The Secret Life of Polymers

How new materials are solving old problems

PURDUE **CHEMICAL**

ENGINEERING IMPACT

FALL 2009

Up Close: Faculty
Investing in collaboration and innovation

Behind the Scenes
Office staff keep ChE running smoothly

Up Close: Alumni
Weathering the economic storm

up front

On My Mind

Welcome to *Chemical Engineering Impact* magazine. The economy is the main subject of this edition—how it impacts our graduating students, research awards, building renovation efforts, and all day-to-day activities.

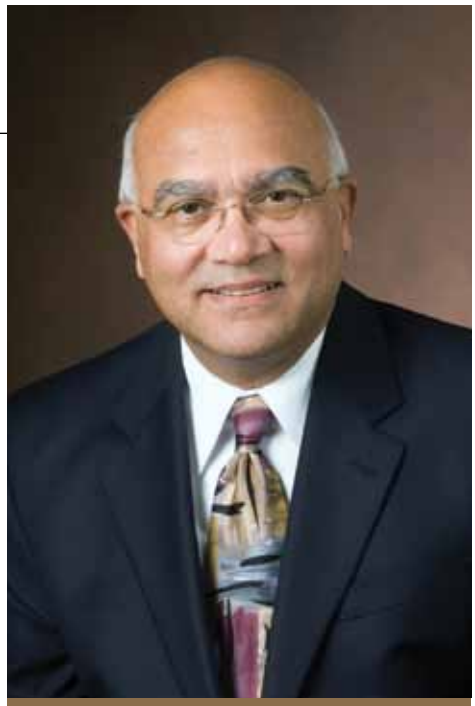
This year, we awarded 103 BSChE, 5 MS, and 24 PhD degrees. We are sending these graduates into one of the most challenging work environments in recent memory. Yet, we are confident that the skills and knowledge they acquired in our school will serve them well in their pursuit of building successful and meaningful careers, while making a positive impact on our economy and society.

While compiling news from our alumni to include in this issue, we were impressed by the vast array of responses. We heard from ChEs going to serve as Peace Corps volunteers to teach science to underprivileged children abroad, professionals fulfilling increasing responsibilities and receiving promotions, entrepreneurs working hard to maintain their companies afloat, young graduates pursuing advanced engineering or law degrees or careers in medical sciences, and retirees more involved than ever in consulting and service activities, in an effort to share their wealth of knowledge and experience. This is a living testimony that ChEs can do anything, and the principles and experience gained from our program serve well in every aspect of our society: industry, academia, government and service.

During difficult economic times, it is reassuring to see that the loyalty, dedication and commitment of our alumni are as strong as ever. We are faced with great challenges, but we are meeting them with hard work, innovation, and enthusiasm.

Hail Purdue!

Arvind Varma
R. Games Slayter Distinguished Professor and Head



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PURDUE UNIVERSITY
COLLEGE OF ENGINEERING

School of Chemical Engineering

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Promotions and Appointments

Mike Harrington is the manager of computing facilities since February 2009.

Amy Hayden has been promoted to account clerk V in the business office effective March 2009.

Julie Paolillo has joined the school as director of development in June 2009. (For more on Julie, see below.)

Michelle Ryker is the new Account Clerk IV in the Business Office, effective April 2009.

You-Yeon Won has been promoted to Associate Professor, effective August 2009. (For more on Won, see page 4.)

ChE Welcomes New Director of Development

In June, the School of Chemical Engineering welcomed **Julie Paolillo** as the new director of development. Julie holds a bachelor of science degree from Purdue University.

She most recently worked as a marketing representative for Health Professionals Ltd. and prior to that as a sales associate with Dialyn, Inc. She is a member of CASE and has been an active volunteer in development activities for various agencies. Please join us in welcoming Julie to the School of Chemical Engineering!


Emery

In Memoriam

Prof. Alden H. Emery Jr. (1925-2009)

Alden Emery, a beloved faculty member for generations of ChE students, passed away on February 7, 2009. Prof. Emery joined Purdue ChE in 1954, immediately after completing his PhD degree from the University of Illinois, and remained active in all aspects of the school's programs until his retirement in 1995. His initial research was in transport phenomena, and starting with the early 1970s he became active in biochemical engineering. He served the school admirably and long in numerous ways: for nearly 30 years, graduate program administrator, faculty member in charge of the PhD qualifying exams, professor in charge of the seminar UG lab, the heart of the Catalyst Club, and author of numerous skits, mocking the habits of seniors, performed by the faculty at the annual Razz banquet.

Prof. Emery is survived by his wife, Verna, and two children. He will be missed by countless admiring students, staff, and faculty colleagues.

Awards and Honors

Faculty

Rakesh Agrawal, Winthrop E. Stone Distinguished Professor, was the inaugural recipient of the Annual Technical Symposium Excellence in Research Award from the Gas Processing Center at Qatar University.

Chelsey Baertsch, assistant professor, received the School's Shreve Teaching Award for Excellence for 2008-09.

Steve Beaudoin, professor, was named Purdue University Provost Fellow.

Michael Harris, professor and associate dean for undergraduate education, has been elected a Fellow of the American Institute of Chemical Engineers.

Hugh Hillhouse, associate professor, was named Purdue University Faculty Scholar.

Doraiswami Ramkrishna, Harry Creighton Peffer Distinguished Professor, was elected to the National Academy of Engineering and received the Platinum Award from the Institute of Chemical Technology in Mumbai, India.

Arvind Varma, R. Games Slayter Distinguished Professor and head, was among the three inaugural recipients of the Distinguished ChE Alumnus award of the Department of Chemical Engineering and Technology, Panjab University. He also received a Distinguished Alumnus Award of Panjab University. In honor of his 60th birthday, he was honored by a special Festschrift issue of the journal Industrial & Engineering Chemistry Research.

Students

Intan Hamdan, **Megan Kelchner**, and **Rugved Pathare**, all PhD candidates, received the Excellence in Teaching Magoon Award, College of Engineering, Purdue University.

Julie Kadrmas, PhD candidate, and **David Hanna**, BS ChE 2009, received the National Science Foundation Graduate Fellowship. (For more on Julie, see page 7.)

Krista Novstrup, PhD candidate, received the Outstanding Service Scholarship, College of Engineering, Purdue University.

Alumni

Kristi Anseth, BSChE '92, was elected to the National Academy of Engineering.

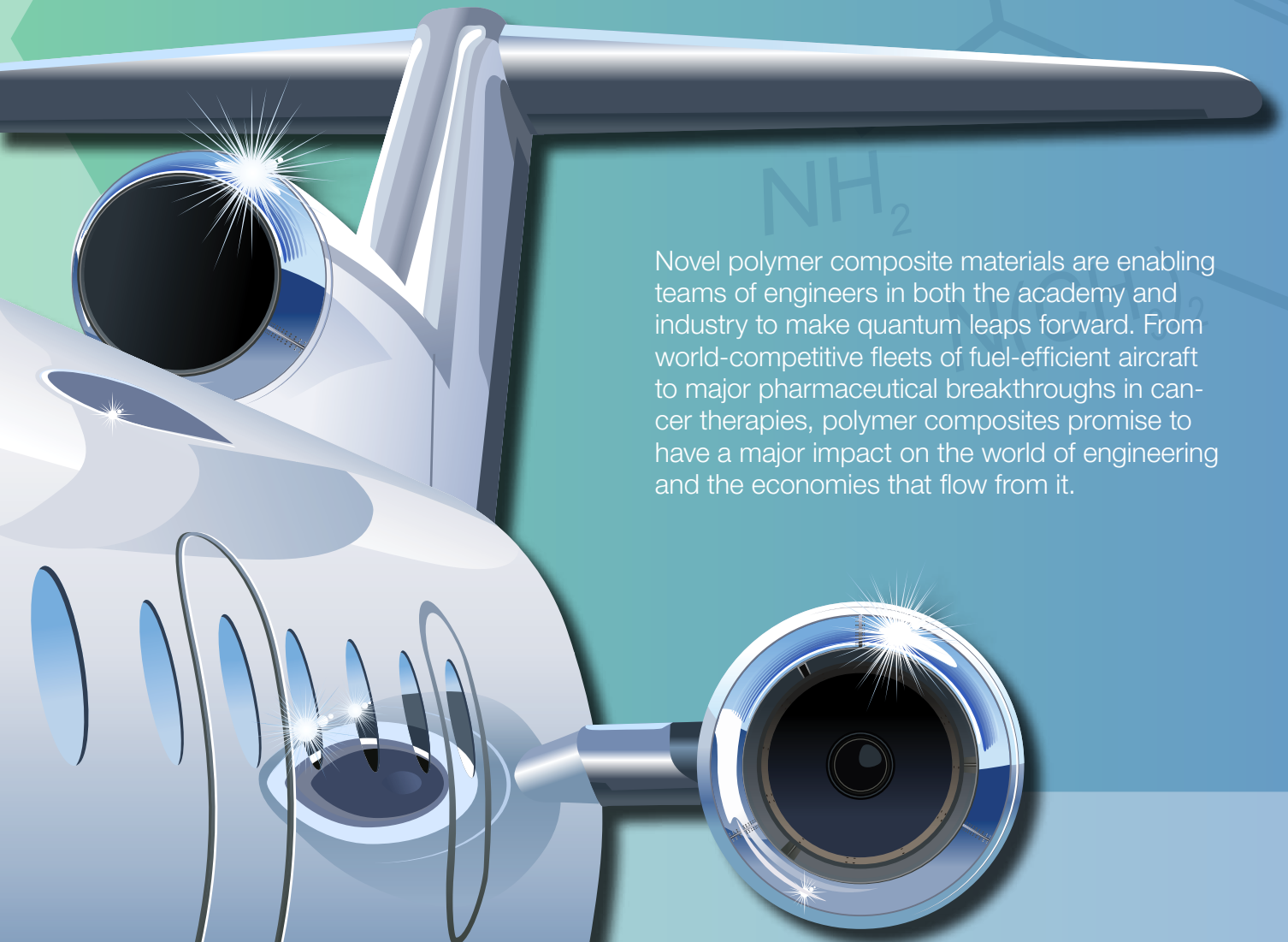
Jeffrey Hemmer, BSChE '80, was honored by the College of Engineering, Purdue University, with the Distinguished Engineering Alumni Award. (For more on Jeff, see page 9.)

Antonios Mikos, PhD '88, received the 2009 ChE Lectureship Award, American Society for Engineering Education.

James Rust, BSChE '58, received the Pinnacle Award, one of Purdue University's highest development honors.

The Secret Life of Polymers

How new materials are solving old problems



Novel polymer composite materials are enabling teams of engineers in both the academy and industry to make quantum leaps forward. From world-competitive fleets of fuel-efficient aircraft to major pharmaceutical breakthroughs in cancer therapies, polymer composites promise to have a major impact on the world of engineering and the economies that flow from it.

By Gina Vozenilek

Flying high with new polymer composites

R. Byron Pipes has his eye on the sky—or at least on the aviation industry that fills the sky with aircraft. And if things for the airline business are looking up, it's because of work down at the molecular level. Polymer composite materials are driving the evolution of airplanes to become leaner, less fuel-thirsty machines. The strategy goes something like this: Develop good new materials, build better airplanes, best your competition in the marketplace. Pipes, the John Leighton Bray Distinguished Professor of Engineering, notes that commercial aircraft manufacturing remains one of the major U.S. exports, contributing significantly to the health of the economy. But in recent years, the U.S. market share has been shrinking, losing ground to European-based Airbus. "The future of aviation depends on this polymer composite technology. It's not only advancing the industry in the U.S.," says Pipes, "it's saving it."

Case in point: Boeing's new 787 Dreamliner, the first polymer composite commercial aircraft to take flight, represents a major victory in the race to rule the skies. By replacing up to 50 percent of heavy aluminum and titanium components with polymer composites (including the fuselage and the wings), the Boeing 787 Dreamliner is lighter and therefore uses 20 percent less fuel. This brings longer flight range capability to mid-sized planes and enables travel speeds similar to today's fastest wide bodies (Mach 0.85). Lighter planes reduce the cost of flying, not to mention the simple green goodness of decreasing fossil fuel consumption and reducing emissions at high altitudes. The 787 flight testing began in summer 2009, and the planes are slated for delivery in 2010. Boeing has orders for 878 of the new airplanes to 57 customers.

That's just the beginning. The Boeing 787 Dreamliner is the progenitor of a new family of polymer composite aircraft. What the next generation will look like depends largely on the work of a team of engineers at Purdue who are further advancing composite polymer science. Pipes, who has joint appointments in chemical, aeronautical, and materials engineering, is part of this team involved in a program called "Atoms to Aircraft." It is a collaborative effort with Boeing to "understand a polymer composite material's behavior with much greater clarity," Pipes explains. The plan is to build models of new polymer composite materials across 12 orders of magnitude—from 10^{-10} m up to 10^{2} m—connecting these models from small to large scales and studying how the materials behave. "The multiplicity of physics and chemistry we need to do this is enormous and it is growth in computing power that will enable this new approach," says Pipes, undaunted.

Enter Jim Caruthers, professor of chemical engineering and director of Purdue's Center for Integrated Materials and Product Design. With a bachelor's degree in chemistry, a master's and doctorate in chemical engineering, and a gift for high-end computer applications, he characterizes himself as "an integrator." Caruthers says, "I take the chemistry and the chemical engineering, then the mechanics, and then add the high-end computer science. I cross discipline boundaries." He is also considered one of the world's experts in the nonlinear behavior of polymers.

For the Atoms to Aircraft project, Caruthers is focused on the performance of potential aviation-grade polymeric materials under challenging use conditions. He and his group develop models to describe the complex "life history" of each new material as it is manipulated: What happens in the chemical reactions when heating it to shape it? As it cools, how much "cure shrinkage" occurs? Then, once it is a structural part of a plane, say a wing, Caruthers'

Byron Pipes

Jim Caruthers

computer models test the effect of forces such as the complex deformation that occurs during flight. Finally Caruthers has also to consider that polymers are organic, and over a 20-year life span, the material can "evolve" unlike traditional materials like steel which are basically inert; for example, polymer composites may change because of factors such as ultraviolet degradation. Caruthers' models have to account for all this variability.

Computer modeling of new polymer composites is the key to this process. "It saves prototype dollars," says Pipes. To fully test a new material all the way through the Federal Aviation Administration certification process costs hundreds of millions of dollars. By starting with small-scale lab bench experimentation and applying major computer power to the problem, says Caruthers, "we are optimizing testing dollars and enabling innovation. Our process accelerates the introduction of new materials."

Pipes, Caruthers and their students delivered their research to the worldwide scientific community in Edinburgh this July at the International Conference on Composite Materials. No matter how much of a race it might be to produce new fleets of aircraft, the science must advance like any other—with global agreement about the principles underpinning new technologies. The Atoms to Aircraft team intends to show the world the way.

Polymer composites and a cancer cure

You-Yeon Won, assistant professor of chemical engineering, is an example of the cross-pollination of expertise and enthusiasm within the College of Engineering. He holds a doctorate in chemical engineering, has a joint appointment by courtesy in material science, completed a (second) post doc in applied physics, and happens to have a passion for finding a cure for cancer. "Even while doing my PhD, and even through a couple of post-docs," says Won, "I never formally did biology. But I always had interest in it."

Now as a nanobioengineer, Won is applying his know-how with polymers to a promising cancer therapy mechanism called RNA interference (RNAi). RNAi is an approach developed by genomic researchers to "knock down" oncogene transcripts responsible for cancer development using sequence-matched short interfering RNA (siRNA). The problem has been in figuring out an efficient, effective way to deliver the therapeutic siRNA to the tumor cells so that it can "interfere" with the cancer genes.

Won has developed a new approach to the problem. He synthesizes a fully synthetic triblock copolymer nanoparticle, adds water to create a micelle, and then, through convenient self-assembly, the siRNA conjugates with the micelle to form an "siRNA micelleplex." This elegant system is effective because "the size of the carrier is key," explains Won. "Tumor tissue has anomalous blood vascularization, making it naturally 'leaky.' If we can create a particle of the appropriate size, we can use that leakiness to our advantage." Won's carrier system is small enough (<100 nm) to enter the leaky vascular tissue of the tumor, but big enough (>10 nm) not to be diffused back into the blood stream.

At 50 nm, Won's siRNA micelleplex can therefore be injected into the bloodstream, and from there the polymer complex targets the tumor and delivers the siRNA to do its curative work. "Things look quite promising," according to Won. He has used real breast cancer cells in mice and has seen dramatic reduction in tumor size just days after therapy.

Won hopes to be in clinical human trials within a year. He is excited about the relative simplicity of the technique: no wildly expensive equipment or materials are needed to produce the micelleplex. Not surprisingly, Won's project is attracting the attention of the pharmaceutical industry. "We have filed for a provisional patent for this delivery technique," he says. "The Purdue Research Foundation's Office of Technology Commercialization is helping us connect to biotech firms, and there is already serious interest."

Weathering the Economic Storm

Staying true to a long-term vision is key

As companies face tough economic decisions and strategies for survival, ChE alumnus Michael J. Graff, a veteran of the industry with more than 30 years of experience, offers some insights. As president and chief executive officer of Air Liquide USA, he has seen the crisis up close and believes there is a light at the end of the tunnel.

Over the years and certainly since I began my professional career after graduating from Purdue, the U.S. and worldwide economies have experienced a number of recessionary periods which were driven by a variety of factors including the rise in oil and energy prices, overcapacity and supply, the collapse of the savings and loan sector and, in the current recession, the near disappearance of credit markets.

Whatever the root cause is, we see that the effects of a recession tend to be the same with falling production, employment, investments, income and profits. While serious economic slowdowns are marked by generalized uncertainty, what is certain is that change always follows. Markets are disrupted, affected industries are restructured to some degree, companies need to modify their development plans, and governments often enact new or updated laws and regulations to stimulate the economy with increased spending and/or reduced taxes.

In these difficult times, companies must stay true to their strategic vision, recognizing however that the path to get there will evolve. With a focus on managing cash, resources and costs, developing efficiencies and unlocking the talents of its people to create technological innovation, a business can develop a resilient model that provides value to customers and emerge from economic turns in a stronger position, ready to seize the advantage and capture opportunities in the recovery period.

Our globalized world is now the stage of a confluence of interdependent issues affecting societies, the environment and trade. At Air Liquide, we see firsthand the effects of the economic slowdown on our customers and business partners worldwide.

Air Liquide's products (gases and advanced technologies) touch virtually every industry in every part of the world including health care, food and pharmaceuticals, water purification, petrochemicals and refining, enhanced oil recovery and natural gas production, glass, steel, automotive and semiconductors. We are proud that our gases and technologies help curb polluting emissions, lower energy use, recover and reuse natural resources and are used to develop the energies of tomorrow, such as hydrogen, biofuels and photovoltaic energy.

Through the talents and "can do" attitude of our people, coupled with the diversity of our teams, businesses, markets and geographic presence, I feel we have a resilient model to pursue growth throughout the economic cycles. We are striving to enable our customers worldwide to grow and evolve in key sectors and regions, and to create and develop new markets thanks to innovative applications. As a leader in industry, we are also cognizant of our responsibilities, thus seeking to assure a safe and sustainable approach in all we do, working jointly with our employees, customers and the communities in which we operate to fulfill our social and environmental responsibilities.

Our company, with 43,000 employees in 76 countries worldwide (4,500 in the U.S.) recognizes the tremendous stakes the economic downturn holds. In response we are working to combine many products and technologies to develop valuable applications and services not only for our customers but for society at large. I feel that the key is to anticipate the challenges facing our customers and future market needs worldwide; innovating to enable progress, to achieve dynamic growth, and deliver sustainable value for our customers, employees and shareholders. ■ **Michael J. Graff (MSChE '79; OChE 2002; DEA 2008)**

The Mathematics of Excellence

Faculty member invests in collaboration and innovation

Doraiswami Ramkrishna's approach to research in chemical engineering, unlike those of many engineering colleagues, has a uniquely mathematical focus.

The Harry Creighton Peffer Distinguished Professor of Chemical Engineering says that real understanding of the essential behavior of systems can be reached by applying mathematical processes and formulas and building mathematical models. An important aspect of his research is evolving theoretical and experimental machinery for the identification of model parameters and phenomenological functions.

Now in his thirty-fourth year at Purdue, Ramkrishna's work and approach has not gone unnoticed.

Earlier this year he was elected as a member of the National Academy of Engineering, the highest professional distinction for a U.S. engineer.

"I am amazed by it," he said. "It makes me feel very good because I did not think I would gain this recognition. The award represents to me a vindication of the role of mathematical analysis in engineering research."

Ramkrishna cites his studies at the University of Minnesota, where he gained a doctorate in chemical engineering in 1965, as laying the foundation for his research philosophy. He credits Arnold Fredrickson, Rutherford Aris, and Neal Amundson as having a major influence on his intellectual development during his tenure as a student and in his subsequent career.

"It was a fantastic fit for me," he said. "It showed me how doing mathematical work was such an important part of doing good engineering research. It also showed the way for other departments in the country to do a quantitative analysis of every problem."

After graduating and working for three years at Minnesota, Ramkrishna took what he had learned back to his native India at the Indian Institute of Technology (IIT) in Kanpur. Various changes at the IIT, though, led Ramkrishna back to the United States in 1974, where he accepted visiting positions at other universities.

He joined the faculty at Purdue in 1976. Despite intriguing offers from other institutions over the years, his colleagues' strong support for his research encouraged Ramkrishna to keep his work in West Lafayette.

Ramkrishna has published several books on the fundamentals of applying mathematical processes to chemical engineering, including a study of population balances of particulate systems in engineering, as well as groundbreaking research in biological and reaction engineering.

Current projects include a biomedical study with Robert Hannemann in chemical engineering and Ann Rundell in biomedical engineering that applies mathematical models to alternative cancer treatment research. Unlike conventional chemotherapy, their treatment for leukemia provides a rational quantitative focus that seeks to kill 100 percent of all cancer cells with a specified probability.

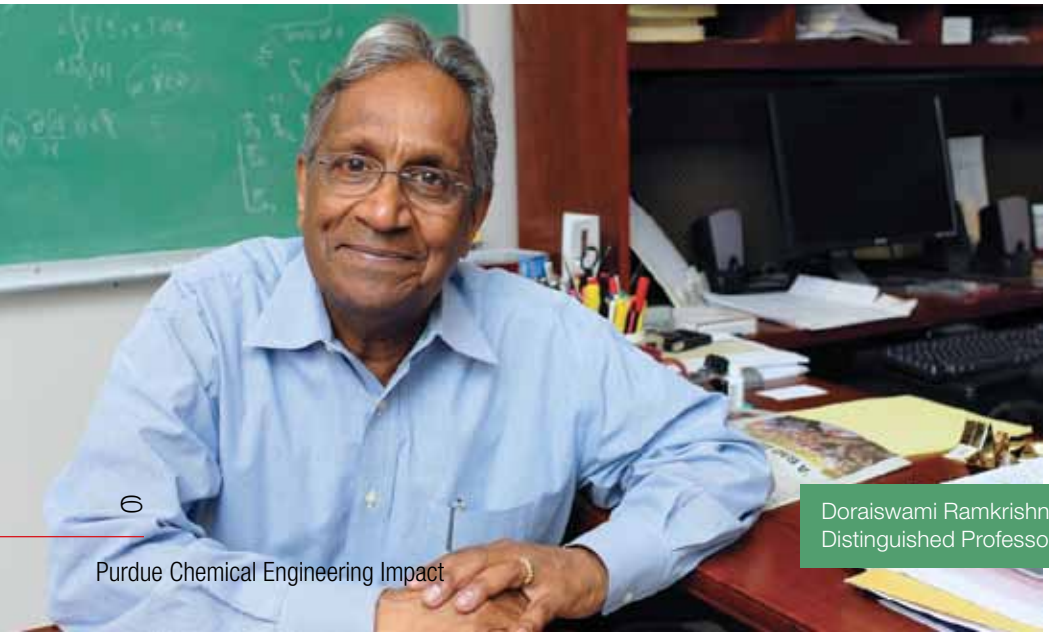
He is also working in collaboration with John Morgan of chemical engineering and Lou Sherman of biological sciences on alternative energy research that focuses on the production of hydrogen from photosynthesis in blue-green algae and other biofuels. According to Ramkrishna, this work differs from traditional research in this area by looking at the amount of biochemical productivity in time, rather than the yield of a single cell.

Such interdisciplinary efforts are crucial in Ramkrishna's research and in putting his philosophy into practice. He believes that taking an active role in the academic community allowed him to build these essential relationships.

As he looks forward to furthering partnerships with engineers at universities in Belgium, Germany, India and elsewhere in the United States, Ramkrishna envisions a globalized approach as the future of engineering research.

"A global approach is just the way to go," he said. "It has caught on now because of economic necessity and it will continue to expand in the future. I think we should be looking outside of the Western Hemisphere to grow everywhere across the globe."

■ **Kevin Smith**



Doraiswami Ramkrishna, the Harry Creighton Peffer Distinguished Professor of Chemical Engineering

Photo by Julie Kadrmas

Doctoral student Julie Kadrmas describes this image of her hugging the distillation column in the atrium of Forney Hall as, "showing her love and appreciation for the chemical engineering discipline." As a pioneering tissue engineer, she is making her own contribution to the field.

One to Watch

Student research fuels advances in tissue engineering

Julie Kadrmas grew up on the prairie frontier, in a rural area in southwest North Dakota. Now, as a rising star in the world of tissue engineering, she is on the frontier of modern medicine. Her cutting-edge research abilities in tissue engineering were recently recognized with a prestigious National Science Foundation Graduate Research Fellowship.

Kadrmas, who is completing the second year of the chemical engineering doctoral program, is working on the tissue engineering of cartilage with Julie Liu, assistant professor of chemical engineering (and biomedical engineering by courtesy). Her vision is to make a protein specifically designed so that when it hits body temperature it gels. Subsequent exposure to UV light would increase the mechanical properties of the gel even further. A solution of this protein, mixed with the patient's own adult stem cells, could be injected and would then cue cells to grow real cartilage. In the case of knee surgeries, for example, injecting cartilage would be a vast improvement over cutting a patient's knee open. "That's the vision," she says, then adds with a laugh, "but I'm a long way away from it."

Kadrmas' interest in tissue engineering comes from a love of biology and an aptitude for math. Chemical engineering, she says, brings the two subjects together. Tissue engineering comes even closer. The subject fascinates Kadrmas with its opportunities for multidisciplinary collaboration and its potential for improving lives and positive impact. "The opportunity to explore what tissue engineering can do is really cool. A lot is still unknown in tissue regeneration ... the frontiers are still open," she says.

"It's amazing stuff, trying to come up with practical solutions to medical problems. The FDA approval process can take a long time, though, especially for artificial proteins. Some problems might exist with getting treatments to market, but I see increasing collaboration between engineers and doctors as helping to get rid of those problems," she says. ■ **Linda Thomas Terhune**

It's All About the Journey

Graduating engineers face a tough economy

Nicholas Kissel, '09 graduate of the School of Chemical Engineering

It all began with a high school road trip from his Southern Indiana home to Virginia Beach. There, on the side of the interstate, sat a Marathon refinery. Its stacks and columns intrigued Nick Kissel, so much that, when he got home, he researched industrial chemistry and decided that was what he wanted to do in life.

Kissel mapped out his path to the future, studying chemical engineering at Purdue, doing three co-op rotations with Marathon refineries in Detroit and Texas City, Texas, and setting his sights on becoming a process engineer after graduation in May. He didn't anticipate one problem—Kissel and hundreds of other newly minted engineers across the country are entering the workforce during a down economy. With graduation only a week away, he still did not have a job offer.

Kissel declined to be as down as the economy, saying instead that he is an optimist and is looking for an internship. He views the free time as a chance to have a little fun and put a spin on the traditional post-graduation vacation by making job hunting a recreational activity.

"Instead of already having a job and taking a scheduled trip after graduation, I will take road trips as job fairs come up," he said. His first trip was planned the week before commencement, to a Westinghouse job fair in Pittsburgh.

Kissel may have other cards to play if his career aspirations are delayed. As president of the famed Rube Goldberg Competition organized by Theta Tau, he says he gained leadership experience and learned how to interact with corporate sponsors. As a seasoned baseball player and working umpire, he could even head for a different field of dreams. If all else fails, Kissel may find his future on a road trip. ■ **L.T.T.**

A Solid Foundation

Six individuals support the school's many daily activities

Standing left to right: Katherine Henke, Chris Murray, Jenni Layne. Sitting: Karen Heide, Debbie Leudtke, Marcella Maynard.

They are the glue that holds the School of Chemical Engineering together. They are the nails that connect the planks of students and teachers. They are the office support system of the school. If a student needs to speak to a certain professor or administrator, they often need to speak to them first. If a professor needs to arrange travel to a conference, these staff members will see that it happens. Grad students sign out equipment from them and hand in their thesis prep; these six women have a combined 69 years of experience at Purdue University.

Chris Murray, Debbie Luedtke, Katherine Henke, Jenni Layne, Marcella Maynard and Karen Heide have a staggering amount of responsibilities. Each handles multiple deadlines (both long and short) each day. While Murray supervises the clerical staff and is the assistant to the head of the school, the others each assist a group of professors in their day-to-day work. Layne is secretary to seven professors and also assists in the renovations of Forney Hall. Layne coordinates with vendors and other departments, and schedules meetings and works with the university architect's office.

Heide—who has worked at Purdue for almost 35 years—types books for professors; she's on her third chemical engineering text. Luedtke works in the school's main office and is a familiar face to students and staff. "We are the first point of contact that outsiders have with the school," said Luedtke. Henke works primarily with students and teachers, "We serve as liaisons between the faculty and the students. We'll schedule trips, hand back homework, help schedule thesis projects, defenses, prelims and practices," said Henke.

This group brings not just years of experience but also variety. Collectively, they have worked in areas and buildings ranging from aviation technology, the Krannert School of Management, the president's office, first-year engineering, physics, math, and the dean of engineering's office. This experience has made them adept at helping students. "We're the middlemen, if a student can't get to a professor; they know they can come to us," said Layne. "Sometimes students just need to talk, we're here to listen as well," said Maynard.

Murray said juggling the daily responsibilities can sometimes be a test, while Luedtke said that interruptions can make reaching their daily deadlines a challenge, "On any given day, there are interruptions every 5-10 minutes." Henke feels that their work is the epitome of multi-tasking. "Taking on student and faculty needs, meetings and calendars, every day is a busy day." Layne agreed, "There's never a dull moment in chemical engineering!"

Enjoyment and contentment also come along with responsibility. Layne enjoys the busy days and Henke sees their group as the face of ChE and enjoys the different skills and talents that they each bring to the table. "I like working for people who appreciate the effort I put forth," said Luedtke. She also enjoys the diversity of Purdue, where she is constantly encountering new groups and people.

Seeing their office as one piece of a bigger picture, Murray talked about the level of connection between ChE and other departments. "We are a smaller part of a larger picture of Purdue. It's very unique how we're connected." The staff work with different parts of the university on a daily basis but their true focus is of course, on the students. "We have wonderful students," said Murray. "This year I've had a lot of interaction with ChE students in three different classes with over a hundred students each. And you know what? I haven't encountered a single rude student. They have been so very kind," said Maynard. ■ **Joseph Fowler**

Alumnus Jeffrey Hemmer (center) is pictured with executive vice president for academic affairs and provost, Randy Woodson, and dean Leah Jamieson, at the 2009 Distinguished Engineering Alumni event, during which he was honored.

Keeping Your Heart in It

Hard work and passion are keys to weathering economic downturn

With downbeat talk on the current economic crisis dominating the news, Jeffrey Hemmer takes a slightly different view, referring to a famous quote from Winston Churchill.

"Success is not final, failure is not fatal: It is the courage to continue that counts."

Hemmer, a 1980 BSChE graduate, says that these words help to put his life in perspective. He experienced the last significant recession in the early 1980s in his first role at Exxon Chemical, just six weeks out of college.

After witnessing the first layoffs at a plant that enjoyed substantial profits in its early years of operation, Hemmer said that the economic downturn forced the company to make tough decisions in order to survive.

Now drawing on over 25 years of experience in various roles in the petroleum industry as a Senior Vice President for solution implementation at management consulting firm Sinclair Group,™ Hemmer advises industrial firms facing similar circumstances.

He says his early experiences taught him that most companies only seek change when either they are placed in a serious "situation of pain," or boldly choose to pursue new endeavors. As a result, Hemmer believes that rising to meet new challenges should be integral to the mindset of any business, entrepreneur, or individual.

According to Hemmer, individuals must take advantage of challenges and opportunities in order to stay ahead. "You have to find ways to add value, to help make your company more profitable so they want to invest in you," he said.

Hemmer admits that some companies have failed to grasp this understanding over the past 15 years. With no significant downturn to speak of, he says only now, as a new generation of engineers experience a recession for the first time, are U.S. firms adapting to changing economic conditions and the effects of globalization.

Hemmer predicts these firms will go in one of two directions over the next five years. They will either continue to move to less expensive offshore locations or choose to make significant investment in new technologies to replace aging plants at home.

Hemmer believes that these challenges provide a tremendous opportunity for the next generation of engineers, but only as long as they have the right tools and frame of mind to rise to the top.

Those who simply expect success instead of working for it won't cut it.

"When I used to hire engineers in the 1980s, if I saw that their parents had paid for 100 percent of their education and they didn't have full-time career-related summer jobs, I wouldn't hire them," Hemmer said. "I didn't hire people for their head or their hands; I hired them for their heart."

As he looks to the future, Hemmer refers to the need for engineers not just to have intellectual intelligence but practical intelligence and a desire to succeed in the industry, something he has emphasized since he took a position on the Purdue chemical engineering Industrial Advisory Council in 1997.

He says that Purdue graduates are held in high regard in industry because of their ability to show that they have this practical experience, versatility, and determination.

"Engineering by trade isn't about technical stuff, it is about the people," he said. "You have got to wear two hats. You have to wear your engineering hat, and your selling hat. Because if you can't get a group to understand what you are trying to do, and it doesn't get implemented, it doesn't have value to your employer or society."

With this in mind, he argues that graduates need to demonstrate that they have the passion, courage, and commitment to sell an idea as much as to develop one. If they do, Hemmer believes, the next generation will show that they have the character to succeed, and "the courage to continue."

■ **Kevin Smith**

1950-59

Henry T. Sampson, BSChE '56, on May 8 received the 2009 Alumni Awards for Distinguished Service from the University of Illinois Urbana-Champaign where he completed his PhD in 1967.

Jack B. ReVelle, BSChE '57 co-authored *Home Builder's Guide to Continuous Improvement: Schedule, Quality, Customer Satisfaction, Cost, and Safety*, which will be released in October this year by CRC Press.

1960-69

Joseph Alford, BSChE '66, was selected to be a member of the Science Advisory Board of the National Science Foundation sponsored "Engineering Research Center on Structured Organic Particulate Systems."

John Hosmer, BSChE '67, MS '68, retired in December 2008 from Constellation Energy as chief nuclear officer for UniStar.

Leonard Bernstein, PhD '69, closed his climate change consulting business, L.S. Bernstein & Associates, at the end of 2008. He was recently honored as a distinguished alumnus of the University of Florida's School of Engineering, where he received his BSChE in 1962. Previously he had been recognized for his contributions to the Intergovernmental Panel on Climate Change, which received the 2007 Nobel Peace Prize.

A. Robert Winslow, BSChE '69, retired in December 2008 after 24 years with the Weyerhaeuser Company.

1970-79

Larry A. Baker, BSChE '70, in mid-2008 retired from Ashland, Inc in Dublin, Ohio, having held roles of VP of the Composite Polymer Division, VP of the Global Supply Chain, and VP of Engineering. Upon retirement from Ashland, he began his consulting business, DenAlan Consulting, LLC.

Surendra Gupta, PhD '72, retired from BP on April 1, 2009 after 36 years of service. His last role at BP was global learning and development manager for Reservoir & Petroleum Engineering and Petrophysics Disciplines in Exploration & Production.

Daniel M. Sobieski, BSChE '72, was recently appointed executive vice president Consulting Services for O'Brien's Response Management.

1970-79 (cont.)

Raymond Carlston, BSChE '73, retired from service as an assistant state attorney (felony prosecutor) in Jacksonville, Florida in August 2008. He is currently serving as the command legal counsel, Naval Hospital, Naval Air Station, Jacksonville, Florida.

Ronald Wright, BSChE '72, MS '73, retired in May 2009 from the GD Fuels Coordinator position with Chevron, after 32 years with the company.

Norm Gilsdorf, BSChE '77, has been promoted to president, Honeywell Process Solutions in November, 2008. He is now based in Bracknell, UK.

Deborah Grubbe, BSChE '77, has opened her own operations and safety consulting business, and is now president of Operations and Safety Solutions, LLC. Formerly an executive with BP and DuPont, Deborah continues to serve on the NASA Aerospace Safety Advisory Panel.

1980-89

Paul Fithian, BSChE '80, is the co-founder of Lighthouse Industries, an ISO 9001 Registered injection molding and tooling company. He just completed a term on Purdue's TAP Advisory Council.

Sharron Hunter-Rainey, BSChE '83, is an Assistant Professor in the School of Business at North Carolina Central University, Durham, NC. For 2008-09, she was the undergraduate students' choice as the Most Influential Faculty Member in the School of Business and received one of three NCCU Excellence in Teaching awards.

William Pottratz, BSChE '83, was promoted to Deputy of the Army Aviation and Missile Command Safety Office, Huntsville, AL in December 2008.

David A. Rockstraw, BS '86, is currently a professor of chemical engineering at New Mexico State University and also operates Rockstraw Consulting. He is the recipient of the 2009 National Society of Professional Engineers (NSPE)/ Professional Engineers in Higher Education (PEHE) / Sustaining University Program (SUP) /Engineering Education Excellence Award.

Michael G. Locklar, ChE '87, was named partner in the intellectual property practice group at Jackson Walker LLP, Houston, TX.

Phillip K. Zeller, BSChE '89, is a senior engineer with DuPont. In April of 2009, he assumed the role of process safety management (PSM) leader for the DuPont Washington Works Facility in Washington, WV.

The Chemical Engineering Class of 1970 are planning to get together in 2010 to celebrate 40 years! If you would like more information, please contact Jim and Linda Huff at: Purdue Che 1970@googlegroups.com.

1990-99

Pedro Arce, PhD '90, received the 2008 Quality Enhancement Productivity Award (QEP) of the Tennessee Technological University and the 2009 "International Exemplary Award" from the Chair Academy.

Majella Stevenson, BSChE '90, returned from a six-month deployment in the Middle East, for which he was awarded the Joint Service Commendation Medal. He also received a volunteer service award from Area Support Group Qatar. He completed an executive Master's Degree in Public Administration from Indiana University. His current position is public works officer, Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility.

Amie Best, BSChE '91, graduated from Marquette University in December 2008 with an executive MBA degree, including a specialization in International Business. Her current position is marketing associate, Home Cleaners - North America Consumer Products at SC Johnson in Racine, WI.

Salman Adil, BSChE '92, in February 2009 accepted the position of VP of Operations for Blue Sun Energy - a renewable energy company based in Colorado.

Kenneth K. Harris, BSChE '92, in March 2009 completed a second mobilization tour as executive officer in Iraq. He received a second Campaign Star for Operation Iraqi Freedom and the Army Commendation Medal for Achievement in May 2008. He is currently enrolled in the University of Phoenix, Arizona, earning a Masters of Education in Curriculum and Instruction.

Joshua Rockhold, BSChE '94, has been promoted in November 2008 to Director, Delivery & Distribution at Harland Clarke Corp., San Antonio, TX.

Christopher L. Selby, BSChE '95, is a program manager, Minor Capital and Energy, The Kroger Co. He recently obtained the Certified Energy Manager designation from the Association of Energy Engineers.

Catherine Barrow, BSChE '99, recently obtained a new position at Unilever as a supply chain innovation manager.

Cassandra Forthofer Shell, BSChE '99, has recently been transferred to Puerto Rico as a production leader for Lilly del Caribe (Eli Lilly and Co.).

2000-present

Alvaro Timotheo, BSChE 2000, has recently been promoted to technical Sales manager for Recovery and Power Boilers in North America with Andritz, Inc.

Dennis M. Sopka, BSChE 2000, graduated from Drexel University College of Medicine in May 2008 and completed his transitional internship at Lehigh Valley Health Network, in Allentown, PA. He is now a 2nd year resident in radiation oncology at the Fox Chase Cancer Center, in Philadelphia, PA.

Abid Ansari, BSChE '2001, has been promoted in November 2008 to the senior manager, portfolio management position with MedImmune, an AstraZeneca subsidiary. He received his CPA certification in January 2009 and the Director's award for statistical/financial work.

Nicolle Orillo, BSChE 2002, is a 2009 Acumen Fund Fellow with the Acumen Fund, a non-profit global venture fund that uses entrepreneurial approaches to solve the problems of global poverty.

Wendy Wiker, BSChE 2002, was promoted to lean master for Grace Construction Products, Americas in February 2009.

Susan Hall, BSChE 2004, was promoted in March 2009 to senior engineer in packaging development with General Mills.

Kevin Roche, BSChE 2004, in July 2009 changed his process control engineering position with Eli Lilly for a term in the Peace Corps. He is going to teach 7th-10th grade physics in Guinea.

Julie Percifield, BSChE 2008, is currently a DEFI process front line manager with Unilever HPC in Hammond, IN.

Allison Yates, BSChE 2008, just started her position in July 2009 as innovation planner for Unilever, in Englewood Cliffs, NJ. Before this appointment she was a reliability engineer in Hammond, IN, with the same company.

Send your updates to **chealumni@ecn.purdue.edu**. News from the most recent six months will be included in the next issue of *Impact*. Any other updates will be listed on the ChE alumni Web site at **engineering.purdue.edu/ChE/People/Alumni**.

aperture

Researchers have uncovered evidence suggesting that factors other than genes could cause obesity. A team led by researcher Ji-Xin Cheng, assistant professor in the Weldon School of Biomedical Engineering and Department of Chemistry, found that genetically identical cells store widely differing amounts of fat depending on subtle variations in how cells process insulin. In this image, insulin (green) is present in cells with no fat storage and absent in cells with fat storage at two days after insulin addition. This observation indicates faster insulin processing rates in cells with fat storage. Fluorophore-labeled insulin (green) is visualized with fluorescence imaging, and fat is visualized with coherent anti-Stokes Raman scattering—or CARS—imaging (red/white).