

## Chad Mirkin: Chubb Innovation Award Winner

Scientist-entrepreneur **Chad Mirkin** is the 2013 Sigma Xi Walston Chubb Innovation Award winner. Mirkin currently serves in several roles at Northwestern University, including as the George B. Rathmann Professor of Chemistry and Director of the International Institute for Nanotechnology and Center for Nanofabrication and Molecular Self-Assembly.



In May 2013, Mirkin was recognized by *National Geographic* Magazine for his efforts in making “one of the top 100 scientific discoveries that changed the world” for his development of nanoparticle-based bio-detection schemes, the invention of Dip-Pen Nanolithography, and his contributions to supra-molecular chemistry, nano-electronics and nano-optics. Mirkin is one of only 12 scientists, engineers and medical doctors and the only chemist to be elected into all three branches of the National Academies. He has published more than 500 manuscripts and currently has more than 800 patents and patent applications. These discoveries and innovations have led to more than 200 commercial products currently sold throughout the world.

Mirkin currently focuses his research on developing methods for controlling the architecture of molecules and materials on the 1–100 nm length scale, and on using such structures in the development of analytical tools that can be used in the areas of chemical and biological sensing, lithography, catalysis and optics.

On April 27, 2009, Mirkin was appointed by President Barack Obama to the President’s Council of Advisors on Science and Technology. In addition, he has served on the editorial advisory boards of the *Journal of the American Chemical*

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## From the President



### Who speaks for science?

Who speaks for science? There are countless authorities, individual and institutional, and there are innumerable degrees of filters, from the most rigorous (peer-review) to the least rigorous (microblogs, for example). To be fair, not everyone agrees about the rigor of peer-review (see “Three myths about scientific peer review,” a blog posted by Michael Nielsen on January 8, 2009), and it should be acknowledged that science blogs as well as macro-blogs suggest some degree of validation by peers.

There are infinite voices as social media continues to morph and proliferate. The power and wonder of *American Scientist* in this streaming cosmos of science communication has been as a direct channel of conversation from scientist to scientist, across disciplines. Those who teach, study, use or have an avid interest in science are offered the stories of discovery by knowledge creators, whose narratives are carefully and expertly authenticated by *American Scientist* editors—alchemists really, who add additional magic to the telling.

*American Scientist* has won national awards often and on several occasions in its more than 100-year history, multiple accolades within a given year. In print form it has been a work of art. Many members of Sigma Xi want the Society to continue the treasured paper format. There are also a number of new members who prefer a digital format. To honor both audiences, Sigma Xi currently publishes both. Acknowledged are the limitations of the web-based digital platform, but gleefully and with a certain joyful giddiness, we await the iPad app that is to be released with this issue.

“Blogfather” Bora Zivkovic, organizer of ScienceOnline conferences and editor of Open Laboratory anthologies of best science writing on the Web, explains that the new media ecosystem offers infinite possibilities and an equal number of challenges. *American Scientist* is on the cusp of change, not only because technology has repackaged it, but also in response to the explosive world of social media and science communication in the 21st century, which has called us to re-examine its role and how to shape its future. One of the ScienceOnline 2011 conference sessions was titled “Keepers of the Bullshit Filter: How to Crowdsource Accountability and Accuracy in the New Media World.” Sigma Xi has always stood for honor in science. Is serving as a filter a role for us as well? A journalistic approach by other science magazines has been responsive to the need to generate audience and revenue, but also has alienated faithful readers. What is the way forward for *American Scientist*?

This year some of the world’s most notable science communicators will convene on two occasions to help us chart a course for the magazine that enables it to continue to play a unique, valued role in the understanding of science.

Your own thoughts are most welcome, fellow companions.

Linda Meadows

## Sigma Xi Awards at Intel International Science and Engineering Fair

At this year's **Intel International Science and Engineering Fair (ISEF)** in Phoenix, Arizona, Executive Director Dr. Jerry Baker presented several Sigma Xi awards for students and projects whose work best represented interdisciplinary research.

On May 16, Dr. Baker presented students with associate memberships in Sigma Xi, as well as divisional awards and cash prizes. In the Life Science division, **Albert Kim** of Manhasset Secondary School in Manhasset, New York, and **Byeong Ho Jung** of Herricks High School in New Hyde Park, New York, took top honors for their research into the causes of inflammatory bowel disease. For Physical Science, **Shujat Ali Khan** and **Shamoon Syed Rizvi**, both of East Meadow High School in East Meadow, New York, as well as **Niranjan Balachandar** and **Nirali Kunjan Thakor**, both of Shepton High School in Plano, Texas, shared the top award for their work in water distribution systems for third world countries and protein folding, respectively. (Photograph courtesy of Society for Science & the Public.)

For more information on other Sigma Xi students at this year's Intel ISEF, please visit our website at [www.sigmaxi.org](http://www.sigmaxi.org).



## Mirkin Receives Award

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*Society and Angewandte Chemie*, among others. He is the founding editor of the journal *Small*, a premier international nanotechnology journal. In keeping with his entrepreneurial spirit, on finding a need in the marketplace, Mirkin has frequently worked to fill it, as evidenced through his roles as founder of four companies; Nanosphere, NanoInk, AuraSense and AuraSense Therapeutics.

Mirkin received his B.S. degree from Dickinson College in 1986 and his Ph.D. from Penn State University in 1989.

The Sigma Xi Walston Chubb Award for Innovation is designed to honor and promote creativity among scientists and engineers. In the fall of 2013, Chad Mirkin will attend the 2013 Sigma Xi Student Research Conference in Research Triangle Park, North Carolina, where the formal presentation of the Walston Chubb Award for Innovation and his honorary keynote will take place.

For more information on the event, please visit our website at [www.sigmaxi.org/meetings](http://www.sigmaxi.org/meetings).

## Conrad Spirit of Innovation Challenge Winners

The final round of competition for the **2012-2013 Conrad Spirit of Innovation Challenge** took place over the weekend of April 10–13 at the NASA Johnson Space Center in Houston. Four teams of high school students received top honors at this year's event in recognition of their efforts to create a product or service to benefit humanity, and the winning teams took home more than \$50,000 in cash prizes and awards. The Conrad Foundation's Spirit of Innovation Challenge celebrates the life and entrepreneurial spirit of astronaut Pete Conrad, third man to walk on the Moon.

The four winning teams included the following:

- **Team M<sup>3</sup>** from Warren High School in Downey, California, who won for their innovative "Sleep Halo"—an adjustable circular headrest device that seeks to revolutionize the air travel industry by allowing for maximum comfort of passengers during long flights.
- **Team AirCOM** from the North Carolina School of Science and Mathematics in Durham, North Carolina, who won for

their suite of electronic detection products that use international crowdsourcing to inform the public on dangerous levels of airborne pollutants.

- **Team Eco-Cooker** from Gulliver Preparatory School in Miami, Florida, who won for their self-sustaining methane production system, which stores bio-waste to produce combustible gas that can be used as a low-cost energy and heating source.
- **The Back Straight Boys** from Canyon Crest Academy in San Diego, California, who won for their "Posture Pad"—a device built to improve computer-related workplace injuries through constant feedback with users.

All winning teams at the Conrad Spirit of Innovation Challenge are awarded with Sigma Xi affiliate memberships. We also take this opportunity to thank the many Sigma Xi members who served as mentors and judges at this year's competition.





## Mid-Atlantic Regional Meeting

Over the weekend of April 20, 2013, Manager of Chapter and Member Services Tammey Bohle traveled to George Mason University to meet with chapter leaders for the Mid-Atlantic Region of Sigma Xi. In an event organized by President of the Sigma Xi's Washington D.C. chapter and Mid-Atlantic Regional Director Tina Paul, attendees enjoyed discussions on chapter processes and best practices, as well as a student research presentation. Sigma Xi President Kelly O. Sullivan was also on hand to deliver a keynote titled "Team Science: Working Together on a Grand Scale," which focused on the importance of interdisciplinary science in solving the major problems of the future.

Sigma Xi chapter participants hailed from across the region, including representatives from chapters at Harvard University, Johns Hopkins University, George Mason University and the Washington D.C. area. •

## Sigma Xi Board Meeting

The second weekend in May marked an exciting time here at our headquarters, as the Sigma Xi Board of Directors held their first meeting of 2013. We welcomed the directors to Research Triangle Park for rigorous discussions on the future of Sigma Xi and *American Scientist* magazine. Sessions on strategic planning were directed by Wendy Scott of Wendy Scott & Associates, a local association management consulting firm.

We'll have a full breakdown of the Board's decisions in the next edition of the Member E-Newsletter. Contact us today to at [memberinfo@sigmaxi.org](mailto:memberinfo@sigmaxi.org) to ensure that we have your most recent e-mail address on file. •



## NC FIRST Robotics

Sigma Xi Executive Director Dr. Jerry Baker participated as a judge and volunteer for the North Carolina FIRST Robotics Regional competition over the weekend of March 13–16, also known as the "Ultimate Ascent." In this competition, students of varying ages from around the world designed, built and programmed robots to shoot flying discs through hoops arranged at varying heights.

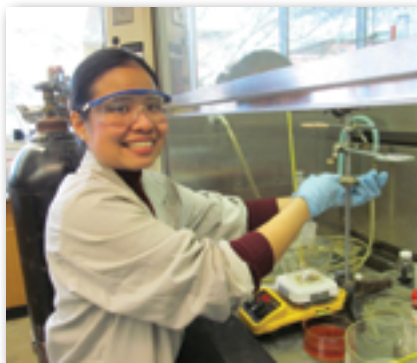
According to competition founder Dean Kamen, FIRST was created in 1989 to inspire young people's interest and participation in science and technology. On FIRST's website, Kamen states, "From fund-raising to imagery to the technical design, FIRST is about more than building a robot. It is about building the best students who will turn into the best workforce."

In late April, more than 10,000 students ranging in age from 6–18 traveled to St. Louis, Missouri, for the championship competition, which included 2,546 teams representing 17 countries throughout the world. Pop superstar will.i.am was recognized by FIRST leadership for his dedication to the cause of inspiring young people to pursue careers in STEM fields and solve the problems of tomorrow.

We hope you'll consider getting involved on a local level with these outstanding students—and potential future Sigma Xi members. Across the country, mentors, sponsors and assistants are needed to keep this incredible program going in this time of decreased governmental funding for student STEM initiatives. Please take a moment and visit their website at [www.usfirst.org](http://www.usfirst.org) to find an opportunity near you. •



## Meet Your Fellow Companion: Patrisha Pham-Bugayong



*Sigma Xi members hail from diverse fields of academia, government and industry. Our motto is the Greek "Spoudon Xynones," or "Companions in Zealous Research." With that thought in mind, each issue in Sigma Xi Today, we like to take a moment to highlight a different "Fellow Companion"—to learn more about their work and what the honor of induction into Sigma Xi has meant for their career.*

**T**his issue, we are excited to feature **Dr. Patrisha Pham-Bugayong**—a Postdoctoral Researcher for the Renewable Fuels and Chemicals Laboratory at the Dave C. Swalm School of Chemical Engineering at Mississippi State University. Pham-Bugayong received her Ph.D. in chemistry from Mississippi State University under Dr. Tingyu Li, currently of the National Science Foundation (NSF). Pham-Bugayong's innovative work in the field of alternative energies is both timely and engaging, and we are proud to welcome her into membership in Sigma Xi.

### What is the focus of your current research?

My current research work focuses on developing specialty or value-added products from activated sludge. Our research group is actively working on activated sludge as a main feedstock and converting it to biodiesel. Activated sludge is a solid or semi-solid by-product of the biological treatment of wastewater. Our group has recognized that although we can produce biodiesel from this feedstock, there's still an array of other materials that can be harvested, synthesized and developed from this material. The beauty of our work lies in the fact that one's perspective on sludge can change and suddenly, something that's long been considered waste actually has value after all.

### Tell us about something we might see in our daily lives that directly correlates to your work.

Every day we encounter news in all forms of media about the worldwide oil price increase. The United States has recognized that by reducing its demand for oil, it can become more resilient to oil price shocks. The U.S. has numerous options for further reducing its oil demand, including additional tightening of fuel economy standards and shifting to alternative fuels. Our research belongs to a small portion of this alternative fuels or renewable energy area that encompasses biofuels, specifically biodiesel.

### What are your thoughts on the future of STEM education?

Young people nowadays are reluctant to enter into a STEM-related field. It seems to me that their reluctance is based in the fear that STEM fields are too challenging, that they don't know anything about it, or haven't been exposed enough to it to spark a personal interest. Students think this way because they do not have access to enough teachers with a passion for STEM fields themselves. We need to retain STEM talent first in our teachers to ensure that it is also retained in education. I believe further incentives from both government and the private sector would allow STEM talent to stay in schools as educators—better teachers, better education, better students.

### Describe the patent/publishing experience—were there any bumps along the way for you?

In terms of publication, our work is pretty original. Thus, to justify the scientific content is not really difficult. The challenge of publishing lies more in proving that what we're doing actually has value and potential for success in the long run.

### What has the honor of induction into Sigma Xi meant to you?

Induction into Sigma Xi has inspired me to work even harder and contribute more both for the scientific community and my fellow researchers in similar fields. It has given me a sense of "belonging" and I feel I can finally call myself a scientist.

### Has Sigma Xi helped further your career? If so, how?

My membership in Sigma Xi has introduced me to contacts within the same research area, as well as to other scientists who work in fields that are not related to my own. Belonging to the Society has broadened my network of scientists and researchers. I am sure that my affiliation with Sigma Xi will help me positively in my career.

### What is your favorite motto?

"To look is one thing, to see what you look at is another, to understand what you see is a third, to learn what you understand is still something else, to act on what you learn is all that really matters." —Winston Churchill

### What advice would you give a young researcher just starting out in your field?

My advice for young researchers is not to get disheartened easily, because even in failure there is opportunity.

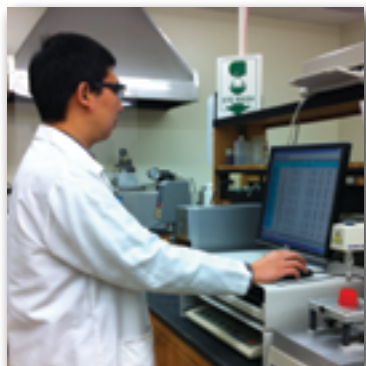
### Sigma Xi just celebrated its 125th year. What advances do you see in your field of research over the next 125 years?

Demand for renewable fuel has an increasing trend. Thinking positively ahead 125 years from now, I think research in this area will surge and become more parallel with petroleum research. Also, most (if not all) of the wastewater treatment facilities have the capability of producing renewable fuel and powering their own communities. •

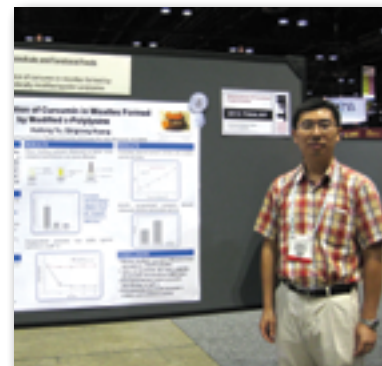
Please note that the text above is just a small excerpt of all Dr. Pham-Bugayong had to say in response to our questions. To read her interview in full, please visit Sigma Xi's website at <http://www.sigmaxi.org>.

# meet your fellow companion

## Meet Your Fellow Companion: Hailong Yu



**T**his issue, we are excited to feature **Dr. Hailong Yu**, currently a research scientist in the Biogums Innovation Group at CP Kelco. Following his master's studies in genetics, microbiology and immunology at the University of Medicine and Dentistry of New Jersey, and the receipt of his Ph.D. in food science from Rutgers, Yu's work today can be seen on the shelves of your local grocery store and pantry. As the world of food science bends toward creating healthier options for consumers, Yu's talents and skills will no doubt continue to be in high demand.



### What is the focus of your current research?

My current research focuses on studying the structure-function relationship of polysaccharides and the generation of novel fermentation-based polysaccharides for food, personal care and industry applications.

### Tell us about something we might see in our daily lives that directly correlates to your work.

Salad dressing is a mixture of water, oil and spices. To make it stable during storage, easy to pour, able to cling to the salad and have a pleasant mouth feel, xanthan gum is put into the dressing to function as a thickening agent. Part of my work is to modulate the chemical structure of xanthan gum so that it can be accommodated into different foods with varying pH and salt content.

### Give us an example of how multi-disciplinary research directly contributed to your work.

In my Ph.D. research, to generate proper formulations to improve the oral bioavailability of curcumin, cell biology experiments were primarily performed to identify the key factor of the low absorption of curcumin. Subsequently, nanotechnology and physical chemistry knowledge was used to prepare the formulations, during which statistical method of experimental design was used in the optimization process. Finally, the oral bioavailability of the formulated curcumin was demonstrated in pharmaceutical experiments.

### What are your thoughts on the future of STEM education?

Basic and applied research is one of the key factors of the competitiveness of a country. STEM education is the only way to generate the qualified scientists needed to perform the research. I believe that more resources and social attention should be put into STEM education, to keep the United States in a leading position in the world.

### What has the honor of induction into Sigma Xi meant to you?

Induction into Sigma Xi has truly been an honor for me. I feel that my induction was in recognition of my hard work and contributions to my field of science. I feel very encouraged to continue my research, now that I am a member of Sigma Xi.

### Has Sigma Xi helped further your career? If so, how?

I am a relatively new member of the society and very recently relocated from New Jersey to San Diego, California. I am looking forward to participating in more activities hosted by my local Sigma Xi chapter to help me build my professional network.

### What is your favorite motto?

"Knowledge is power."  
—Sir Francis Bacon

### What advice would you give a young researcher just starting out in your field?

Food science research depends heavily on the knowledge and approaches of other fundamental sciences, including chemistry, biology and engineering. To become an excellent food scientist, one needs to really build their expertise in one of the three aforementioned disciplines, have broad exposure to approaches of other fields and be excited to address the key questions facing our discipline.

### Sigma Xi just celebrated its 125th year. What advances do you see in your field of research over the next 125 years?

Improving human health through diet is no doubt the next frontier of food science research. In my opinion, three specific areas could advance us quickly in this field: primarily, the investigation of the various health benefits, such as anti-oxidant, anti-cancer, anti-inflammatory and anti-aging, of natural bioactives in food components; secondarily, new food formulations that provide novel matrix to modulate the absorption of natural bioactives, mimic the texture and mouth feel of high-sugar and/or high-fat food; and finally, an examination of composition and function of the microbes inside the digestive tract, including the small intestine and colon, and understanding the approach to regulate the activity of the microbes through diets. •

Please note that the text above is just a small excerpt of all Dr. Yu had to say in response to our questions. To read his interview in full, please visit Sigma Xi's website at <http://www.sigmaxi.org>.

## NAS Elects 24 Sigma Xi Members

This April, Sigma Xi members were among the 84 new members and 21 foreign associates elected to the **National Academy of Sciences (NAS)** in recognition of their distinguished achievements in original research. This class was identical in size to the class of 2012 and continued the trend of increased female recognition.

The NAS is a non-profit society of scientists and engineers committed to the furtherance of science and technology and its use for the general welfare. NAS was established in 1863 by a congressional act of incorporation signed by President Lincoln that calls on the Academy to act as official liaison to the federal government, upon request, in any matter of science and technology.

Newly elected Sigma Xi members and their affiliations at the time of election are:

**Ian T. Baldwin** (SX 1985); director, department of molecular ecology, Max Planck Institute for Chemical Ecology, Jena, Germany

**James A. Brown** (SX 1967); professor, department of anthropology, Northwestern University, Evanston, Ill.

**Michael E. Brown** (SX 1987); Richard and Barbara Rosenberg Professor, division of geological and planetary sciences, California Institute of Technology, Pasadena

**Mark A. Cane** (SX 1975); G. Unger Vetlesen Professor of Earth and Climate Sciences, department of earth and environmental sciences, Lamont-Doherty Earth Observatory of Columbia University, Palisades, N.Y.

**Xuemei Chen** (SX 2003); investigator, Howard Hughes Medical Institute and the Gordon and Betty Moore Foundation, and professor, department of botany and plant sciences,

University of California, Riverside

**Robert W. Field** (SX 1972); Haslam and Dewey Professor of Chemistry, department of chemistry, Massachusetts Institute of Technology, Cambridge

**Susan T. Fiske** (SX 1979); Eugene Higgins Professor of Psychology, department of psychology, Princeton University, Princeton, N.J.

**Joseph S. Francisco** (SX 1990); associate dean of research and graduate education, College of Science, and William E. Moore Distinguished Professor, departments of chemistry and of earth and atmospheric sciences, Purdue University, West Lafayette, Ind.

**Katherine H. Freeman** (SX 1984); professor, department of geosciences, Pennsylvania State University, University Park

**Martin Gruebele** (SX 1989); James R. Eiszner Professor of Chemistry, department of chemistry, University of Illinois, Urbana-Champaign

**Naomi J. Halas** (SX 1983); Stanley C. Moore Professor of Electrical Engineering and Computer Science and director, Laboratory for Nanophotonics, Rice University, Houston

**Sharon Hammes-Schiffer** (SX 1988); professor of chemistry, department of chemistry, University of Illinois, Urbana-Champaign

**Juris Hartmanis** (SX 1954); Walter R. Read Professor of Computer Science and Engineering, Emeritus, department of computer science, Cornell University, Ithaca, N.Y.

**Nancy Knowlton** (SX 1977); Sant Chair in Marine Science, department of invertebrate zoology, National Museum of Natural History, Smithsonian Institution, Washington, D.C.

**Terry A. Plank** (SX 1993); professor, department of earth and environmental sciences, Lamont-Doherty Earth Observatory of Columbia University, Palisades, N.Y.

**John H. Seinfeld** (SX 1968); Louis E. Nohl Professor, department of chemical engineering, California Institute of Technology, Pasadena

**Osamu Shimomura** (SX 1963); senior scientist, Marine Biological Laboratory, Falmouth, Mass. (Japan)

**Robert H. Singer** (SX 1966); co-director, Gruss Lipper Biophotonics Center, and professor and co-chair, department of anatomy and structural biology, Albert Einstein College of Medicine of Yeshiva University, Bronx, N.Y.

**Joan E. Strassmann** (SX 1983); professor, department of biology, Washington University, St. Louis

**Galen D. Stucky** (SX 2004); professor, departments of chemistry and biochemistry and of materials, University of California, Santa Barbara

**David Vanderbilt** (SX 1976); Board of Governors Professor of Physics, department of physics and astronomy, Rutgers, The State University of New Jersey, Piscataway

**David A. Vogan, Jr.** (SX 1974); professor of mathematics, department of mathematics, Massachusetts Institute of Technology, Cambridge

**Fred M. Winston** (SX 1974); John Emory Andrus Professor of Genetics, department of genetics, Harvard Medical School, Boston

**Wei Yang** (SX 2001); senior investigator and section chief, Laboratory of Molecular Biology, National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health, Bethesda, Md. •



### American Scientist Pizza Lunch

About once a month at Sigma Xi headquarters, we liven up the lunch hour in the Research Triangle Park with an **American Scientist Pizza Lunch** talk. In these informal lectures, scientists describe new research to nonscientists. Each Pizza Lunch offers an in-depth look at its subject, whether it's bedbugs, dog cognition or the smart grid.

After each talk, *American Scientist* editors chat with the speakers about their research. Anyone in the world can tune into this discussion via our *American Scientist* Pizza Lunch podcast. Don't miss our rich archives of full-length audio slideshows of earlier lectures, too.

The series is supported by a grant from the N.C. Biotechnology Center and is co-sponsored by the Research Triangle Park Chapter of Sigma Xi. •

