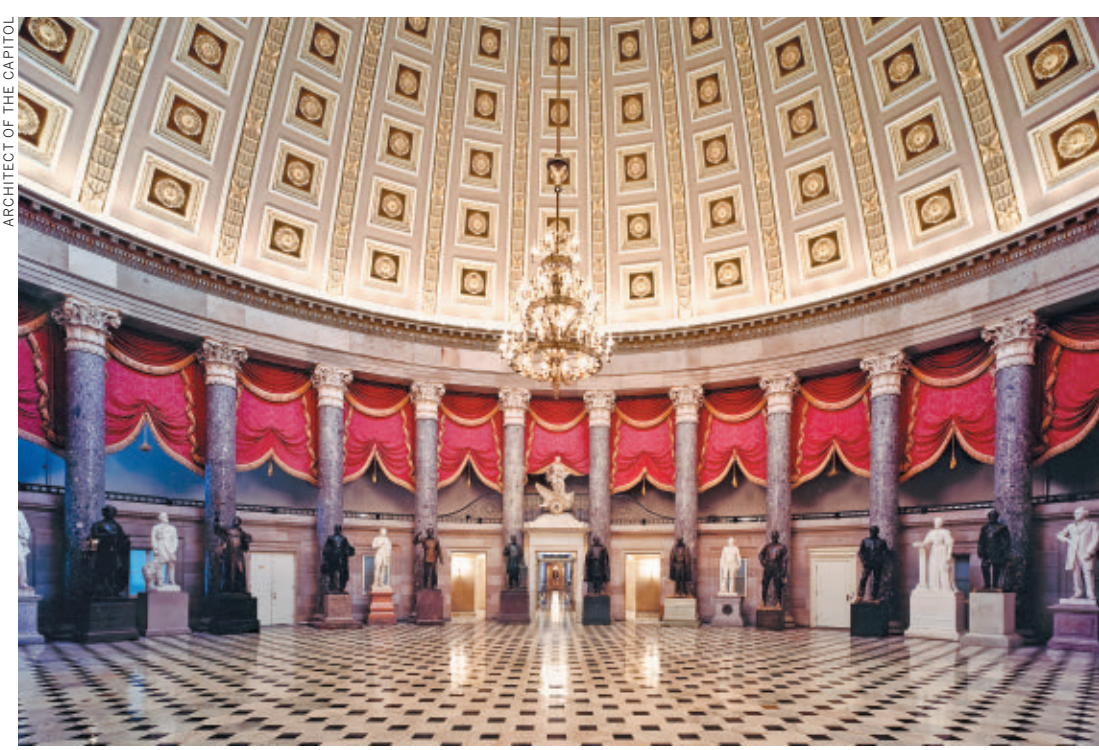
In the Senate, Frank R. Lautenberg (D-N.J.), who sponsored unsuccessful legislation in 2005 and 2008 to transform TSCA into the Kid-Safe Chemicals Act, has said he will introduce a similar bill soon (C&EN. Dec. 7, 2009, page 10). Lautenberg chairs the Senate Environment & Public Works Subcommittee on Superfund, Toxics & Environmental Health. His efforts on TSCA reform have the support of Environment & Public Works Committee Chairwoman Barbara Boxer (D-Calif.).

In other legislation, bills are pending in the House and Senate that would directly impact four chemical plants that use mercury cells to produce chlorine, sodium hydroxide, and potassium hydroxide. Already approved by the Energy & Commerce Committee and awaiting a vote in the full House is H.R. 2190, which would outlaw the use of mercury in chlor-alkali production. Designed to cut mercury pollution, the measure targets two facilities owned by Olin and two others, one owned by PPG and the other by Ashta Chemicals (C&EN, June 15, 2009, page 24). The Senate Environment & Public Works Committee is likely to consider a similar bill, S. 1428, this year.

Endocrine-disrupting chemicals, such as bisphenol A (BPA), are also likely to get the attention of Congress this year. Leading the charge questioning the safety of BPA, a plastics chemical found in polycarbonate food and beverage containers and in the epoxy resin lining of most food and beverage cans, is Rep. Edward J. Markey (D-Mass.), chairman of the Energy & Commerce Committee's Energy & Environment Subcommittee.

The congressman successfully added an amendment to the Food Safety Enhancement Act of 2009 (H.R. 2749), which passed the House last year. That amendment required the Food & Drug Administration to reevaluate approved uses of BPA in food and beverage containers by the end of 2009 (C&EN, Aug. 10, 2009, page 24). However, because the bill did not clear the Senate, the BPA review did not happen. Markey is expected to introduce new legislation related to BPA and other endocrine disrupters early this year.

Adding to the congressional interest in BPA is the fact that FDA—the agency responsible for monitoring the safety of BPA in food and beverage containers—failed to



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PETER CUTTS PHOTOGRAPHY

meet its self-set deadline of Nov. 30, 2009, for evaluating BPA's safety. Congress is likely to put pressure on FDA to speed up its review.

Legislation to address concerns about intersex fish in the nation's rivers and a dramatic rise in hormone-related disorders in people will also see action this year. This activity is prompted by the introduction of the Endocrine Disruption Prevention Act of 2009 (H.R. 4190, S. 2828) last month by Rep. James P. Moran Jr. (D-Va.) and Sen. Kerry (C&EN, Dec. 14, 2009, page 28).

The bill authorizes the National Institute of Environmental Health Sciences to develop a new research program and establish an independent panel of scientists to prioritize chemicals for screening as endocrine disrupters. It addresses inadequacies in EPA's Endocrine Disrupter Screening Program, which officially launched in October 2009 after more than a decade of delays (C&EN, Oct. 26, 2009, page 7).

Hearings on endocrine disrupters are expected this year in the House Energy & Commerce Committee and Senate Health, Education, Labor & Pensions Committee.

HOMELAND SECURITY. Congress is under pressure to pass permanent chemical plant security legislation this year. The current regulatory program administered by the Department of Homeland Security (DHS)—the Chemical Facility Anti-Terrorism Standards—will expire on Oct. 4.

The skirmishing began last year, with the primary question being whether to authorize DHS to require companies to evaluate and in some cases adopt so-called inherently safer technology (IST), such as using different chemicals or processes to reduce the potential damage that a terrorist attack on a chemical facility could cause.

The industry has endorsed IST as a design concept for the construction of new or modified plants but adamantly opposes giving the federal government authority to require the retrofit of existing facilities to meet recommendations with which the facility owners may not agree. But environmental groups such as Greenpeace and the think-tank Center for American Progress argue that the only certain way to protect communities is to eliminate the possibility of a toxic release by converting facilities to safer, more secure technologies.

The Chemical & Water Security Act (H.R. 2868) passed by the House on Nov. 6, 2009, would increase DHS's authority to regulate security practices at chemical facilities and give EPA new power to protect wastewater treatment plants and drinking water facilities.

In a victory for the environmental lobby, chemical-handling facilities would be required to assess whether a switch to alternative processes or chemicals could limit the potential consequences of a terrorist attack. Facilities in the top two of four risk-based tiers could be required by DHS to implement the safer technology if it is technically feasible, is cost-effective, and lowers the risk at the facility while not shifting it to other locations in the supply chain.

With attention now moving to the Senate, an aide to Homeland Security & Governmental Affairs Committee Chairman Lieberman says a hearing on chemical security is likely to be held early in the year. Lieberman has indicated that he hopes to craft a bipartisan bill with the committee's ranking Republican, Susan M. Collins (Maine), but the two differ sharply on the IST requirement. Lieberman favors it, and Collins does not.

In addition, Sen. Lautenberg has confirmed that he also plans to propose comprehensive chemical security legislation. Last month, on the 25th anniversary of the gas leak in Bhopal, India, that killed 3,500 people, Lautenberg issued a statement saying the tragedy "serves as a warning that a chemical disaster or attack could kill thousands of Americans. We have a responsibility to reduce the use of dangerous chemicals and keep our families and communities safe from potential attacks against these facilities."

ACC's Dooley says the industry will continue to oppose efforts "to give DHS the authority to mandate the implementation of a specific technology that [the department] alone could determine is inherently safer. We think that is too great of an intrusion of government into the responsibilities of the private sector, which has the expertise and the capacity to make those determinations."

A process is needed to ensure that government and industry "collaborate in putting together a security plan that achieves a very high level of safety against an act of terrorism," Dooley adds. "We don't think that's going to be as successful with mandatory authority vested in DHS."

CHEMICAL WEAPONS. After years of delay, the destruction of the nation's stockpile of chemical weapons is getting a push from the Obama Administration. Responding to a request by the Defense Department, Congress in late December approved a 29% increase in fiscal 2010 funding for the Army's Assembled Chemical Weapons Alternatives (ACWA) program, to $550.2 million.

The money will be used to build chemical neutralization plants at the Pueblo Chemical Depot in Colorado and the Blue Grass Army Depot in Kentucky, two of the six military installations where the obsolete weapons are stored. Stockpiles are being incinerated at the other four sites in Alabama, Arkansas, Oregon, and Utah.

Sen. Mitch McConnell (R-Ky.) and Rep. Ben Chandler III (D-Ky.) led the effort to secure the increased funding to allow acceleration of the demilitarization project in Kentucky. Sen. Mark Udall (D-Colo.) and Rep. John T. Salazar (D-Colo.) undertook similar efforts for the disposal project in Colorado.

Despite the substantial funding increase, the Pentagon does not expect to eliminate all of its chemical weapons until 2021, well beyond the 2012 deadline set by the Chemical Weapons Convention, an international treaty that requires full destruction of the U.S. chemical arsenal. The military has destroyed about 60% of the stockpile, which includes VX, GB (sarin), and mustard agent produced before the weapons program was terminated 40 years ago.

Under the Pentagon's plan, destruction of the 523 tons of mustard agent and sarin

The addition of "new and expanded mechanisms for the administrative reexamination of patents ... are quite problematic."

and VX nerve agents stored at Blue Grass is scheduled to begin in 2018 and finish in 2021. Destruction of 2,600 tons of mustard blister agent held at Pueblo is expected to be completed in 2017.

Funding for the ACWA program this year is up from $427.5 million in fiscal 2009, $407.1 million in fiscal 2008, and $349.2 million in fiscal 2007. "This latest increase is further proof that Congress understands the need to provide adequate funding for this project," says Craig Williams, cochair of the Chemical Weapons Working Group, a watchdog group in Berea, Ky.

FOOD & DRUG SAFETY. Despite other pressing issues expected to occupy Congress, 2010 will be the year for food safety reform, observers predict. Pressure to modernize U.S. food safety laws has been mounting for years, following several high-profile outbreaks involving contaminated peanuts, peppers, spinach, and other food products.

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Last year, the House passed legislation that would overhaul how FDA regulates food safety, but it stalled in the Senate, taking a back seat to health care reform.

The Food Safety Enhancement Act of 2009 (H.R. 2749), sponsored by Rep. John D. Dingell (D-Mich.), requires all food facilities to develop a hazard analysis and risk-based preventive control plan. The bill gives FDA the authority to order a recall and to access records and laboratory data. It also increases the frequency of FDA inspections at high-risk food facilities and requires food facilities to pay a $500 fee annually to help pay for inspections. The bill passed with strong bipartisan support in July 2009.

This past November, the Senate Health, Education, Labor & Pensions Committee passed similar legislation: the FDA Food Safety Modernization Act (S. 510), sponsored by Sen. Richard J. Durbin (D-Ill.) (C&EN, Nov. 23, 2009, page 26). Like the House bill, the Senate bill emphasizes prevention of food-borne illness. One difference between the bills is that the Senate version does not include an annual registration fee for food facilities.

The Senate is expected to vote on the bill early in 2010. Sen. Tom Harkin (D-Iowa), chairman of the Health, Education, Labor & Pensions Committee, said in a statement that he is "hopeful that the issue will come to the Senate floor very soon."

Supporting the cause is the fact that the President has made food safety a top priority for his Administration and has said that he supports H.R. 2749. In March 2009, Obama created a Food Safety Working Group to modernize and enforce food safety laws and coordinate food safety measures across the federal government.

Drug safety is also likely to come before Congress this year. During the health care debate last December, a group of senators tried to attach an amendment to the health care bill that would have allowed lower priced prescription drugs to be imported into the U.S. from Canada and other countries. The amendment failed because of concerns from FDA and others about drug safety.

The Obama Administration is committed to lowering drug prices for Americans and has said it will resolve any safety issues regarding imported drugs with FDA. Hearings on drug importation and safety are likely once work on the health care bill is complete.

ECONOMY & BUDGET. A multi-billion-dollar tax credit that companies with big R&D budgets depend on expired at the end of 2009, but lawmakers have vowed to retroactively renew the incentive this year.

The 20% R&D credit, worth $7 billion in annual tax savings to companies, fell by the wayside and expired on Dec. 31. The House included a one-year extension of the credit in H.R. 4213, the Tax Extenders Act, which it passed on Dec. 9, 2009, by a vote of 241-181. But the Senate got bogged down on sweeping health care legislation and was unable to push through the tax package by the end of the year.

More than 300 companies, including Dow Chemical, DuPont, Pfizer, and GlaxoSmithKline, have been urging lawmakers to broaden the credit and make it permanent. Companies argue that short-term extensions of the credit fail to provide firms with the certainty they need to invest in long-term research projects. The R&D Credit Coalition, a Washington, D.C.-based trade group, estimates the credit is equal to a federal subsidy of 6 cents for every dollar a company spends on research in the U.S.

In a joint statement on Dec. 22, 2009, Senate Finance Committee Chairman Baucus and ranking member Charles E. Grassley (R-Iowa) promised to move legislation in early 2010 to extend the R&D credit and other expired tax breaks for businesses and individuals "without a gap in coverage."

"Although the House and Senate were unable to come to agreement on a package to extend several expiring tax provisions before Congress adjourned, these measures must be addressed as soon as possible," the senators said. "Expiration of these provisions makes it difficult for taxpayers to fully and effectively realize the intended benefits by creating uncertainty and complexity in the tax law."

Baucus and Grassley vowed to take up legislation that provides "a seamless exten-

sion of these provisions as quickly as possible in the new year." The credit has lapsed numerous times since it was created by Congress in 1981 and then been extended after expiration, sometimes retroactively.

PATENT REFORM. Congress could not reach consensus on how to reform the nation's patent law in 2009, but lawmakers will try again this year. The Senate Judiciary Committee approved the Patent Reform Act (S. 515) last April; the bill attempts to end the long-standing dispute between technology companies and the pharmaceutical industry over whether damages for patent infringement should be reduced. A similar measure, H.R. 1260, is pending in the House.

High-tech firms, which face a flood of patent infringement lawsuits, have been urging lawmakers to limit the amount of money juries may award in such cases. But drug, biotech, and manufacturing companies say the threat of high damages is needed to deter infringement and protect their intellectual property.

In a bid to bridge the gap, Sens. Patrick J. Leahy (D-Vt.), Dianne Feinstein (D-Calif.), and Arlen Specter (D-Pa.) agreed on compromise language that instructs judges to act as gatekeepers and provide juries with guidance on what factors they should consider in determining damage awards based on existing case law.

The gatekeeper concept has been endorsed by several major stakeholders, including the Coalition for 21st Century Patent Reform, a broad group of nearly 50 global corporations, such as Eli Lilly & Co., Pfizer, and Novartis. The group calls the compromise "a major breakthrough" that should move the bill "toward consensus and, hopefully, ultimate enactment by the Congress."

Leahy, who chairs the Judiciary Committee and is one of patent reform's biggest congressional proponents, says the deal on damages has "paved the way for success that will benefit all inventors and innovators." But at least a dozen Republican senators believe the legislation "needs additional work before it is brought to the floor" for a vote.

In a recent letter to Senate Majority Leader Reid, Sen. Sam Brownback (R-Kan.) and 11 other Republicans asserted that S. 515 would harm small businesses, universities, and individual inventors. Although the bill has been "greatly improved" since its introduction in March 2009, especially with regard to the damages provision, the senators wrote that the addition of "new and expanded mechanisms for the administrative reexamination of patents ... are quite problematic."

The so-called postgrant review provisions would allow anyone to challenge the validity of a patent for any reason within the first 12 months after it is issued by the patent office, says Renee Kaswan, founder of IP Advocate, a group that represents the interests of academic inventors.

"This really serves the big players at the expense of small-business patentees," Kaswan says. "It is an open invitation for procedural challenges by incumbent firms to impede disruptive innovations in order to protect their established markets. The resulting costs and delays will cripple innovation and thwart start-up investments in companies that rely on patents for their survival."

The House is not expected to act until the Senate resolves its lingering disagreements.

SCIENCE POLICY. The soon-to-be-released Obama plan for the National Aeronautics & Space Administration's human exploration program will certainly result in numerous hearings in both the House and Senate. Based on a report released last fall of a blue-ribbon panel chaired by Norman R. Augustine, the President's vision is expected to address the future of the space shuttle, the future of the International Space Station, and the locations for future space exploration missions (C&EN, Nov. 2, 2009, page 22).

Congress is also likely to take up legislation that promotes the development of commercially successful and safe nanotechnologies. The House passed its version (H.R. 554) of the Reauthorization of the National Nanotechnology Initiative (NNI) last year, but the bill (S. 1482) has yet to move in the Senate. Established in 2001, NNI coordinates nanotechnology research and development among 25 federal agencies. Both bills would require a strategic plan for environmental, health, and safety (EHS) research for nanoscale materials, but they do not specify how much federal agencies should spend on EHS research.

House staffers say they expect the Senate to clear the bill this year. "We are hoping to see a bill in the Senate in early 2010 that we can bring to conference and bring to the President's desk sometime before summer," says Dahlia Sokolov, a congressional staffer with the House Committee on Science & Technology.

Sokolov says she has every reason to believe that the Obama Administration is placing a much higher importance on EHS research than the previous Administration because of the potential economic impact should something go wrong. Therefore, the President is expected to sign the bill once it is passed by Congress. ■

ROCHELLE BOHATY/C&EN

UOP AWARDED GRANT FOR BIOFUEL PLANT

The Department of Energy has awarded a $25 million grant to Honeywell's UOP unit to build a cellulosic biofuel demonstration facility. The plant is scheduled to begin production in 2014 in Kapolei, Hawaii. Feedstocks will include forestry and agricultural wastes, pulp and paper, algae, and dedicated energy crops. The conversion technology, developed by Ottawa, Ontario-based Ensyn, requires rapidly heating the biomass at ambient pressure to generate liquid pyrolysis oil. The oil will be upgraded to transportation fuels using technology developed by UOP and DOE.—MV

TESSENDERLO GETS NEW CHIEF EXECUTIVE

Belgian specialty chemical maker Tessenderlo has named Frank Coenen, 50, as CEO, effective on Jan. 15. He replaces Gérard Marchand, 66, who led the firm since 1987. Coenen joined Tessenderlo in 2006

TESSENDERLO

Coenen

and became chief operating officer last year. He previously held management positions with Cytec Industries and UCB.—MM

CHEMICAL ENGINEER SENTENCED TO PRISON

A federal judge has sentenced chemical engineer Ali Amirnazmi to four years in prison for violating U.S. trade sanctions against Iran. A jury in the U.S. District Court for the Eastern District of Pennsylvania convicted Amirnazmi in February 2009 of conspiracy, lying to federal authorities, and violating the International Emergency Economic Powers Act. The government had charged that Amirnazmi, owner of Pennsylvania-based TranTech Consultants, sold several Iranian companies software designed to help locate the best prices for chemicals. In addition to the prison term, the judge ordered Amirnazmi to pay an $81,000 fine, forfeit $17,000 to a bank he defrauded, and serve five years of probation following his release from prison.—MSR

LONZA STREAMLINES MANUFACTURING

Lonza is restructuring operations because of economic pressures and cost reductions at its pharmaceutical customers. This year, the Swiss company will close its Conshohocken, Pa., active pharmaceutical ingredients facility; a vitamin K-3 plant in Shawinigan, Quebec; and a warehouse and offices for its biosciences business in Wokingham, England. The closures will impact 175 employees and cost about $140 million. Lonza expects the changes to achieve about 40% of the $60 million to $80 million in annual cost savings it earmarked in October 2009; the remainder will be achieved through routine cost-cutting measures, Chief Financial Officer Toralf Haag says. Lonza will transfer customer projects and activities from the three closed locations to other sites. Meanwhile, it will continue to build up capabilities at its new site in Nansha, China. "The closure of the three sites will help to optimize our global operational network and further increase the competitiveness for our customers," CEO Stefan Borgas says. "The reengineering project is a key element in our endeavor to bring Lonza back to a sustainable growth."—AMT

MONSANTO'S SOYBEANS ATTRACT DOJ ATTENTION

Monsanto says it is cooperating with a Department of Justice investigation of its soybean traits business. Both DOJ and the Department of Agriculture are looking into possible anticompetitive behavior by Monsanto in the seed industry. The company's Roundup Ready soybean—the world's first genetically modified seed—will lose patent protection in 2014. In December 2009, Monsanto assured its customers that it would continue to make the soybeans available after the patent expires.—MV

DOW AGROSCIENCES TO BOLSTER CASSAVA

Dow AgroSciences and the Donald Danforth Plant Science Center will collaborate to improve the nutritional value and viral resistance of cassava, the root crop also known as manioc or yuca. Dow will donate its Exzact Precision Technology tool kit used to add, edit, or delete plant genes. It will also support the effort with zinc-finger reagents and scientific expertise. Scientists at the Danforth Center recently sequenced the cassava genome. According to the center, one-third of the African cassava crop is lost to viral diseases.—MV

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FIRMS TO SEQUENCE JATROPHA GENOME

Plant science firm SG Biofuels has formed an alliance with biotechnology equipment company Life Technologies to sequence the jatropha shrub genome. Jatropha seeds contain high amounts of an inedible oil that can be converted into biodiesel, jet fuel, and chemical feedstocks. The partners will use the genetic information to develop region-specific cultivars and increase plant yield. In addition, Life Technologies will become a strategic partner in SG Biofuels.—MV

CEREPLAST SEEKS MAJOR LISTING

Biobased plastics compounder Cereplast is seeking to list its stock on a major exchange, such as the American Stock

Exchange or NASDAQ. Currently, the company has penny stock traded on the Over-The-Counter Bulletin Board. To prepare for such a move, the company will implement a 1-for-40 reverse stock split, is hiring an independent director, and has retained a law firm to help with the paperwork. Separately, Cereplast is closing down manufacturing and R&D operations at its Hawthorne, Calif., headquarters, moving into smaller offices, and transferring equipment to its Seymour, Ind., site.—AHT

CHARLES RIVER CLOSES PRECLINICAL FACILITY

Charles River Laboratories will close its preclinical services facility in Shrewsbury, Mass., eliminating 300 jobs. "This decision comes after a challenging year in which the consolidation of the biopharmaceutical industry, the slowdown in R&D efforts, and the financial constraints for biotechnology companies resulted in softness in market demand for our services," says James C. Foster, Charles River's CEO. The company estimates the move will reduce operating costs by $20 million in 2010, and expects associated charges of $7 million. The company, which has about 8,000 employees worldwide, will retain approximately 30 workers from the Shrewsbury site responsible for ongoing operations, some of whom will be relocated to other facilities.—RM

EVOTEC TO RESEARCH HUNTINGTON'S DISEASE

Evotec and the nonprofit CHDI Foundation have extended a collaboration aimed at finding treatments for Huntington's disease, a brain disorder that leads to cognitive and physical impairments. Under the new deal, Evotec will get up to $37.5 million in research funding over the next three years. Evotec, a German small-molecule drug discovery firm, has been working with CHDI since 2006. CHDI also has discovery collaborations with Albany Molecular Research and Galapagos.—MM

PHARMA FIRMS MAKE PAYOUTS

GlaxoSmithKline has exercised an option with ChemoCentryx to license Traficet-EN, a small-molecule CCR9 chemokine receptor antagonist targeting inflammatory bowel diseases. In exchange, ChemoCentryx will get $35 million and possible future milestone payments. Separately, Targacept has received its first payment of $200 million under a collaborative agreement with AstraZeneca. The partners are planning to begin Phase III trials of Targacept's antidepressant therapy, TC-5214, in mid-2010. Targacept could receive more than $1 billion more in potential milestone payments, though it must give an undisclosed percentage to the University of South Florida Research Foundation.—AMT

GALAPAGOS DEALS WITH ROCHE, TB ALLIANCE

Galapagos, the Belgian biotech company, and Roche have signed a drug-development agreement to work on potential therapies for chronic obstructive pulmonary disease. Under the deal, Galapagos will employ its target discovery platform and assume responsibility for discovery and development of new small-molecule candidates. Galapagos has received a $9 million research access payment. Development, regulatory, and commercial milestones could amount to $573 million. Meanwhile, BioFocus, the services division of Galapagos, has signed a three-year agreement to manage the chemical library collection of the Global Alliance for TB Drug Development.—RM

BUSINESS ROUNDUP

LANZHOU Petrochemical suffered an explosion at its facility in the northwest Chinese province of Gansu, killing six. The unit, a subsidiary of the state-owned China National Petroleum, said in a statement that static electricity may have ignited flammable gas that had leaked from a tank.

FERRO ELECTRONIC Materials has received a $1 million grant from the Ohio Department of Development to engineer a new sealing system for thin-film solar cells. The company will work with the Edison Welding Institute, StrateNexus Technologies, and Ohio State University to develop a vitreous frit system that can hermetically seal the solar cells.

DUPONT and BASF have settled a patent infringement dispute that started in June 2009 when they sued each other over biotechnology traits, including ones providing tolerance to herbicides that inhibit the plant enzyme acetolactate synthase. The two firms are cross-licensing patents and dismissing the claims.

MINERALS Technologies has signed a long-term agreement to supply up to 70,000 tons per year of precipitated calcium carbonate for use in papermaking at NewPage's Duluth, Minn., paper mill. Minerals Technologies will build a new PCC plant in nearby Superior to supply NewPage.

AIR LIQUIDE and the oil company Total have inaugurated a joint carbon capture and storage project in Lacq, France. Air Liquide is supplying technology that replaces boiler air with pure oxygen to concentrate CO_2 in the fumes. The CO_2 is then transported to the Rousse geological storage site and injected into a 4,500-meter-deep former natural gas reservoir.

DSM has made an equity investment in Bioprocess Control, a Swedish biogas processes services provider. DSM's Biogas unit will also cooperate with Bioprocess Control to improve the performance of biogas plants.

MANNKIND CORP. has been told by FDA that a review of the company's rapid-acting inhaled insulin therapy Afrezza has been delayed. The agency says it hasn't completed the inspection of MannKind's insulin supplier, Organon, a subsidiary of Merck & Co.

TAKASAGO Fine Chemicals has extended an agreement that gives Merck & Co. broader access to Takasago's ligands and catalysts. Merck and Takasago scientists recently published a paper describing an efficient approach for synthesizing unprotected ß-amino amides (*J. Am. Chem. Soc.* **2009,** *131,* 11316).

LIFE TECHNOLOGIES will acquire AcroMetrix, a Benicia, Calif.-based provider of molecular and serological diagnostic quality-control products. The products are designed for use in clinical laboratories, blood screening centers, and in vitro diagnostic manufacturing.

PHARMARON Holdings, in Irvine, Calif., has acquired Bridge Laboratories' contract services operation in Beijing for an undisclosed sum, adding Good Laboratory Practice-compliant toxicology services to its contract services in China. Bridge's U.S. operations in Gaithersburg, Md., were acquired last month in a management buyout that formed Avanza Laboratories.

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CHINA'S VENERABLE VINYL PROCESS

Replaced in most of the world, the **CALCIUM CARBIDE ROUTE** to PVC gains ground in China

JEAN-FRANÇOIS TREMBLAY, C&EN HONG KONG

ACETYLENE, COKE, and calcium carbide are no longer part of the vocabulary of chemists and chemical engineers working at most modern industrial sites. But in China, these materials, dating back to the early days of the chemical industry, are still widely used to manufacture polyvinyl chloride.

Making an anachronism contemporary, Chinese firms are building new, larger scale facilities to produce vinyl from calcium carbide, a process that most of the world replaced with a petrochemical one decades ago. The method has been widely faulted for using too much energy and creating too much waste, but Chinese firms are confident they will be able to modernize it.

China has valid economic reasons for sticking with the calcium carbide route to PVC, industry observers say. The country is endowed with the vast coal and lime resources necessary for the production of calcium carbide. In contrast, it does not have the abundant supply of ethylene required for making PVC via the petrochemical route that the rest of the world uses.

China is a major producer and consumer of PVC. According to figures C&EN obtained from a major international PVC producer, the country consumed nearly 10 million metric tons of PVC in 2009. That year, it had a production capacity of 19 million metric tons, about 80% of which was based on the carbide route. Chemical Market Associates Inc. (CMAI), a market research firm, estimates that China represents one-third of the world's PVC capacity.

"If you look at the expansion of facilities in China in the past four to five years, it's been mostly plants featuring the carbide route," says Eddie Kok, Asian director for chlor-alkali and vinyls at CMAI. "There's little ethylene from the Chinese crackers available for making PVC because it's often allocated to more profitable products."

PVC, one of the world's most widely used plastics, can basically be made in two ways. The petrochemical route involves the chlorination of ethylene to yield ethylene dichloride, which is then cracked to generate vinyl chloride. Vinyl chloride is polymerized into PVC. Implementing this method in an economically viable fashion typically requires that a chlorine plant be set up in the vicinity of an ethylene cracker.

The calcium carbide route used in China involves heating lime and coal-derived coke in an electric furnace at a temperature of 2,000 °C to obtain calcium carbide. Acetylene is generated by the hydrolysis of this calcium carbide. This early part of the process is labor intensive, requires a lot of energy, and generates vast quantities of a watery calcium hydroxide slag. With the use of a catalyst that is usually based on mercuric chloride, the acetylene is then reacted with anhydrous hydrogen chloride to produce vinyl chloride.

BUILDER'S CHOICE Most Chinese PVC is used in the construction industry.

Both methods for making PVC were invented in the early-20th century. Calcium carbide even dominated until the 1960s, when ethylene became the preferred starting material in most of the world.

The calcium carbide route has a number of flaws that explain why it has mostly been replaced. Yet because China is such a big business partner, chemical industry executives refuse to be quoted speaking critically of the practice.

An executive at a major producer of PVC, who requested anonymity because China is a big market for his company, tells C&EN that PVC made by the carbide route is of inferior quality. "There are a lot of impurities," he says. "It can be used in construction materials, such as in pipes, but you can't make film from it." Others say the poor quality is the result of inferior polymerization techniques and is unrelated to the carbide process.

CALCIUM CARBIDE production requires huge amounts of power, the executive further explains, but that issue has been largely overcome in China. "They can make cheap electricity with all the coal they have," he says. Indeed, most of the PVC plants in China that employ the calcium carbide route are located near coal mines, and some house large on-site generators.

But by far the biggest flaw in the carbide route is its negative environmental impact. First of all, there is all the calcium hydroxide slag to deal with. "It's the biggest problem," the PVC executive says. His Chinese competitors, he says, endeavor to use the slag in cement production and are encour-

By far the biggest flaw in the carbide route is its negative environmental impact.

aged to do so by government policies. But the amount of slag yielded in the process is huge—as much as the calcium carbide generated—and it's unlikely that all of it can be turned into cement.

An additional environmental issue with the calcium carbide route is the use of mercuric chloride catalysts to turn acetylene into vinyl. There is much concern worldwide over the release of mercury compounds into the environment. Representatives of environmental protection bureaus from several countries have met repeatedly with Chinese government officials and executives at Chinese vinyl-producing firms in recent years to discuss their concerns.

One official at a non-Chinese environmental protection agency, who asked not to be named, tells C&EN that "the Chinese vinyl industry may well be doing a good job of recovering the residue of mercuric chloride remaining within the depleted catalyst."

The environmental official estimates that mercuric chloride represents up to 10% of the fresh catalyst by weight; the rest of the catalyst is mainly carbon. Inside a reactor vessel, he explains, heat causes a gradual vaporization of mercuric chloride. Some of the compound goes into the raw vinyl, from which it must be removed along with other impurities. After a period of roughly six months, the official says, the catalyst becomes depleted of mercuric chloride and must be replaced.

THE RESPONSIBILITY for recovering depleted catalyst lies with catalyst suppliers, according to Kok. "The producers say that whoever supplied the catalyst has to take it back," he says. Regulatory enforcement of this aspect of PVC production in China is in the process of being strengthened, he believes. None of the four Chinese PVC producers contacted by C&EN responded to requests for comment.

When they appear at events where the fate of mercury is discussed, top managers in the Chinese vinyl industry acknowledge that even if spent mercury catalyst is properly recovered, it would be better not to use it in the first place. Speaking at a conference two years ago, Li Jun, a representative from the China Chlor-Alkali Industry Association, noted the existence of research on nonmercury catalysts. The British catalyst maker Johnson Matthey has started commercialization of such catalysts in tandem with the engineering firm Akers Solutions. Neither firm responded to C&EN's requests for comment before press time.

Between 2009 and 2013, Chinese producers of PVC will boost their capacity 20%, to 24 million metric tons per year, mostly by building more plants that will employ the carbide route, according to figures C&EN obtained from a major international resin manufacturer. Kok says the new plants will likely be able to hold their own against foreign producers in terms of price.

"It's the price of ethylene that really determines whether calcium carbide-route PVC is competitive," he says. "As long as oil prices are high, ethylene prices are high—and the carbide route has a position in the industry."

Even if many engineers consider it an oddity, Kok says, China's devotion to PVC via the calcium carbide route is here to stay. "They're building new plants," he points out. "I don't see it going away for at least 20 years." ■

GELEST PUSHES AHEAD

Organometallics specialist **FINDS ITS NICHE** just below the radar of much larger competitors

GELEST, a specialist in organosilicones and metal organics, has a knack for survival. A plucky maker of custom chemicals with 100 employees and annual sales in the double-digit millions, it has found a niche supplying high-value intermediates in quantities that barely register on the radar of multi-billion-dollar competitors such as Dow Corning, Momentive Performance Materials, and Wacker Chemie.

Silicon-based materials make up about 85% of sales and have been the primary engine of Gelest's growth in recent years. But metal organic derivatives, used in electronic applications, are now on the rise at the management-owned firm.

Earlier this month, Gelest arranged to sell high-purity germane (GeH_4) for electronics and solar-cell applications exclusively through Matheson Tri-Gas, the U.S. subsidiary of Japanese industrial gas major Taiyo Nippon Sanso. The deal, says Joel Zazyczny, Gelest's business manager for silanes and metal organics, also includes plans for a joint manufacturing operation.

GELEST

TALL ORDER A worker unloads a silane reducing agent for use in pharmaceutical synthesis.

Germane is a colorless gas used to make photovoltaic reflective coatings, diodes, and semiconductors that are more efficient than their silicon-based cousins. The partners also plan to develop other germanium-based molecules for electronics industry customers through a joint research effort, Zazyczny says.

However, Gelest is not ignoring silicon-based materials at its current site, a 21-acre complex in Morrisville, Pa. The firm recently commissioned new equipment to modify substrates for cosmetics and industrial fillers in an 8,000-sq-ft stand-alone manufacturing suite. The suite was added two years ago as part of a project that doubled capacity with new reactors.

A large part of the recently commissioned equipment will provide products and services for personal care industry customers, allowing Gelest, for instance, to supply silane-treated pigments for skin care formulations. The firm hopes to expand its business with cosmetic industry customers, explains Matt Edison, manager of silicones and performance products.

As important as silicon-based materials are to Gelest today, it started in 1991 as a maker of metal organic compounds, mostly for electronics makers. Barry Arkles, the firm's president, notes that the name Gelest is made up of the first two letters of germanium, lead, and stannate.

Arkles has a Ph.D. in biochemistry from Temple University and holds about 65 patents, most covering silicones, silanes, and metal organic materials. Earlier in his career, Arkles owned a silicones catalog company called Petrarch Systems. He sold it in 1985 to a predecessor of the German firm Hüls and became a Hüls vice president. But he missed the day-to-day customer interaction and intimacy with technology that he had at a smaller firm, he says, and decided to leave Hüls together with Kevin King, now Gelest's vice president of operations, to start Gelest.

Under the terms of his departure, Arkles had agreed to not compete with Hüls, now a part of Evonik Industries, until 1993. Gelest started making silicon compounds in 1994. The extra year was long enough, he says, so that "there could be no hard feelings about our return to silicones." The firm built a significant business supplying pharmaceutical intermediates, custom silica, silanes for chemical separation and diagnostic markets, and silicon-based materials for optics applications.

Production of Roche's flu treatment Tamiflu uses Gelest intermediates. Microarrays from life sciences firm Affymetrix contain Gelest's silanes to complex DNA for gene identification. Some contact lens makers use Gelest's reactive monomers and silicone macromers as starting materials.

Although Gelest has had its share of successes, it has experienced setbacks, too. An explosion and fire destroyed the firm's first location, in Tullytown, Pa., in 2001.

Fortunately, the company was already planning the Morrisville site and was able to start building it in 2002. Silicones manager Edison, a mechanical engineer, was hired to help design the manufacturing facility and warehouse. The buildings boast 14-inch-thick concrete walls at critical locations and a ventilation system that keeps air hazards at bay. To date, the firm has invested about $25 million in the Morrisville site.

SILICON SPECIALISTS like Gelest are "good at capturing high-value, low-volume business," notes Ray Will, a senior consultant at business research publisher SRI Consulting. Big firms typically have more resources they can put into developing highly sophisticated products. But the smaller silicone specialists, such as Carpinteria, Calif.-based NuSil Technology and Bristol, Pa.-based United Chemical Technologies, often do very well with their customized approaches, Will says.

What Gelest also has going for it is a well-known catalog containing about 3,000 compounds, most of which are stored at the Morrisville site. Arkles says the catalog helps customers open discussions with Gerald Larson, vice president of research and a former Petrarch employee, and his 20-member research staff.

Researchers can then tweak catalog molecules for customers' specific needs and custom-make small quantities. For bigger volumes, the Morrisville plant can generate quantities from 20 to 80 tons, depending on the product. "Above that, customers would want to contract with larger manufacturers," Edison says.

"For us here, the excitement is getting involved in the nitty-gritty," Arkles says. "We are unapologetic chemists."—MARC REISCH

The Patient Ascendant

A **NEW HEALTH CARE ORDER** is emerging, fueled by genetics and information

RICK MULLIN, C&EN NORTHEAST NEWS BUREAU

TOWARD THE END of a lunch discussion at the Burrill Personalized Medicine conference in San Francisco late last year, someone suggested that two commercially available cancer drugs be administered as a combination therapy immediately, given the opinion of prominent researchers that they would work better together. The silence that followed was broken by a physician at the table.

ISTOCK

"That's not how science works," she said.

End of discussion? Well, a drug company researcher at the table nodded his head in agreement with the doctor. But a patient activist, unimpressed, reminded the group that certain individuals can hire their own scientists to do things differently in support of patients who are unwilling to wait for science-according-to-protocol.

Um ... could you pass the sugar, please?

Yes, things were a little tense at times, but they were also exciting at the fifth annual two-day conference, hosted by Burrill & Co., the venture capital and merchant banking firm. For one thing, everyone was talking about science. For another, the traditional relationship between doctor, patient, and scientist was changing even as we lunched. We were witnessing the ascendance of the patient.

One might expect this dynamic at a conference on personalized medicine, the field of genetics-driven therapies and preventive measures tailored to individuals. But it is not the health care enterprise's focus on personalized treatment and counseling alone that empowers the patient. It is also patients' increased access to information about their personal genomes and the seemingly infinite bank of information on health care, drugs, and science on the Internet.

THIS CONVERGENCE seems positive for the most part. Better informed patients ask better questions and can handle more detailed information from doctors. And doctors tend to be more personally involved with patients with whom they can discuss details. Personalized medicine, in turn, will get physicians more involved with the science of developing wellness strategies and therapies for their patients.

One might even anticipate a phoenixlike reemergence of the medical profession from the regulatory and insurance-driven numbers game that for decades has placed a heavier emphasis on the quantity than on the quality of patient interactions. An ironic return to simpler times. But nothing is simple when it comes to changes in the status quo or the science protocol. Free-flowing information makes people nervous.

One parent I spoke with recently told me of an exchange with his son's physician upon learning that the boy has a rare and incurable disease. "The first thing the doctor told me," he said, "was not to go on the Internet. It was almost as if he were afraid we would find something out. Of course, the first thing I did was look on the Internet."

The Western medical profession is right to shield patients from quackery and unguided forays in the world of pharmaceuticals and surgery. But there is also an issue of turf protection.

If the information available to patients is increasing, so is the patient's skill at vetting that information. Jonathan Jacoby, the head of the RARE Project (Rare Disease Advocacy Research Education Project), notes that the way people work today has honed their ability to deal with complex information.

"Many patients come from disciplines in which they develop skills and expertise that can be valuable to the clinical process," Jacoby says, pointing to engineers, information technology professionals, and community organizers. Jacoby himself came to the RARE Project with a background in conflict resolution, a useful discipline in patient advocacy.

Describing the risks involved in empowering patients, Jacoby uses a metaphor. "I'd compare patient advocacy to fuel," he says. "If you take fuel and refine it, it can add enormous power. If you don't refine it, it can destroy the engine. If you waste it, you destroy the environment."

Clearly, something must be done with this energy. And it is in the arena of personalized medicine—Jacoby would argue primarily for cancer—that much of the refining is happening via collaborative engagement and education.

The quiet guest at the lunch table—the industry researcher—will bear much of the brunt of health care change as new routes to cures circumvent the now rather dry and creaky big pharma pipeline. Collaborations with academia and biotech firms are paving the way to collaborations between big drug companies themselves, much of it directed at genetic or other biotechnology-based therapies in the field of personalized medicine. And fuel for these collaborations will come in no small part from patient advocacy groups such as Stand Up to Cancer, an entertainment industry initiative launched by cancer survivors to raise cancer awareness and money for research (C&EN, Nov. 3, 2008, page 16).

Such groups, which also include the Michael J. Fox Foundation for Parkinson's Research and the Multiple Myeloma Research Foundation, have clout. They are the voice of the patient. What matters most, however, is the individual patient, the consumer whom Jacoby describes as the traditional source of money to the health care enterprise. That description seems cold, but money is not a bad thing when combined with information and the ability to use it.

"Many patients come from disciplines in which they develop skills and expertise that can be valuable to the clinical process."

Views expressed on this page are those of the author and not necessarily those of ACS.

NANOMATERIALS IN FOOD UNDER SCRUTINY

The U.K.'s House of Lords Science & Technology Committee has released a report calling on the food industry to be more transparent about its use of nanotechnology. The committee acknowledged that food manufacturers are concerned about negative public reactions to the use of nanoscale materials in food, but it warned that hiding research on nanotech foods may backfire and lead to the type of public fear that companies are trying to prevent. The report offers several recommendations, including increased funding from the U.K. Government & Research Councils to investigate potential health and safety risks of nanomaterials in food and how nanomaterials behave in the body. It also urges the U.K Food Standards Agency to establish and maintain a publicly available registry of nanotech foods and food packaging. Nanomaterials can be used to create foods with reduced fat, salt, or sugar without altering taste, and they can be added to food packaging to keep foods fresher or warn consumers when a food is spoiled. Currently, the number of nanotech food products is small, but it is expected to grow rapidly.—BEE

FTC SEEKS BAN ON PAY-FOR-DELAY DEALS

Patent dispute settlements in which brand-name pharmaceutical companies pay generics competitors to delay entry into the market are costing consumers $3.5 billion per year, the Federal Trade Commission said last week. Eliminating these "anticompetitive" pay-for-delay deals is one of the commission's highest priorities, FTC Chairman Jon Leibowitz says. He wants Congress to include a provision in the final health care reform legislation that would block generic-delaying settlements. Since 2005, the number of pay-for-delay deals has increased following a number of court decisions that have "misapplied the antitrust law" and upheld the agreements, according to the FTC analysis. "Most of these agreements are still in effect. They currently protect at least $20 billion in sales of brand-name pharmaceuticals from generic competition," the report says. The drug industry argues that most compensation agreements are pro-consumer because they still allow generic manufacturers to introduce cheaper drugs before the patents expire on their brand counterparts. Similar questions are now being raised in Europe (see page 6).—GH

SHUTTERSTOCK

STAKEHOLDERS ISSUE PUBLIC-ACCESS REPORT

Federal agencies should develop and implement a policy that ensures public access to peer-reviewed journal articles containing federally funded research data, according to a report from the Scholarly Publishing Roundtable. The group of academic administrators, academic librarians, publishers, and information technology researchers was convened by the House Science & Technology Committee and the Office of Technology Policy last June. The report includes several recommendations to achieve a federal public-access policy. Most important, to balance the needs of different science disciplines, the report calls for an embargo period of zero to 12 months to be set up between publication and public access. Other recommendations include working closely with stakeholders to develop public-access policies, making sure standards are in place to allow searchability across databases, and requiring that the final version of an article or a link to that version is available. "These recommendations strike a good balance by allowing public access to the results of research paid for with federal funds, while preserving the high quality and editorial integrity of scholarly publishing so critical to scientists and seasoned science writers," says Rep. Bart Gordon (D-Tenn.), chairman of the S&T Committee.—SRM

HEARINGS PLANNED ON CHEMICAL LABELING

OSHA has scheduled a series of public hearings to gather comments on its proposal to harmonize its chemical hazard communication rule with the United Nations' Globally Harmonized System of Classification & Labeling of Chemicals (C&EN, Oct. 5, 2009, page 31). The move is designed to improve communications when chemicals move between countries by using a consistent system of labels or pictograms to convey chemical safety information. A three-year phase-in is planned. The first public hearing will be in Washington, D.C., on March 2, and subsequent hearings will be held in Pittsburgh and Los Angeles. The National Association of Chemical Distributors, whose members would be affected by the new rule, supports the goal of a harmonized system but is requesting an 18-month extension in implementation to give smaller chemical distributors time to complete the transition to the new system. For more information go to osha.gov.—DJH

NIST FUNDS NEW RESEARCH FACILITIES

The National Institute of Standards & Technology has awarded more than $123 million in American Recovery & Reinvestment Act of 2009 funds to support construction of scientific research facilities at 11 universities and one nonprofit organization. The projects were chosen because they support research goals of NIST and of the National Oceanic & Atmospheric Administration, including programs for the study of advanced materials, coral reefs, nanoscience, metrology, and quantum physics. Among the institutions getting awards are the University of Pittsburgh, which will receive $15 million for a new nanoscience lab; the University of Maine, which will get $12.4 million to build an advanced nanocomposites and renewable energy lab; the University of Kansas Center for Research, which will receive $12.3 million to build a measurement, materials, and sustainable environment center; and Georgia Tech Research Corp., which is getting $11.6 million for a pilot-scale lab to study carbon-neutral energy solutions.—DJH

Trade Secrets

Legitimate confidential business information must remain part of **CHEMICAL CONTROL LAW**

DAVID J. HANSON, C&EN WASHINGTON

ISTOCK

ONE OF THE BATTLES facing the chemical industry in 2010 will be fought over congressional efforts to strengthen the 1976 Toxic Substances Control Act (see page 10). Lisa P. Jackson, administrator of the Environmental Protection Agency, has already moved to bolster the agency's review of chemicals (C&EN, Oct. 19, 2009, page 28), and organizations on all sides of TSCA reform have been laying the groundwork for this year's debate.

So far, many of the arguments center on EPA's lack of authority to force chemical makers to provide detailed health and safety data on the chemicals they manufacture. Supporters of stronger controls, including the Obama Administration and environmental advocacy organizations, contend that the chemical industry is getting a free ride under the current law because it is not required to do toxicity testing on chemicals already being produced. Industry representatives agree that the law needs modification, but they are balking at some of the ideas being discussed.

Of special concern is the law's liberal interpretation of "confidential business information." According to the Washington, D.C.-based Environmental Working Group (EWG), because of unnecessary confidentiality claims, chemical companies are threatening human health. The group bases this claim on its analysis of EPA data, which was completed last month, for the frequency of confidentiality claims by companies submitting new chemicals for review (www.ewg.org/chemicalindustryexposed/topsecretchemicals).

That analysis says that data on 17,000 of the more than 83,000 chemicals in the TSCA inventory of commercial chemicals are "secret" and that, historically, EPA gives in too easily to companies when they assert that data are confidential business information. Because the public has no access to the confidential business information of a chemical submitted for inclusion in the inventory, EWG insists that the industry has thousands of secret chemicals in products that "directly threaten human health."

This allegation is a stretch even for EWG, which has a reputation for making sensational claims of health threats from chemicals. Even if information about a chemical is not public, EPA reviews all the available health and safety data for the compound before allowing its manufacture or importation. If these data are poor or incomplete, the agency can ask for additional information. Just because companies want to claim the information confidential does not make the compound dangerous, which is what EWG is implying.

There are no secret chemicals on the market, said the American Chemistry Council, which represents most of the U.S.'s largest chemical manufacturers, in a statement reacting to EWG's claims. "In those cases where a specific chemical identity has been claimed confidential, the manufacturing and use of that substance must always fully comply with the requirements of the law," ACC stated. Full compliance includes disclosing any information on significant risks to health and the environment.

The Society of Chemical Manufacturers & Affiliates, which represents the batch and custom chemical industry, refutes the charge that industry is at fault on this matter. "Even if the information is deemed confidential, it is still up to EPA to make the final determination about the safety of the chemical," says William E. Allmond IV, SOCMA vice president for government relations. SOCMA is aware that the chemical industry might have been too quick to claim information on chemicals as confidential in the past, but Allmond tells C&EN that the trade group is working with its members to exercise this claim more prudently in the future.

BUT THE PRIMARY PROBLEM is the law. The chemical industry is highly competitive; maintaining a slight edge by keeping new compounds confidential is critical to companies' survival, and TSCA allows it in spades. Not only can a company claim confidential business information for any chemical submitted for review, but the law also imposes heavy penalties—including jail time—on anyone who reveals that data. That EPA seems to favor industry is not the result of policy or whim—it is because that is what the law demands.

"The solution is not as simple as requiring all information to be fully disclosed in all cases," writes Richard Denison, a senior scientist with the advocacy group Environmental Defense Fund, in his thoughtful blog (www.edf.org/chemandnano). There are legitimate reasons for keeping data secret, he notes, at least for a period of time. Although he strongly favors full disclosure of product ingredients, Denison writes that it is the law that has "tied EPA's hands both legally and resource-wise in any effort to challenge or rein in such claims where they are not legitimate."

The claims of confidential business information will be part of the debate on TSCA reform, and they deserve a more nuanced analysis than EWG's crude "investigation." Congress and the Administration need to be cautious when they rewrite laws with major impact on the nation's industries. As ACC said in its statement, "Balanced confidentiality laws help protect the trade secrets that foster innovation and create jobs." And of all the needs that the Administration has emphasized over the past year, the greatest has been for jobs and innovation.

That EPA seems to favor industry is not the result of policy or whim—it is because that is what the law demands.

Views expressed on this page are those of the author and not necessarily those of ACS.

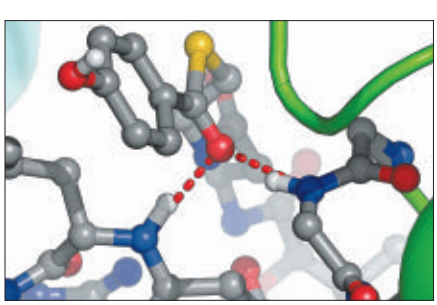
KEY NUTRIENTS DECLINE IN TRANSGENIC RICE

Genetic modifications aimed at introducing useful traits such as pest resistance into rice appear to have unintended negative nutritional consequences (*J. Agric. Food Chem.*, DOI: 10.1021/jf902676y). Gong-Ke Li and colleagues of Sun Yat-Sen University, in Guangzhou, China, examined three kinds of *Oryza sativa* rice engineered to have resistance to certain insect pests and fungal diseases. The researchers studied the nutritional content of the rice using near-infrared reflectance spectroscopy, gas chromatography-mass spectrometry, high-performance liquid chromatography, and inductively coupled plasma-atomic emission spectroscopy coupled with chemometrics methods. When they compared the transgenic varieties with conventional *O. sativa* rice, they detected a significant decline in vitamin E in the first type of transgenic rice; a sizable reduction in protein content in the second type; and a deficiency in amino acids, including alanine, glycine, and tyrosine, in the third type. The study yielded "alarming information with regard to the nutritional value of transgenic rice," the researchers report. "To confirm the biosafety of transgenic rice," they add, "more detailed nutritional and toxicological tests should be carried out."—SLR

TWISTED NATURE OF TRANSITION STATES

A textbook rule about enzyme catalysis is being called into question by Jonathan M. Goodman of the University of Cambridge and Luis Simón of Spain's University of Salamanca. The duo finds that the long-held adage that an enzyme's active site stabilizes a reactant's transition state in order to speed up reactions might not be universally true (*J. Org. Chem.*, DOI: 10.1021/jo901503d). After reviewing hundreds of so-called oxyanion-hole enzyme structures, which catalyze addition reactions to carbonyl groups, Goodman's team noticed that active-site residues in these enzymes don't form optimally oriented hydrogen bonds to transition-state atoms. Instead, the hydrogen bonds are twisted around the carbonyl axis by up to 90°, Goodman says. There's some evolutionary logic behind the twisted bonds. Goodman points out that hydrogen bonding that is too snug might decrease the speed of a reaction because molecules could find interacting with the enzyme too enjoyable to move along quickly. That observation might be useful to scientists designing artificial enzymes and organocatalysts, the researchers suggest.—SE

JONATHAN GOODMAN

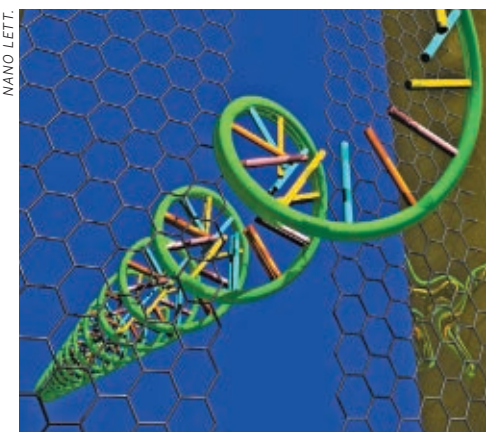


Hydrogen bonding of a nucleophilic reactant isn't optimal in oxyanion-hole enzymes, such as this dehalogenase.

GRAPHENE NANOGAPS FOR DNA

Solid-state and protein nanopores are of great interest for DNA sequencing because of the possibility of reading longer stretches of DNA. But nanopores have trouble achieving single-base resolution. In a theoretical study, Henk W. Ch. Postma of California State University, Northridge, suggests a variation on the nanopore concept—graphene nanogaps. Postma proposes using a narrow gap in a graphene sheet attached to a pair of gold electrodes to measure the transverse conductance of DNA (*Nano Lett.*, DOI: 10.1021/nl9029237). Each base has a characteristic conductance, and graphene's single-atom thickness should make it possible to achieve single-base resolution during sequencing. The nanogap needs to be large enough for single-stranded DNA to slide through, but it can't be larger than 1.6 nm. "For every 0.1-nm increase in width, the current decreases by about an order of magnitude," Postma says. He proposes measuring the conductance with nonlinear current-voltage analysis, which would allow determination of whether current changes are due to gap-width variations or due to different bases. Postma's calculations suggest that graphene nanogaps up to 1.6 nm will lead to error-free sequencing.—CHA

NANO LETT.



Single-stranded DNA moves through a nanogap in a graphene sheet.

NEW AND IMPROVED CROSS-COUPLINGS

A general method for conducting direct reductive cross-couplings of aryl and alkyl halides without an intermediate stoichiometric organometallic reagent has been achieved by Daniel J. Weix and coworkers of the University of Rochester (*J. Am. Chem. Soc.*, DOI: 10.1021/ja9093956). These indispensible reactions to prepare alkylated aromatics typically require preforming an alkyl magnesium or alkyl zinc halide in a separate step. But last year, chemists simplified the method by devising procedures to generate the reagents as in situ intermediates in one-pot reactions (C&EN, Oct. 26, 2009, page 6). Weix's group has now simplified the reaction further by creating conditions that avoid the formation of an organometallic reagent entirely. The researchers prepared a chemical soup made from a host of ingredients: aryl iodide and alkyl iodide substrates, an NiI_2 catalyst, bipyridine and bis(diphenylphosphino)-benzene ligands, a pyridine additive, manganese powder as a reducing agent, and a pyrimidinone solvent (DMPU). Instead of forming a discrete organometallic reagent, such as RMnI, the reaction appears to proceed via a sequence of oxidative additions of the aryl iodide and alkyl iodide to nickel, aided by a synergistic effect of the dual

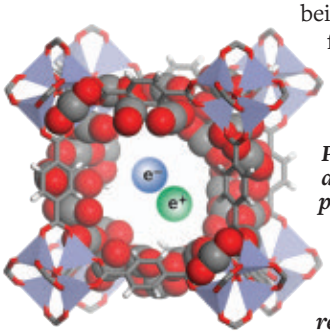
ligands. The coupled alkylated aromatic products possess a variety of functionality, Weix says, including an unprotected alcohol.—SR

IRON UPTAKE BY PLANKTON DECREASES AS OCEANS ACIDIFY

Ocean acidification resulting from increased carbon dioxide levels might decrease the bioavailability of iron for marine phytoplankton, according to a report by Princeton University's Dalin Shi, François M. M. Morel, and coworkers (*Science*, DOI: 10.1126/science.1183517). In laboratory studies, the team tested the effect of pH on iron uptake by four species of phytoplankton in the presence of different classes of metal chelators. They found that iron uptake decreased as the pH decreased in the presence of the chelators ethylenediaminetetraacetic acid and desferriferrioxamine B. In contrast, iron uptake didn't change with pH in the presence of the catechol azotochelin. In analyses using Atlantic Ocean surface water, Shi and coworkers found modest decreases in iron uptake of about 10% by a model diatom when they decreased the pH of seawater from 8.4 to 7.8. Biogeochemist Constant M. G. van den Berg of England's University of Liverpool finds the results surprising. "We did not know that iron uptake would be less at lower pH, as the calculated concentration of bioavailable inorganic iron actually increases slightly with decreasing pH," van den Berg says. "This is indeed very important."—CHA

POROUS COMPOUNDS PROBED WITH POSITRONS

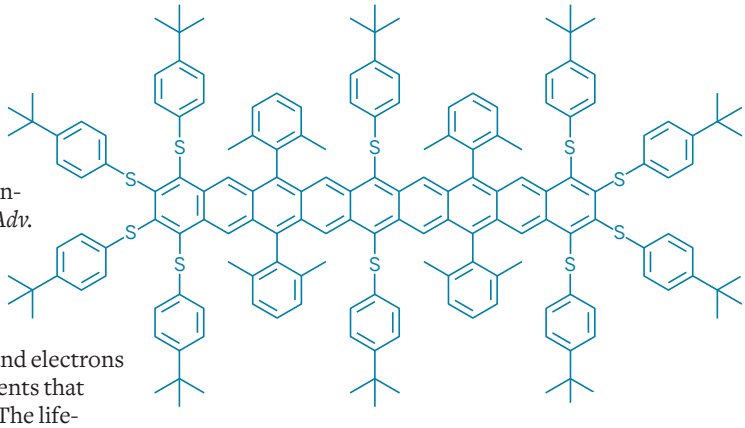
Chemically and thermally induced changes in the pore structure of nanoporous metal-organic framework (MOF) compounds being investigated for gas-storage and other applications can be probed in detail with positrons, according to a Michigan-based research team (*Adv. Mater.*, DOI: 10.1002/adma.200903618). Collisions between positrons (positively charged electrons) and electrons lead to annihilation events that generate gamma rays. The lifetimes of positrons injected into a solid depend on how quickly the particles encounter electrons, which in turn depends on the material's porosity—its distribution of void spaces. Ming Liu, David W. Gidley, and Adam J. Matzger of the University of Michigan and coworkers exploited those relationships to investigate carbon dioxide uptake and the effects of temperature on MOF-5, a well-studied porous compound. Among the team's observations is the finding that 20–30% of MOF-5's open volume remains unfilled with CO_2, even at 400 psi, and that the crystals are unexpectedly riddled with 6-nm-long defects. In addition, the researchers found that heat treatments degrade the crystal structure and form pores of a broad range of sizes. These types of defects have not been reported previously in MOF studies based on X-ray structure methods and gas-adsorption techniques, which provide only structurally averaged results, the team says.—MJ



Positron-electron annihilation reveals previously unknown structural defects in MOF-5 pores (adsorbed CO_2 is gray and red spheres).

A NONACENE WITH STAYING POWER

The first persistent derivative of nonacene—a compound with nine aromatic rings fused in a linear fashion—has been prepared by chemists at the University of New Hampshire (*J. Am. Chem. Soc.*, DOI: 10.1021/ja9095472). With high-charge-carrier mobilities, acenes are promising organic semiconductors for thin-film transistors, displays, and photovoltaics. Smaller acenes, such as pentacene, have already found use in organic light-emitting-diode displays, for example. Larger acenes potentially have even higher mobilities, but the compounds oxidize rapidly. Glen P. Miller, Irvinder Kaur, and coworkers found that they could impede this degradation by adding arylthio groups to nonacene. Density functional theory calculations predict that these substituents alter nonacene's electronics, Miller says, "effectively converting a ground-state singlet diradical into a closed-shell species while simultaneously reducing the HOMO-LUMO gap to about 1 eV." Miller hopes to perform a detailed computational study of how substituents affect the total spin and molecular orbital energy gaps in larger acenes. Preparing very large, persistent acenes "is an intellectually tantalizing and increasingly realistic goal," he says.—BH



Nonacene derivative

FLEXIBLE DRUG TARGET REVEALS ITS SECRETS

The first X-ray crystal structure of a flexible member of an enzyme family involved in diseases ranging from cancer and diabetes to inflammation and asthma could bolster efforts to develop drugs that selectively inhibit the enzymes. Pharmaceutical companies trying to develop drugs aimed at the phosphoinositide-3-OH kinases (PI3Ks) have been stymied by an inability to target specific family members and therefore minimize side effects from interactions with other members. A team led by Roger L. Williams of the Medical Research Council's Laboratory of Molecular Biology, in Cambridge, England, solved the structure of the δ isoform of PI3K bound to several inhibitors that were flat or shaped like propellers (*Nat. Chem. Biol.*, DOI: 10.1038/nchembio.293). This isoform, associated with inflammation, has a topology similar to other structurally characterized PI3K isoforms, but it appears to be more flexible. For example, the team found that propeller-shaped inhibitors squeeze into a site normally occupied by the energy-giving molecule ATP. In order to fit, the inhibitors create a new cavity in a section of the enzyme that is not normally open. Learning more about the conformational flexibility of enzymes that otherwise look the same could be key to designing drugs specific to a particular isoform, Williams says.—SE

ADAM MATZGER

COURTESY OF SABINE BAHN

PROTEOMICS IN PINK Bahn (right) and students Melanie Beer (left) and Agnes Ernst analyze proteomic data.

A SYSTEMIC LOOK AT SCHIZOPHRENIA

Proteomic analysis of **PERIPHERAL CELLS** reveals aspects of psychiatric disorder

CELIA HENRY ARNAUD, C&EN WASHINGTON

BECAUSE SCHIZOPHRENIA is a psychiatric disorder, its physical manifestations must all be in the brain, right? Maybe not. Proteomic studies using cells from other parts of the body are showing that there might be a systemic aspect of the disorder. The ability to use nonbrain cells to study schizophrenia could make it easier to find biomarkers of the disease and to develop diagnostic tools.

To date, most studies of the disorder have been done with brain tissue taken from schizophrenia patients after death. A major drawback of such studies is that the tissue might no longer reflect the circumstances that existed while the patient was still alive.

"The problem with psychiatric disorders is that you can't take biopsies at different disease stages," says Sabine Bahn, director of the Cambridge Institute for Psychiatric Research at the University of Cambridge. "Patients would not be too happy to have pieces of brain taken at different time points."

Bahn and her colleagues are investigating disease markers in tissues such as skin, immune cells, and blood serum to find samples that give a real-time picture of the disease. Their studies of protein expression in fibroblasts (skin cells) on schizophrenia patients' arms have identified systemic problems such as cell-cycle abnormalities (*J. Proteome Res.* **2010,** *9,* 521).

"It's clear that schizophrenia has a very strong genetic component," Bahn says. "Most genes are not used only in the brain. If there is an underlying abnormality at the genetic level that leads to pathology in the brain, the assumption can be made that there should also be dysregulation in the peripheral system. It may not lead to pathology, but it may reflect the pathology in the brain."

Bahn and her coworkers have seen that 40% of the changes observed in the brains of schizophrenia patients also occur in the peripheral systems. The affected pathways include cell replication, immune function, and glucose metabolism.

"We were pleased that some of our previous findings could be reproduced in the fibroblast system," Bahn says. "It was reassuring that we can trace central nervous system abnormalities in the peripheral system."

Bahn started out working with fibroblasts, but she is now using immune cells in her schizophrenia studies. Skin cells are easier to culture than immune cells, but the latter have the advantage that they are involved in more signaling pathways. Immune cells are "much more similar to neurons in the way they have to communicate with other cells," Bahn says.

Other researchers see both advantages and disadvantages in using peripheral cells to study schizophrenia. "Differentially expressed proteins in blood and cerebrospinal fluid might be used as good biomarkers, but they are not always as informative as brain proteins regarding an understanding of the disease," says Daniel Martins-de-Souza, a schizophrenia researcher at Max Planck Institute of Psychiatry, in Munich.

EARLIER STUDIES from other labs suggest that the link between neural cells and peripheral cells might not be so clear cut. In a gene expression study using white blood cells and skin cells from schizophrenia patients and control individuals, Nicholas A. Matigian and coworkers of Queensland Institute of Medical Research, in Australia, found no convergent set of differentially expressed genes in the different cell types (*PLoS One* **2008,** *3,* e2412). The lack of a common set of changes in white blood cells and fibroblasts "weakens the case that these nonneuronal tissue sources are informative for detecting the underlying causative genetic and epigenetic changes responsible for" schizophrenia, the researchers wrote.

Bahn nevertheless believes peripheral-cell-based diagnostics will be useful. She and her coworkers have identified schizophrenia biomarkers in serum, and working with the company Rules-Based Medicine, located in Austin, Texas, and Lake Placid, N.Y., she expects that a serum-based test to aid in the diagnosis of schizophrenia will be launched sometime this year.

"We've identified a signature of numerous protein biomarkers, which give a very high sensitivity and specificity," Bahn says. "We've looked at hundreds of samples from patients and controls and other disorders that are related to schizophrenia."

The test would help confirm diagnoses made on the basis of conventional methods. "The customary window is often a delay of several years until someone is confirmed and diagnosed," Bahn says. "We know very well that if patients are treated early in the disease process, we improve outcome." ■

SEX THERAPY LEAD FROM BIRD BRAINS

REPRODUCTIVE HORMONE previously detected in birds, rats, and fish has now been found in humans

A HORMONE first found in bird brains could have ramifications for human sexuality, a new study reveals.

Analogs of the hormone, which suppresses reproduction and sexual behavior in birds and some other species, have now been detected in humans (*PLoS One,* DOI: 10.1371/journal.pone.0008400). The discovery could yield a new class of contraceptives as well as treatments for early puberty, low libido, and infertility.

Kazuyoshi Tsutsui, a biologist at Waseda University, in Tokyo, and coauthor of the *PLoS One* paper, discovered the first example of the peptide hormone in quail brains a decade ago (*Biochem. Biophys. Res. Commun.* **2000,** *275,* 661). Tsutsui and his coworkers named it gonadotropin-inhibitory hormone (GnIH).

Since Tsutsui's initial discovery of GnIH in quail, homologs belonging to the RF-amide-related peptide (RFRP) family have been found in other birds, as well as in fish, frogs, rodents, and monkeys. Now, University of California, Berkeley, biologists George E. Bentley and Takayoshi Ubuka, along with Tsutsui and other colleagues, have isolated from human brain tissue two compounds that they believe are GnIH homologs. They have dubbed the compounds RFRP-1 and RFRP-3.

Because the reproduction-suppressing properties of GnIH "seem to be quite highly evolutionarily conserved across vertebrates, GnIH most likely inhibits reproductive function in humans" as well, Bentley says. "It is possible that it inhibits sexual behavior, too, although we have no data on this in humans yet," he adds.

"Identifying the inhibitory hormone in humans forces us to revise our understanding of the control mechanism of human reproduction," Ubuka says. "We hope this will stimulate clinical studies on people with precocious puberty or in the area of contraception." Because reproductive hormones promote the growth of some types of cancer cells, GnIH or its derivatives might also work as anticancer agents.

In its normal role, GnIH opposes gonadotropin-releasing hormone (GnRH), a key player in the reproductive system. GnRH is produced by neurons in the hypothalamus and travels through the bloodstream to the pituitary gland, prompting it to release gonadotropin hormones that prime the body for sex and procreation.

GnIH, which is also produced by hypothalamic neurons, blocks GnRH through multiple avenues. In their *PLoS One* paper, Bentley and colleagues report that the neurons that produce GnIH extend fibers, or projections, that contact the neurons that produce GnRH. They identified a receptor for the human GnIHs on the GnRH neurons. The researchers believe that binding of GnIH to that receptor suppresses secretion of GnRH.

COURTESY OF GEORGE BENTLEY

Bentley

In addition, GnIH inhibits secretion of gonadotropins by the pituitary gland, which also possesses the GnIH receptor, the researchers showed. Finally, GnIH is produced in the reproductive organs that are the targets of gonadotropins—ovaries in females and testes in males—and impedes their release of sex steroids.

Bentley and Tsutsui have studied the effect of GnIH on the response of female sparrows to male sparrows. A female normally signals her willingness to mate by raising her tail and head, fluttering her wings, and vocalizing. The researchers showed that administering GnIH to a female sparrow dampens her mating ardor considerably—but only for a short time.

Bentley thinks GnIH acts as an easily reversible check on the reproductive system. Such a light restraint could be particularly useful in seasonal breeders, which include many birds and mammals. "Within the time frame of the breeding season, it might be wise to have a system whereby you can pause reproduction if there's a stressful stimulus or if environmental conditions are not conducive to breeding," he says. "We think GnIH is acting as a pause button, so you don't have to shut down the whole reproductive machinery," he explains. "You can just temporarily put a halt to the proceedings."

STRESS IS KNOWN to cause sexual dysfunction and infertility. Bentley and colleagues recently showed that GnIH neurons have a receptor for the hormones released when an animal is stressed and that stress stimulates GnIH expression (*Proc. Natl. Acad. Sci. USA* **2009,** *106,* 11324).

GnIH neural function in birds and mammals is also affected by the hormone melatonin, Tsutsui says (*Endocrinology* **2010,** *151,* 271). Melatonin is involved in the sleep/wake and reproductive cycles, and its synthesis and release are regulated by day length. Binding of melatonin to receptors on GnIH neurons increases the release of GnIH. "Melatonin manipulation may offer means of manipulating reproduction in humans and other mammalian species," Tsutsui says.

Greg M. Anderson, a biologist at New Zealand's University of Otago who studies GnIH and GnRH, recommends that the latest results be interpreted with caution. "The paper by Ubuka et al. is the first to characterize the RFRP-1 and -3 neurons and their projections to GnRH neurons in the human hypothalamus," Anderson says. But he questions whether RFRPs produced in the brain can escape the blood-brain barrier and enter the bloodstream. He is also not convinced that all RFRPs can inhibit gonadotropin synthesis and secretion (*Endocrinology* **2009,** *150,* 1413).

"Whether RFRP-1 and -3 are in fact GnIHs will remain controversial until they are detected at physiologically meaningful concentrations in the mammalian portal blood system," which carries blood and hormones from the base of the hypothalamus to the pituitary gland, Anderson says.

Bentley and Tsutsui plan to study the compounds' activities and physiological concentrations further. Bentley will also explore whether modulating RFRP levels can help endangered animals breed more successfully in captivity.—SOPHIE ROVNER

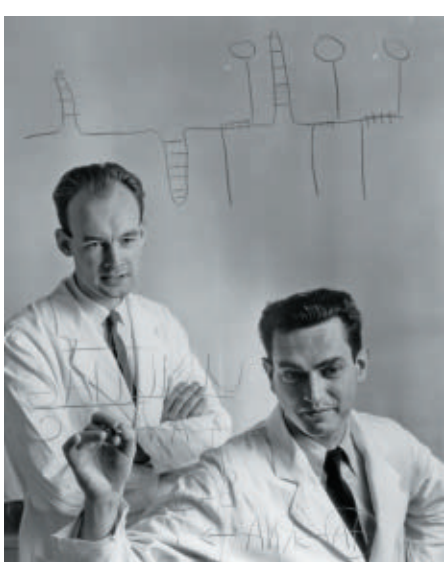
MARSHALL NIRENBERG'S WORK HONORED

Research deciphering the GENETIC CODE is the latest National Historic Chemical Landmark

IN MAY 1961, "Big Science" was grabbing headlines: On May 5, ground crews cheered as Alan Shepard flew high enough to earn the title "First American in Space." Less than three weeks later, on May 25, President John F. Kennedy vowed that the U.S. would put a man on the moon by the end of the decade.

While these events were capturing the nation's imagination, a pair of scientists quietly reached a breathtaking new frontier right here on Earth. In the wee hours of May 27, in Building 10 on the campus of the National Institutes of Health, in Bethesda, Md., researcher Marshall W. Nirenberg and postdoc Heinrich Matthaei found the key to deciphering the genetic code of virtually all life on Earth—a biochemical Rosetta Stone—in a humble test tube. That discovery was recently honored by the American Chemical Society as a National Historic Chemical Landmark.

Nirenberg set out to prove the existence of messenger RNA, which he did, but his experiment yielded much more. He instructed Matthaei to mix 20 samples of synthetic mRNA composed entirely of uracil with a specially prepared cell-free extract of *Escherichia coli*. For each sample, Matthaei introduced one radiolabeled amino acid and 19 unlabeled amino acids into the extract, varying the "hot" amino acid in each tube.



NIH

TRANSLATION Matthaei (left) and Nirenberg photographed shortly after their groundbreaking experiment.

The sample containing the radiolabeled phenylalanine produced radioactive protein composed entirely of phenylalanine. From these data, Nirenberg concluded that the sequence UUU on mRNA was the genetic code for phenylalanine. This was the first step in determining the genetic instructions for all amino acid synthesis and was also the first demonstration that mRNA, which had been postulated, actually exists.

Within three years, Nirenberg and his colleagues had identified the RNA codons of all 20 standard amino acids that make up proteins. For this work, Nirenberg was one of three winners of the 1968 Nobel Prize in Physiology or Medicine.

Many of Nirenberg's former colleagues and students were on hand as Nirenberg's work became ACS's 64th National Historic Chemical Landmark. Thomas H. Lane, then-ACS president, presented a bronze plaque describing the groundbreaking experiment to Michael Gottesman, NIH's deputy director for intramural research, at the close of a day-long symposium held in Building 10.

The symposium was a tribute to Nirenberg's work and was attended by about 400 people, primarily NIH scientists. Titled "Genes to Proteins: Decoding Genetic Information," the symposium featured presentations of the classical work and cutting-edge research and were punctuated by personal reminiscences. The symposium and landmark ceremony, which together lasted more than five hours, are available in their entirety to view or download at videocast.nih.gov/launch.asp?15434.

Videotaped remarks by NIH Director Francis S. Collins were shown during the symposium and sum up the impact of Nirenberg's work. "It is fair to say that Dr. Nirenberg's discoveries contributed to our completing the human genome, mapping human genetic variation, and studying the correlations between variation and disease," said Collins, who is also the former director of the National Human Genome Research Institute. "One day, when medicine is able to marshal the power of this knowledge to personalize medicine for every individual, the full promise of Nirenberg's work will be realized," he said.

NIH

LANDMARK Gottesman (left) and Nirenberg flank the plaque designating the deciphering of the genetic code as a National Historic Chemical Landmark at a National Institutes of Health ceremony.

Nirenberg, 82, has spent his entire career at NIH and is the longtime chief of its National Heart, Lung & Blood Institute's Laboratory of Biochemical Genetics. He came to NIH in 1957 as a postdoc working on sugar transport, enzyme purification, and glycogen metabolism. After being hired as an independent researcher in 1959, he made an abrupt change in his research focus that his then-colleague Bruce N. Ames deemed "suicidal." Nirenberg made the move because he wanted to find out whether DNA or RNA directed protein synthesis. Although Nirenberg admitted it was a risky thing for a new researcher to do, he says Ames's opinion "was a little extreme."

The Chemical Society of Washington (the ACS Washington, D.C., local section) sponsored the proposal for the landmark status nearly three years ago. NIH Scientist Emeritus Edwin D. (Ted) Becker, who

championed the designation and coorganized the symposium and other events surrounding the landmark designation, says he did so because he "thought it would be particularly important to demonstrate to the public that this work, which sounds like genetics or biology, is really chemistry."—LINDA RABER

ASTELLAS USA AWARDEES ANNOUNCED

ACS has announced the winners of the 2009 Astellas USA Foundation Awards. The awards recognize individuals or teams that have significantly contributed to scientific research that improves public health. Each winner will receive a $30,000 grant from the Astellas USA Foundation's award program to support their research efforts.

Frederick Khachik, a senior research scientist in the College of Chemical & Life Sciences at the University of Maryland, received an award for his research on the synthesis, isolation, and characterization of carotenoids and their metabolites from natural products and human serum and tissues.

Ka Yee C. Lee, professor of chemistry and director of the Chicago Materials Research Center at the University of Chicago, was selected for her work on the mechanisms of amyloid-β aggregation in Alzheimer's disease and the molecular processes underlying the development of neonatal respiratory distress syndrome.

Arup K. SenGupta, professor and chair of the department of civil and environmental engineering at Lehigh University, was recognized for his contributions toward mitigating the arsenic crises around the world through application of chemistry and chemical engineering principles.

UNDERGRADUATE ORGANIC FELLOWSHIPS AVAILABLE

The ACS Division of Organic Chemistry is seeking nominations for its 2010 summer undergraduate research fellowships. Each award consists of a $5,000 stipend to support an undergraduate carrying out research in the summer between the junior and senior year. The fellowships are awarded on the basis of students' research proposals, academic records, and faculty recommendations. Application forms are available online at organicdivision.org/SURFprogram.html, and nominations should be submitted as a single PDF file to Robert A. Volkmann at ravolkmann@gmail.com by Feb. 2.

SEEKING GRADUATE STUDENTS FOR NEW ORGANIC SYMPOSIUM

Graduate students in organic chemistry are invited to apply for the Young Organic Chemists Symposium, a new program of the ACS Division of Organic Chemistry. Fifty to 75 graduate students in organic chemistry will be selected to present their research and to interact with leaders from academia, industry, and various funding agencies at Boston College during the symposium, which will be held on July 15–18. For information on how to apply, visit organicdivision.org. Applications are due on March 1.

STUDENT AWARDS IN GREEN CHEMISTRY

The Joseph Breen Memorial Fellowship sponsors undergraduate and graduate students and postdocs to participate in an international green chemistry technical meeting, conference, or training program of their choosing. This award is sponsored by a fund that commemorates the accomplishments of Joe Breen, the first director of the Green Chemistry Institute.

The Kenneth G. Hancock Memorial Award honors outstanding student contributions to furthering the goals of green chemistry through research or education. The award is a one-time cash payout of $1,000 and is open to all undergraduate and graduate students. It is sponsored by the ACS Division of Environmental Chemistry and the National Institute of Standards & Technology.

There is no limit on the number of applications that can be submitted from any one academic institution or project adviser, and students may apply for both awards. Applications for both awards must be submitted by Feb. 1. For additional information, contact the ACS Green Chemistry Institute by e-mail at gci@acs.org.

JOURNAL OF CHEMICAL EDUCATION PARTNERS WITH ACS

The *Journal of Chemical Education,* which had been self-published by the ACS Division of Chemical Education for more than 80 years, is now available on the ACS Web Editions Platform at pubs.acs.org/jce. The January issue marks the official beginning of the partnership between the division and ACS Publications in the copublication of the *Journal of Chemical Education*. The new website for the journal features a video interview with Editor-in-Chief Norbert J. Pienta in which he affirms his commitment to continue publication of "all of the high value, quality material that people have expected all these years."

The journal is now accepting manuscript submissions electronically via the ACS Paragon Plus online manuscript submission and peer review environment. ACS Publications manages subscriptions and customer service, including subscriber access to the Web and print editions of the journal by individuals and institutions.

CHEMISTRY TEACHER EDUCATION COALITION

Chemistry educators are invited to attend the Physics Teacher Education Coalition Conference (PTEC) on Feb. 12–13 in Washington, D.C. PTEC is partnering with ACS to support the launch of the Chemistry Teacher Education Coalition (CTEC). More than half of the conference sessions will be directly relevant to chemistry teacher educators, and a special session to develop a strategic plan for CTEC will be led by Mary M. Kirchhoff, ACS director of education. Conference topics include funding opportunities, teacher recruiting strategies, development of subject-specific pedagogical knowledge, and preparing teachers for urban schools. Visit ptec.org/conferences/2010 for more information. ■

2010 ACS NATIONAL AWARD WINNERS

Recipients are **HONORED FOR CONTRIBUTIONS** of major significance to chemistry

FOLLOWING is the third set of vignettes of recipients of awards administered by the American Chemical Society for 2010. C&EN will publish the vignettes of the remaining recipients in January and February issues. A profile of Richard N. Zare, the 2010 Priestley Medalist, is scheduled to appear in the March 22 issue of C&EN along with his award address.

Most of the award recipients will be honored at an awards ceremony that will be held on Tuesday, March 23, in conjunction with the 239th ACS national meeting in San Francisco. However, the Arthur C. Cope Scholar awardees will be honored at the 240th ACS national meeting in Boston on Aug. 22–26.

ACS AWARD FOR DISTINGUISHED SERVICE IN THE ADVANCEMENT OF INORGANIC CHEMISTRY

Sponsored by Strem Chemicals

Distinguished service awards recognize the outstanding contributions that a member of a research community has made to his or her field. This year, **Richard D. Adams,** the Carolina Distinguished Professor at the University of South Carolina, Columbia, was selected by his peers for the breadth of his work in advancing inorganic chemistry.

"Rick Adams is an outstanding choice for the distinguished service award," comments Northwestern University's Tobin J. Marks, who received the award in 2008. Adams is an affable chemist known for organizing superlative conferences and symposia and for his editorial work on two key inorganic chemistry journals, Marks says. In addition, Adams' pioneering research on the chemistry of metal carbonyl complexes and cluster compounds "has repeatedly demonstrated the remarkable ability of these compounds to produce novel chemistry upon small molecules at polynuclear metal sites," Marks notes.

MICHAEL BROWN/U OF SOUTH CAROLINA

Adams

Adams is most proud of his group's research studies on hydrogen activation by mixed-metal cluster compounds. These specially designed complexes are crafted from a combination of two transition metals, a bulky phosphine ligand, and a tin or germanium modifier.

In one case, Adams and coworkers used a bimetallic cluster to help elucidate the mechanism by which two metal centers cooperate to facilitate a hydrogen-transfer reaction. For example, $OsH(CO)_4Sn(C_6H_5)_3$ doesn't react with phenylacetylene, even at elevated temperature. But when combined with the platinum complex $Pt[P(tert\text{-}butyl)_3]_2$, the team found, the platinum atom bonds to and activates the Os–H bond. This unique bimetallic synergism leads to easy transfer of hydrogen to phenylacetylene's carbon-carbon triple bond.

Adams has been one of the inorganic community's most prolific volunteer organizers of scientific events. These include many symposia at ACS national and regional meetings, as well as the 1991 Gordon Research Conference on Inorganic Chemistry. In 1982, Adams organized and chaired the committee to create the ACS Award in Organometallic Chemistry. As Marks notes: "Anyone who has been involved in the fundraising and political aspects of organizing new awards knows this is a very significant achievement."

Adams has served for 12 years as the U.S. regional editor for the *Journal of Organometallic Chemistry* (*JOC*) and more than 15 years as coeditor of the *Journal of Cluster Science.* Besides his yeoman's duties as an editor of submitted papers, Adams has organized more than a dozen special issues for *JOC,* including a commemorative issue celebrating the 50th anniversary of the discovery of ferrocene.

Adams, 62, received a B.S. degree in chemistry in 1969 from Pennsylvania State University and a Ph.D. degree in 1973 from Massachusetts Institute of Technology. He began his career with a two-year stint at the State University of New York, Buffalo, followed by 10 years at Yale University. He joined the faculty at the University of South Carolina in 1984.

Adams received the 1999 ACS Award in Inorganic Chemistry, a 1999 Alexander von Humboldt Senior Scientist Award, a 2000 Chemical Pioneer Award from the American Institute of Chemists, and the 2005 Henry J. Albert Award of the International Precious Metals Institute.

Adams will present the award address before the Division of Inorganic Chemistry.—STEVE RITTER

IRVING LANGMUIR AWARD IN CHEMICAL PHYSICS

Sponsored by General Electric Global Research and the ACS Division of Physical Chemistry

A. Welford Castleman Jr., Evan Pugh Professor of Chemistry & Physics and holder of the Eberly Family Distinguished Chair in Science at Pennsylvania State University, is being honored for his pioneering investigations of clusters, including their properties and reaction dynamics.

Castleman's research has provided new insights into the influence of finite size and quantum confinement effects on the behavior of matter; served to bridge the gas and condensed states; and contributed to the fields of nanoscale materials science, catalysis, atmospheric chemistry, and surface and colloid chemistry, says Harry R. Allcock, also a chemistry professor at Penn State.

One of Castleman's particular accomplishments is the discovery of metallocarbohedrenes (MetCars), which are caged clusters composed of transition-metal and carbon atoms. At the time, Castleman and his group were looking at reactions of small organic molecules with metal clusters, he says. One of his students aimed a laser at the intersection of a rod of titanium and a stream of ethylene gas and wound up with something that generated a single peak in the mass spectrum instead of the expected cluster signals. Thinking that something

was wrong with the instrument, they tore it apart and rebuilt it before realizing that that the reaction had actually produced a stable molecular cluster of $Ti_8C_{12}^+$.

Nearly two decades later, MetCars continue to be an active area of study. They've been difficult to isolate in significant quantities, Castleman notes, but he is still intrigued by their properties and possible applications as catalysts, superconductors, and quantum wells in semiconductor devices.

HEIDE CASTLEMAN

Castleman

Another active area of Castleman's research has been to use ultrafast laser techniques to induce Coulomb explosions, which involve using a femtosecond laser pulse to strip clusters of their electrons; the clusters then repel each other due to the positive charges. The experiments can be used to test the interaction of high-intensity radiation with matter or to arrest a chemical reaction to study a reaction intermediate in real time.

Castleman says one of the things that makes clusters interesting is that their properties don't scale linearly with size. "In many cases, one atom makes a difference," he says. Much of the emphasis in his lab now is to devise clusters that mimic the properties of various elements. "Superatoms" like Al_{13}, which behaves like a halogen, and Al_{13}^-, which behaves like a noble gas, could be the building blocks of complex materials that perhaps could include both properties of the composite elements and their clusters.

Castleman received a B.S. from Rensselaer Polytechnic Institute in 1957. In 1958, he joined Brookhaven National Laboratory, where he continued to work while earning a Ph.D. from Polytechnic Institute of New York. He completed that degree in 1969. In 1975, he left Brookhaven for the University of Colorado, Boulder, where he was a chemistry professor and a fellow of the Cooperative Institute for Research in Environmental Sciences.

Castleman moved to Penn State in 1982. He was elected to the National Academy of Sciences and the American Academy of Arts & Sciences in 1998.

Castleman will present the award address before the Division of Physical Chemistry.—JYLLIAN KEMSLEY

ACS AWARD IN INDUSTRIAL CHEMISTRY

Sponsored by the ACS Division of Business Development & Management and the Society of Chemical Manufacturers & Affiliates

James A. Cella, who was a principal scientist in the chemical energy systems laboratory at GE Global Research, in Niskayuna, N.Y., until he retired in 2009, is being honored for his accomplishments in polymer synthesis and silicone chemistry and for the impact of his work on GE and the broader scientific community, according to the company's Global Technology Leader, Terry K. Leib.

Cella's technical contributions "have been financially significant and scientifically meaningful," adds Jonathan D. Rich, a former colleague who is now president and chief executive officer of the specialty chemical company Momentive Performance Materials, in Albany, N.Y.

COURTESY OF JAMES CELLA

Cella

Cella, 63, became interested in chemistry as a boy with the help of Mr. Wizard, a chemistry set, and experiments with home-brewed rocket fuel. He earned a B.S. in chemistry at Seton Hall University in 1968 and a Ph.D. in organic chemistry at Ohio State University in 1973.

After graduation, he served as an officer in the Army Medical Service Corps, conducting medicinal chemistry research at Walter Reed Army Institute of Research, in Washington, D.C. Upon completion of his military service in 1976, he moved to GE's Corporate Research & Development Center, where he found the diversity of projects exceptionally stimulating. "I've been on learning curves my whole career," he says. "That's been fun. You never get stale."

Some of the highlights of his tenure with the company include his work with the team that developed Siltem. This high-temperature thermoplastic elastomer combines the fire-resistance of polyetherimide with the ductility of silicone—features that are particularly useful in aircraft applications such as doors for luggage compartments. Cella also helped develop new silicone-based antifouling coatings to keep ship hulls and water-intake tunnels free of barnacles and other organisms.

In another project, "Jim took on one of the most important challenges in the silicones industry by determining the environmental fate of silicones used in many personal care and consumer products," Rich says. "Jim's pioneering work demonstrated that silicone products are indeed biodegradable and showed definitively the fate of these products in various ecosystems."

Before retiring, Cella joined GE's research and development effort in organic light-emitting diodes, which the company hopes will one day replace incandescent and fluorescent light bulbs in homes.

Altogether, he holds more than 50 patents, but there's more to Cella than his discoveries in the lab. "Jim was one of the most sought-after mentors in our chemistry organization," Leib says. Furthermore, "through three decades of science shows with local schools, Jim has inspired countless children to believe in the magic of chemistry."

Currently, Cella is busy working as the sauté chef at his family's Cella Bistro, which is just down the road from the GE lab. In a sense his career has come full circle: When he interviewed for his first job at GE, his future employers treated him to dinner at the restaurant that used to occupy the bistro's present site. And because the location is still popular with the GE crowd, Cella can keep up with the latest happenings at the company.

Cella will present the award address before the Division of Business Development & Management.—SOPHIE ROVNER

E. BRIGHT WILSON AWARD IN SPECTROSCOPY

Sponsored by Coherent and ACS

Receiving an award from ACS is an honor, but when that award carries the name of one's former mentor, it's especially meaningful.

Such is the case for **George W. Flynn,** a

professor of chemistry at Columbia University, who is being honored with the E. Bright Wilson Award in Spectroscopy. Wilson, the award's namesake, was one of Flynn's graduate thesis advisers.

"Being honored by an award in Wilson's name is very special," Flynn says. "I am particularly pleased to be recognized for using spectroscopy to study molecular dynamics in gases and scanning probe methods to follow the atomic site behavior of interfaces on surfaces."

COURTESY OF GEORGE FLYNN

Flynn

The research that earned Flynn this award involves work he started less than a decade ago. It focuses on using scanning tunneling microscopy (STM) to study the structure of molecules adsorbed on surfaces. His research group has imaged numerous surface adsorbates—including synthetic polypeptides and long-chain, functionalized hydrocarbons—by using functional groups of the molecules as STM markers.

The STM markers include sulfur and bromine atoms and carboxyl groups, which have all been used to study the chirality of molecules adsorbed at the interface between a racemic mixture and a solid surface. Flynn's research group has also used STM to probe chemical reactions of small organic halides on iron oxide surfaces in ultrahigh vacuum and the structure and electronic properties of single sheets of graphite, known as graphene.

In addition to Flynn's work on interface chemistry, his lab has also studied chemical dynamics. Specifically, the group has looked at molecular collisions that lead to chemical reactions or energy exchange between molecules. To do this, the lab developed a diode laser infrared absorption probe technique with a resolution of 0.0003 cm^{-1}.

"George Flynn's work combines an unusual mixture of innovation and deep scientific insight," says Nicholas J. Turro, a chemistry professor at Columbia. The work for which Flynn is being honored, Turro continues, "has provided fundamental understanding of and deep insight into the structural and dynamic processes occurring at liquid-solid and vacuum-solid interfaces and the mechanisms of chemical reactions taking place on surfaces."

"The beauty of George's work is that he makes and interprets difficult measurements always with an eye toward deep physical understanding," notes F. Fleming Crim, a chemistry professor at the University of Wisconsin, Madison. "This approach is the hallmark of a great scientist."

Flynn, 71, received a B.S. from Yale University in 1960. He then studied under Wilson and John D. Baldeschwieler at Harvard University, where he earned an M.A. in 1962 and a Ph.D. in 1965. After a postdoc at Massachusetts Institute of Technology, he joined the Columbia faculty in 1967.

A member of the National Academy of Sciences and the American Academy of Arts & Sciences, he has received numerous other honors including the Herbert P. Broida Award from the American Physical Society in 2003 and the Presidential Teaching Award from Columbia in 2000. In addition to overseeing some 40 Ph.D. students during his career, Flynn is also a proud grandfather.

Flynn will present the award address before the Division of Physical Chemistry.—SUSAN MORRISSEY

GEORGE C. PIMENTEL AWARD IN CHEMICAL EDUCATION

Sponsored by Cengage Publishing and ACS

"Zafra's two missions in life—chemical education and scientific freedom and human rights—really boil down to one: the desire to allow everyone to achieve their potential." This testimonial from Amber S. Hinkle, chair of the ACS Women Chemists Committee and Bayer MaterialScience quality lead for plastics manufacturing, succinctly sums up why **Zafra J. Lerman** is being honored with this award.

A native of Israel, Lerman received both B.Sc. and M.Sc. degrees from Technion—Israel Institute of Technology, in Haifa. In 1969, she received a Ph.D. in chemistry from Weizmann Institute of Science, in Rehovot. As a postdoctoral fellow at Cornell University, she conducted research in isotope effects, which she continued at Northwestern University and the Swiss Federal Institute of Technology, Zurich.

LABEEBA HAMEED

Lerman

Lerman is head of Columbia College Chicago's Institute for Science Education & Science Communication, which she established in 1991. She is a bridge builder on many levels. In 1973, she came to Columbia College, an arts and media-oriented school, to establish a science department. She has developed wide-ranging and innovative approaches to teaching science to nonscience majors, for which she has received numerous awards and national and international recognition.

One of her students was Fred Pienkos, who says: "When I think about college, my thoughts go immediately to Zafra and the integral role she played in my education and my life." He was taking her class called "Ozone to Oil Spills." To make the subject accessible to her students, Lerman encouraged them apply their creative backgrounds to environmental science. "I was studying animation and photography, so partnering with a classmate, I created a five-minute animated short film about global warming," Pienkos says. "The film won some recognition from the school, and Zafra arranged for me to fly with her to Princeton to screen the work and talk about it with an environmental science class there. At the time, I knew it was a unique opportunity, but now, nearly 20 years later, I marvel at Zafra's commitment to my education." Pienkos is now a visual effects supervisor with Eden FX, in Hollywood, Calif. He has won one Emmy Award and received five nominations.

Inspired by Lerman's teaching, other students have gone on to earn graduate degrees in science, as well as the arts and media.

Lerman is also the force behind the grant money given for her programs and curriculum development, including a grant to take several minority students to Kenya in 2002, where she gave science lectures. Labeeba Hameed, one of those students who is currently working on a graduate degree in art education, says Lerman "gives students once-in-a-lifetime experiences."

In parallel with her role as an educator, Lerman's role as a bridge builder in human rights cannot be overlooked. When she was named a fel-

low of the American Association for the Advancement of Science in 2001, her citation read: "For extraordinary innovations in education, especially for nonscientists and the underprivileged, and for truly exceptional success in defending persecuted scientists throughout the world."

Lerman will present the award address before the Division of Chemical Education.—ARLENE GOLDBERG-GIST

ACS AWARD FOR CHEMISTRY OF MATERIALS

Sponsored by E. I. du Pont de Nemours & Co.

Few places are left in industry where a scientist can pursue good science for its own sake. IBM is one of those places, and **Robert D. Miller** has made the most of it.

Miller, 68, is manager of advanced organic materials at the IBM Almaden Research Center in San Jose, Calif. An IBMer for 40 years, he has watched the evolution of microelectronics and other advanced technologies from one of the best seats in the house.

Miller came to IBM by way of Lafayette College, a Ph.D. in organic chemistry from Cornell University, and a postdoc at Union Carbide Research Institute. In 1969, when Miller joined IBM's Thomas J. Watson Research Center in Yorktown Heights, N.Y., organic chemists were rare, but the company was trying to change that. "IBM wanted to learn more about organic materials," Miller recalls.

A few years into his tenure, IBM relocated chemistry to the West Coast. Miller moved to San Jose, and for a while, he continued to pursue his interests in photochemistry, strained molecules, theoretically interesting materials, and other small-molecule chemistry. But a colleague, Jim Economy, eventually convinced him that the future of chemistry at IBM was in polymers.

Miller embarked on research in lithography and soon developed a photoresist sensitizer/polymer that helped IBM shrink microchip wiring dimensions. Work in resists led him to polysilanes, radiation-sensitive materials with interesting spectral and physical properties. He collaborated with Robert West of the University of Wisconsin, Madison, and Josef Michl of the University of Colorado. C. Grant Willson, a professor at the University of Texas, Austin, calls their results "some of the best work in the world in this area."

COURTESY OF ROBERT MILLER

Miller

Computer chips continued to shrink, and after a stint in nonlinear optical materials, Miller helped IBM's semiconductor business again when it needed new dielectric materials to block cross talk between closely spaced circuit lines. He helped shepherd an IBM/Dow Chemical collaboration with academic partners that yielded porous SiLK, a low-dielectric-constant organic polymer marketed by Dow.

Miller was an early proponent of industrial-academic collaboration, calling publicly for such research as far back as 1982. "I saw the evolution of industrial chemistry away from basic research," he says, "and academics becoming isolated from technological problems that really mattered to people."

Since then, he observes, the two sides have moved closer. "Over the years, science has become more interdisciplinary, and no one person has all the answers," Miller says.

A desire to work with others on things that matter has guided his research at IBM as well. Although Miller could pursue the fundamental science of his early days, he says he would miss "a huge opportunity for interdisciplinary interaction with really smart people."

Indeed, Miller is still going strong, heading an "absolutely exciting" IBM initiative on nanomedicine—polymeric materials for medical applications. Miller considers himself fortunate to be working with top scientists on important issues such as health care, energy, food, and water. "There are lots of really cool and interesting problems," he says. "Why would I not do that?"

Miller will present the award address before the Division of Polymeric Materials: Science & Engineering at the fall 2010 ACS national meeting in Boston.—MICHAEL MCCOY

E. V. MURPHREE AWARD IN INDUSTRIAL & ENGINEERING CHEMISTRY

Sponsored by ExxonMobil Research & Engineering

Gregory N. Stephanopoulos, W. H. Dow Professor of Chemical Engineering & Biotechnology at Massachusetts Institute of Technology, is being honored for his contributions to metabolic engineering.

"Greg Stephanopoulos has made outstanding contributions to the synthesis of new metabolic pathways for the production of chemicals and fuels," says Robert S. Langer, a chemical engineering colleague at MIT. "These efforts led to the definition and advancement of metabolic engineering as a new type of organic chemistry harnessing the power of microbial biosynthetic machinery for efficient product synthesis."

COURTESY OF GREGORY STEPHANOPOULOS

Stephanopoulos

Stephanopoulos, 59, has played a significant role in defining the field of metabolic engineering, Langer says. "With his groundbreaking book, 'Metabolic Engineering: Principles and Methodologies,' he established the scientific and engineering fundamentals and thus laid the educational foundations of this new field. This book has created a new interface between chemical engineering and the life sciences," Langer says. In addition, Stephanopoulos is the founding coeditor of the journal *Metabolic Engineering.* He also launched a series of conferences on metabolic engineering.

Much of Stephanopoulos' research has focused on microorganisms' basic metabolism, which he has then used to advance industrial processes. Whereas the hallmark of his research has been a deep focus on metabolic fundamentals in microorganisms, its impact has been felt across product categories ranging from specialty chemicals (pharmaceutical intermediates), bulk chemicals (amino acids), and even renewable fuels (ethanol), says Chaitan Khosla, a professor of chemistry and chemical engineering at Stanford University.

Stephanopoulos developed flux analysis for use in metabolic networks and demonstrated its utility in a number of applications. For example, he used network analysis and metabolic engineering to

identify new pathways for the biosynthesis of indandiol, a chiral precursor of the AIDS drug Crixivan. By modifying the reactions in the bacterium that produces indandiol, he increased the selectivity of the product from 25% to more than 95%.

Stephanopoulos received a bachelor's degree in chemical engineering from National Technical University, in Athens, in 1973. He received an M.S. in chemical engineering from the University of Florida in 1975 and a Ph.D., also in chemical engineering, from the University of Minnesota in 1978.

In 1978, he joined the chemical engineering faculty at California Institute of Technology. He was promoted to associate professor in 1983. In 1985, he moved to MIT as a professor of chemical engineering, where he has been since. From 2000 to 2005, he was the Bayer Professor of Chemical Engineering & Biotechnology at MIT. In 2006, he was appointed to his current position.

He has received many other honors and awards, including the Marvin J. Johnson Award from the American Chemical Society, the R. H. Wilhelm Award in Microbial & Biochemical Technology in Chemical Reaction Engineering from the American Institute of Chemical Engineers (AIChE), the Charles Thom Award from the Society for Industrial Microbiology, and the AIChE Founders Award. He was elected to the National Academy of Engineering in 2003 and as a fellow of the American Association for the Advancement of Science in 2005.

Stephanopoulos will present the award address before the Division of Biochemical Technology.—CELIA ARNAUD

ARTHUR W. ADAMSON AWARD FOR DISTINGUISHED SERVICE IN THE ADVANCEMENT OF SURFACE CHEMISTRY

Sponsored by ACS

In the highly competitive and interdisciplinary field of surface science, **Patricia A. Thiel,** distinguished professor of chemistry at Iowa State University and a senior chemist at Ames Laboratory, stands out in her colleagues' view as a player at the top of her game.

The late Theodore E. Madey, a chemistry and physics professor at Rutgers University, described Thiel as "an outstanding surface scientist—one of the most respected in the country—and a brilliant and imaginative physical chemist." Thiel is also "very influential," says Miquel Salmeron of Lawrence Berkeley National Laboratory, "and a perfect model for other scientists to follow."

COURTESY OF PATRICIA THIEL

Thiel

Thiel's scientific contributions have deepened understanding in key areas of surface science, such as the properties of quasicrystals. These compounds, which include many alloys of aluminum, differ from conventional crystals in that they are ordered but lack three-dimensional periodicity.

Working with colleagues who have wide-ranging expertise, Thiel has elucidated quasicrystal surface structures and has developed fundamental explanations for the remarkable surface properties exhibited by these compounds. Those properties include striking oxidative stability, good wear resistance, and extremely low friction. Thiel is an internationally recognized expert in quasicrystals and has authored definitive review papers covering the topic.

Thiel has also studied nucleation, growth, and structure of thin metallic films. One of her group's novel contributions in metal-film-growth dynamics is the recognition that large metal clusters can diffuse as individual units.

Another area of Thiel's expertise is the structure and kinetics of water layers adsorbed on metal surfaces. Through clever use of isotope methods and analytical tools such as electron energy loss spectroscopy and infrared spectroscopy along with a detailed comparison of results obtained from those techniques, Thiel and coworkers have helped researchers gain a better understanding of water-surface interactions and dynamic processes in adsorbed water layers.

Thiel, 56, completed her undergraduate education in chemistry at Macalester College, in St. Paul, Minn., in 1975, and received a Ph.D. degree in chemistry from California Institute of Technology in 1981. She then conducted research with chemistry Nobel Laureate Gerhard Ertl at the University of Munich before taking a position as assistant professor of chemistry at Iowa State University in 1983. She served as department chair from 1999 to 2002. Since 1991, Thiel has also been a staff scientist at Ames Laboratory, where she has served as program director for materials chemistry and as Science & Technology Division director.

Thiel has published more than 250 articles in scholarly books and peer-reviewed journals and has been cited in scientific papers well over 7,000 times. She has served on the editorial and advisory boards of numerous journals, including *Langmuir*, *Surface Science*, the *Journal of Vacuum Science & Technology*, and the *Journal of Physical Chemistry*.

Among other honors, she has been named a fellow of the American Physical Society, the Institute of Physics, and the American Vacuum Society. She has received honorary degrees from scholarly organizations in several countries, has served as a visiting professor in Japan and France, and has been invited to lecture at some 200 institutions and scientific conferences.

Thiel will present the award address before the Division of Physical Chemistry.—MITCH JACOBY

OBITUARIES

Merle A. Battiste, 76, professor emeritus at the University of Florida, died unexpectedly at his home in Gainesville, Fla., on Aug. 8, 2009.

Battiste received a B.S. degree in chemistry from the Citadel, an M.S. degree in organic chemistry from Louisiana State University, and a Ph.D. in organic chemistry from Columbia University in 1959. He was Ronald Breslow's first Ph.D. student.

After conducting postdoctoral research with Saul Winstein at the University of California, Los Angeles, and after a short stint in the Army, he joined the faculty at the University of Florida where he remained as a professor of organic chemistry for 42 years, until retiring in 2004.

Battiste's research focused on the synthesis of novel molecular structures. He is credited with more than 100 publications and was known as a dedicated, passionate teacher. Battiste was a Sloan Fellow, a Fulbright Research Scholar, and an Erskine Fellow. He was also an emeritus member of ACS, joining in 1959.

Battiste is survived by his wife, Jan; his sons, Mark and John; his stepdaughters, Tanya, Paula, and Tracey; and six grandchildren.

Warren L. DeLano, 37, founder of DeLano Scientific, died suddenly on Nov. 3, 2009.

Born in Philadelphia, DeLano grew up in Palo Alto, Calif. He received B.S. degrees in computer science and molecular biophysics and biochemistry in 1993 from Yale University, where he conducted structural biology research in the lab of Axel Brunger.

DeLano earned a Ph.D. in biophysics at the University of California, San Francisco, in 1999, under James Wells. He then followed Wells to help launch Sunesis Pharmaceuticals.

He started DeLano Scientific in 2003 to commercialize Pymol, his open-source molecular graphics software, which has been adopted by the pharmaceutical industry worldwide. DeLano was a strong advocate of freely available software and the open-source movement. He was a member of ACS, joining in 2004.

He is survived by his wife, Beth Pehrson; his mother, Margaret; his father, James Jr.; his stepmother, Cathy; his stepfather, Tom Snouse; his sister, Jennifer; and his brother, Brendan.

Arthur N. Johnson, 97, a retired Parr Instrument vice president, died on Nov. 18, 2009.

Johnson earned a B.S. in chemistry from Augustana College, in Rock Island, Ill., in 1934.

He began his career working for Moline Water Works and Rock Island Water Works. He joined Parr Instrument in Moline, Ill., in 1947, remaining there until retiring as vice president and technical director in 1986. He was an emeritus member of ACS, joining in 1935.

He was active at Trinity Lutheran Church in Moline throughout his life and volunteered at local hospitals.

He is survived by his daughters, Noreen Casson and Mary Sauer; his stepchildren, Elise Schilb, Fred-Larry Eihl, Marjorie Buck, and Maggie Lancaster; his foster daughter, Nil Turkseven; seven grandchildren; nine stepgrandchildren; and 21 great-grandchildren. His wife, Helen, whom he married in 1936, died in 1982. His wife, Elsa, whom he married in 1983, died in 2007.

Edward F. Levy, 89, a retired cosmetic chemist, died on Nov. 28, 2009.

Born in Minneapolis, Levy earned a bachelor's degree with distinction from the University of Minnesota in 1942 and a Ph.D. in organic chemistry at the University of California, Los Angeles, in 1946.

From 1947 to 1974, Levy was a senior chemist at Gillette, in Boston, working on edge coatings for razors, shaving cream, and other personal care products. For two years afterward, he worked for W.R. Grace, developing an environmentally safe spray can for personal care products. Levy then joined Block Drug in Jersey City, N.J., remaining there until retiring in 1987.

Levy served as chairman of the New England Section of the Society of Cosmetic Chemists in 1977. He was an emeritus member of ACS, joining in 1943. He also served as a volunteer for the International Service Corps in St. Vincent Island & the Grenadines in 1990.

Levy is survived by his wife, Florence; two daughters; and two grandchildren.

Robert Luedeking, 85, professor emeritus of chemical engineering at Washington State University, Pullman, died on Oct. 6, 2009, after a brief illness.

Born in York, Pa., Luedeking enlisted in the Army in 1943 and trained to be a meteorologist. After his honorable discharge in 1944, he earned a bachelor's degree in chemical engineering at Purdue University and a doctorate in chemical engineering at the University of Minnesota, Minneapolis, in 1956.

Luedeking then accepted a position in the chemical engineering department at Washington State University, remaining there as a professor for more than 25 years before retiring in 1981. He was an emeritus member of ACS, joining in 1951.

He was a member of St. James Episcopal Church, the Pullman Kiwanis, and the Whitman County Historical Society.

He is survived by his wife of 57 years, Leila; his daughters, Karen, Sylvia, Christine Gray, Barbara Crandall, and Helen Thomas; four grandchildren; and one great-grandson.

Joseph S. Mihina, 91, a retired G. D. Searle research chemist, died on Aug. 19, 2009.

Born in New York City, Mihina received a bachelor's degree in chemistry from New York University in 1938. He was drafted into the Navy in 1943 and finished his tour on Okinawa at the end of World War II. He then earned an M.S. in physical chemistry in 1948 and a Ph.D. in organic chemistry in 1950, both from Michigan State University.

In 1951, after a postdoctoral stint at Northwestern University, Mihina joined Searle in Skokie, Ill. There, he worked as a research chemist and later as a manager in the chemical manufacturing department before retiring in 1984. He held three patents.

An emeritus member of ACS, Mihina joined the society in 1946. He was active in the Chicago Section and served on a number of committees. Mihina also volunteered in a number of community organizations.

He is survived by his wife of 59 years, Bettye; his daughter, Karen Clifford; and his son, Steve.

Herman E. Schroeder, 94, a retired DuPont director of R&D for synthetic rubbers and plastics, died on Nov. 28, 2009, in Greenville, Del.

Born in Brooklyn, N.Y., Schroeder earned an A.B. in 1936, an A.M. in 1937, and a Ph.D. in organic chemistry in 1939, all from Harvard University.

After joining DuPont in 1938, Schroeder conducted pioneering research, developing the first practical adhesive for bonding rubber to nylon for B-29 bomber tires, dis-

covering lightfast dyes for cotton, and leading the development of dyes for polyester and acrylic fibers. He served as DuPont's director of R&D for synthetic rubbers and plastics from 1963 until 1980.

Schroeder contributed to DuPont's development of numerous products, including Adiprene; Corfam; Lycra; Nordel, the first sulfur-curable ethylene propylene rubber; Hytrel thermoplastic polyether-ester; Viton and Kalrez fluoroelastomers; and Vamac ethylene acrylic elastomer. He held 37 patents and published 40 papers.

He served on advisory groups for numerous organizations and museums. Schroeder was honored by the International Institute of Synthetic Rubber Producers and received the Charles Goodyear Medal from the ACS Rubber Division in 1984. DuPont awarded him the Lavoisier Medal for Inspirational Research Leadership in 1992. He was an emeritus member of ACS, joining in 1942.

He is survived by two sons, Edward and Peter; daughter Martha Lewis; seven grandchildren; and 13 great-grandchildren. He was predeceased by his wife, Elizabeth, and daughter Nancy.

Murray Senkus, 95, a retired R. J. Reynolds Tobacco research director, died in Winston-Salem, N.C., on Nov. 12, 2009.

Born near Saskatoon, Saskatchewan, to parents who had emigrated from what is now Ukraine, Senkus earned a master's of science degree in 1936 from the University of Saskatchewan. He then earned a Ph.D. in chemistry from the University of Chicago in 1938.

Senkus began his career as a research chemist for Commercial Solvents in Terre Haute, Ind., contributing to World War II-related projects such as developing synthetic rubber and a process to stabilize penicillin so it could be stored without refrigeration.

Senkus became director of the chemical division of the newly established research department of R. J. Reynolds Tobacco in Winston-Salem in 1951. He was director of research in 1964 and director of scientific affairs in 1977. He retired from the company in 1979.

Senkus then consulted for the Tobacco Institute in Washington, D.C.; served as director of development for P. T. Djarum in Jakarta, Indonesia; and worked as a litigation consultant. He authored 20 scientific articles and held 57 U.S. patents and several foreign patents.

He was a member of numerous organizations, including the New York Academy of Sciences, the Shevchenko Scientific Society, and several tobacco-related research organizations. He was an emeritus member of ACS, joining in 1940.

Senkus is survived by both his first wife, Emily, and his second wife, Ethel. He is survived by his sons, Neal, Bill, and David; his daughter, Joanne Prior; his stepdaughters, Kathy Hylton and Trish Decker; six grandchildren; six stepgrandchildren; nine great-grandchildren; and 10 step-great-grandchildren.

Eugene E. van Tamelen, 84, an internationally known organic chemist and professor emeritus at Stanford University, died of cancer on Dec. 12, 2009.

Best known for the biologically inspired syntheses of complex natural substances, van Tamelen made fundamental contributions that bridged chemical disciplines, connecting organic chemistry with inorganic, physical, and biological chemistry.

Born in Zeeland, Mich., van Tamelen received a bachelor's degree from Hope College, Holland, Mich., in 1947. He had originally planned to carve out a career in automobile design but became interested in three-dimensional space at the molecular level after taking an organic chemistry class. He went on to earn a Ph.D. in organic chemistry from Harvard University in 1950.

Van Tamelen joined the University of Wisconsin's chemistry faculty, becoming a full professor in 1959 and later being named its Homer Adkins Professor of Chemistry. He accepted a professorship at Stanford in 1962 and served as chairman of its chemistry department from 1972 to 1978. He retired in 1987.

He published hundreds of papers and received numerous honors, including the ACS Award in Pure Chemistry in 1961, the Leo Hendrik Baekeland Award of the ACS North Jersey Section in 1965, and the ACS Award for Creative Work in Synthetic Organic Chemistry in 1970. He was a member of ACS from 1950 to 1985.

The founding and longtime editor of the journal *Bio-Organic Chemistry*, van Tamelen was a member of the National Academy of Sciences and was named one of the 20th century's best scientists by England's International Biographical Center.

Van Tamelen is survived by his wife, Mary; his two daughters, Jane and Carey Haughy; his son, Peter; and five grandchildren.

George L. Zimmerman, 89, emeritus professor of chemistry at Bryn Mawr College, died of complications from a stroke at his home in Bryn Mawr, Pa., on Oct. 21, 2009.

Born in Hershey, Pa., Zimmerman graduated from Swarthmore College in 1941. While attending graduate school at Harvard University during World War II, he was recruited for the Manhattan Project at Columbia University to help develop a method for enriching and purifying uranium isotopes for the atom bomb. After the war, Zimmerman completed a Ph.D. in physical chemistry at the University of Chicago in 1948 under Nobel Laureate James Franck.

Zimmerman then taught physical chemistry at Massachusetts Institute of Technology for two years before joining the Bryn Mawr faculty in 1950. He was a Guggenheim Fellow from 1965 to 1966 at Oxford University and University College London. In his research, he applied spectroscopic methods to study mechanisms of photochemical isomerization of dyes.

After retiring in 1990, Zimmerman was a visiting professor at Drexel University for many years, collaborating on excited-state studies of ruthenium oxide molecules. He was a retired ACS member who joined the society in 1953.

He shared his love of both classical and jazz clarinet with friends and students, and he introduced Morris dancing, a form of pre-Christian English folk dancing, to Bryn Mawr College. He also sang in the Church of the Redeemer choir.

Zimmerman is survived by his wife of 51 years, Un-Jin Paik; his sons, Landis and David; his daughters, Louise Hoehl and Emily; and three grandchildren.

SUSAN J. AINSWORTH *writes Obituaries. Obituary notices may be sent to s_ainsworth@acs.org and should include a detailed educational and professional history.*

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Chemical & Engineering News (ISSN 0009-2347) is published weekly except for the last week in December by the American Chemical Society at 1155—16th St., N.W., Washington, DC 20036. Periodicals postage is paid at Washington, DC, and additional mailing offices.

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OUR TOWN IS ELEMENTAL

While navigating his way through Kentucky a few years back, Nicholas C. Thomas was surprised to find two noble gases on his road atlas. The eastern region of the Bluegrass State is home to the villages of Krypton and Neon, about 50 miles apart. Thomas, a chemistry professor at Auburn University, in Montgomery, Ala., wondered what other **ELEMENTALLY NAMED HAMLETS** might be scattered about. "I guess I've always been interested in finding examples of chemistry in unusual places," he tells Newscripts.

By plugging the elements into the database of the U.S. Board on Geographic Names' website (geonames.usgs.gov), Thomas was able to find a wealth of towns named for various elements. "Gold," for example, appears in the name of some 2,000 locations throughout the country.

Thomas published a sampling of the elemental towns he discovered, along with their histories, in the *Journal of Chemical Education* (**2009,** *86,* 181). "Understanding the origin behind the naming of these towns provides students with an interesting way to connect chemistry with U.S. history and geography," he notes.

Travelers to Bryce Canyon National Park might consider taking a 40-mile detour north to Antimony, Utah. Although it's now a quiet ranching and vacation community, Antimony was once home to Butch Cassidy. The town was originally named Coyote when it was settled by cattle ranchers, but the discovery of stibnite—Sb_2S_3—eventually led to an antimony-mining operation and a new name.

Barium Springs, N.C., was once known as Poison Springs because cattle refused to drink from the local mineral pools. That old name might have come as a shock to customers of a company known as the Great Human Repair Shop, which sold the local waters as a health tonic throughout the country and overseas until the end of World War I.

With a nod toward the alchemical, Lead, S.D., is home to the Homestake mine, which was the largest, deepest, and most productive gold mine in the Western Hemisphere until it was shuttered in 2001. Thomas notes that you'll have to suppress your chemical instincts if you want to fit in with the locals, whose pronunciation of the town's name rhymes with "seed."

Blink and you might miss the 1.2-acre patch of the Show-Me State known as Lithium. There's still a sign to indicate the tiny, now uninhabited Missouri town.

Many of the towns listed in Thomas' paper derive their names from local mineral deposits, but the town of Calcium, N.Y., is an exception. As it turns out, Thomas had to be something of a sleuth to learn how this hamlet of 3,000 residents got its name. Very little information about Calcium is readily available, he tells Newscripts. It was only when he placed a cold call to the Calcium Community Church that Thomas was able to learn the history of the town's name from the local pastor.

In the early 1900s, a local resident named Madison Cooper successfully petitioned to have the town's name changed from Sanford's Corner. It was a somewhat extreme move born out of the frustration of having his mail frequently sent by mistake to Stanfordville, N.Y. Cooper worked in cold storage and refrigeration and chose to name his hometown for the calcium chloride used in his trade. Also on the plus side regarding his postal problems: No other town in the country was named Calcium.

In the course of his investigation, Thomas got to thinking that it might be fun to take an elemental road trip—in his Chevy Cobalt, of course. The idea, however, was quickly shot down by his wife.

RANDY SMITH

MICHAEL HUNTER

Elementville: Boron, Calif.; Carbon, Ill.; and Sulphur, La.

THEODORE GRAY

BETHANY HALFORD *wrote this week's column. Please send comments and suggestions to newscripts@acs.org.*

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