

Sigma Xi Today

A NEWSLETTER OF SIGMA XI, THE SCIENTIFIC RESEARCH SOCIETY

Sigma Xi Awards Grants to Students

Sigma Xi, The Scientific Research Society has awarded \$117,066 to 184 undergraduate and graduate students for their research. The money comes from the latest cycle of the Society's Grants-in-Aid of Research program. A portion of the grants were supported by funds from the National Academy of Sciences.

The Society has awarded grants for student research since 1922. In the latest cycle, Sigma Xi received 1,115 applications, the highest amount of fall applications since 2003. Members who serve on the Grants-in-Aid of Research Committee read the applications and chose the recipients.

Students use the funds to pay for travel expenses to and from a research site or to buy nonstandard laboratory equipment necessary to complete a specific research project.

The next application deadline is March 15. Grants of up to \$1,000 are available. Designated funds from the National Academy of Sciences allow for up to \$5,000 for astronomy research and \$2,500 for vision-related research.



GRANTS-IN-AID OF RESEARCH
SIGMA XI

Sigma Xi will host a Google Hangout to answer questions about the Grants-in-Aid of Research application review process.

Submit your questions to Kevin Bowen, program manager, at kbowen@sigmaxi.org then watch the hangout on February 26 at 2 p.m. EST.

For more details and to apply, visit <https://www.sigmaxi.org/programs/grants-in-aid>.

To see the list of recipients from the fall 2014 cycle, visit <https://www.sigmaxi.org/programs/grants-in-aid/grant-recipients>.

Donate to the Grants-in-Aid of Research program at <https://meeting.sigmaxi.org/about/support/confom.asp>.

From the President

Sigma Xi Will See Changes

It is a pleasure for me to extend the best wishes on behalf of the Board of Sigma Xi to all its members for a productive and enjoyable 2015. As 2015 begins, I am also pleased to alert the Sigma Xi membership to the announcement of several major changes in the organization of the Society and how it functions to effectively fulfill the expectations of its membership. These changes pertain to specific aspects of the Society's activities and programs to maintain their relevance to scientists of all ages who continue to be engaged with Sigma Xi.

Some changes involve the structure of the Sigma Xi headquarters while others focus on ensuring that the mission of Sigma Xi remains consistent with the increasingly dynamic expectations and needs of its members. In all cases, these changes are designed to preserve and enhance the highly respected position Sigma Xi has created as a champion for the ethical practice of scientific research throughout a professional career, especially by the younger generation.

While some patience is required before public announcements can be made, I assure you that the Sigma Xi staff and the Executive Committee, acting on behalf of the Board of Directors, are working diligently to ensure an exceptionally positive future for Sigma Xi.



George H. Atkinson
George H. Atkinson

Sigma Xi Election Results

New leaders of Sigma Xi have been selected through membership-wide elections. These elections put a new president-elect on the path to the Society's presidency and named new directors, associate directors, and members of the Committee on Nominations. We had the highest participation since voting was first held online in 2011. The selected candidates are listed below and in the sidebar at right.

President-Elect Designee

Tee Guidotti will be Sigma Xi's president-elect from July 1, 2015, to June 30, 2016. He will serve as the Society's president from July 1, 2016, to June 30, 2017, then as immediate past president the following year.

Guidotti is a physician-scientist. This year he is the Fulbright Visiting Research Chair at the University of Ottawa, in the Institute for Science, Society, and Policy. His home is in Washington, D.C., where he is a life member of Sigma Xi, affiliated with the chapter at George Washington University. He joined the Society in 1994 at the University of Alberta.

Guidotti is a prolific author and international consultant in environmental and occupational health and sustainability. He is also editor-in-chief of *Archives of Environmental and Occupational Health*.



Image courtesy of Tee Guidotti

At Johns Hopkins University, Guidotti trained in medicine and earned his master's of public health. He also trained in research at the National Institutes of Health. He holds U.S. board certification in occupational medicine and pulmonary medicine.

In his candidate statement, he wrote that Sigma Xi must defend basic science and devise a way to manage scientific integrity without suffocating investigators. He wants to expand the Society's role as a "science academy" to deepen the public's understanding of science, to create more programming on career development in scientific and engineering fields, and to use social media creatively.

For Guidotti's full candidate statement and biography, visit <https://www.sigmaxi.org/teeguidotti>.

Our Next President

The 2013 election tapped Mark Peeples, a professor in the Department of Pediatrics at The Ohio State University, to be Sigma Xi president from July 1, 2015, to June 30, 2016. More on Peeples can be found at <https://www.sigmaxi.org/markpeeples>.

Directors

Directors will serve three years, starting July 1, 2015.

Baccalaureate Colleges Constituency Director
Amy Stockert
Canadian/International Constituency Director
Richard Boudreaault
Northwest Regional Director
Jonathan Clark
Southeast Regional Director
Robert Black

Associate Directors

Associate directors will serve three years, starting July 1, 2015.

Baccalaureate Colleges Constituency Associate Director
Francis Dane
Canadian/International Constituency Associate Director
Digvir S. Jayas
Comprehensive Colleges and Universities Constituency Associate Director
Tieli Wang
Research and Doctoral Universities Constituency Associate Director
Richard Watkins
Mid-Atlantic Regional Associate Director
Richard Bradley
North Central Regional Associate Director
Thomas Lane
Southwest Regional Associate Director
Sang-Hee Lee

Members of the Committee on Nominations

These members will serve three years. Terms began December 9, 2014.

Area Groups, Industries, State, and Federal Laboratories Representative for the Committee on Nominations
John J. Kelley
Comprehensive Colleges and Universities Representative on the Committee on Nominations
Perry J. Kurtz
Research and Doctoral Universities Representative on the Committee on Nominations
Vishnu Nath Kamalnath
North Central Region Representative on the Committee on Nominations
Christopher Fasano
Northeast Region Representative on the Committee on Nominations
Theodora Pinou
Southwest Region Representative on the Committee on Nominations
Miroslav Synek

For these members' statements and biographical information, see <https://www.sigmaxi.org/2014-elections>.

Advice from a Student Research Showcase Winner

In our digital-driven world, young scientists need to build skills for presenting their research online. Sigma Xi runs the Student Research Showcase to prepare them. The showcase is an online presentation competition that will be held March 23–29, 2015. Students prepare websites with a personal video, written abstract, and technical slideshow about their research. They compete in graduate, undergraduate, and high school divisions and the top presentation in each group wins a prize of up to \$500.

The deadline to register and submit presentations is March 16. Students do not need to be Sigma Xi members to participate, but everyone must submit a preliminary abstract for preapproval.

Sigma Xi caught up with last year's graduate division winner, Kathryn Peiman, to get her advice for this year's participants.

What advice would you give to students who are thinking about participating in the showcase this year?

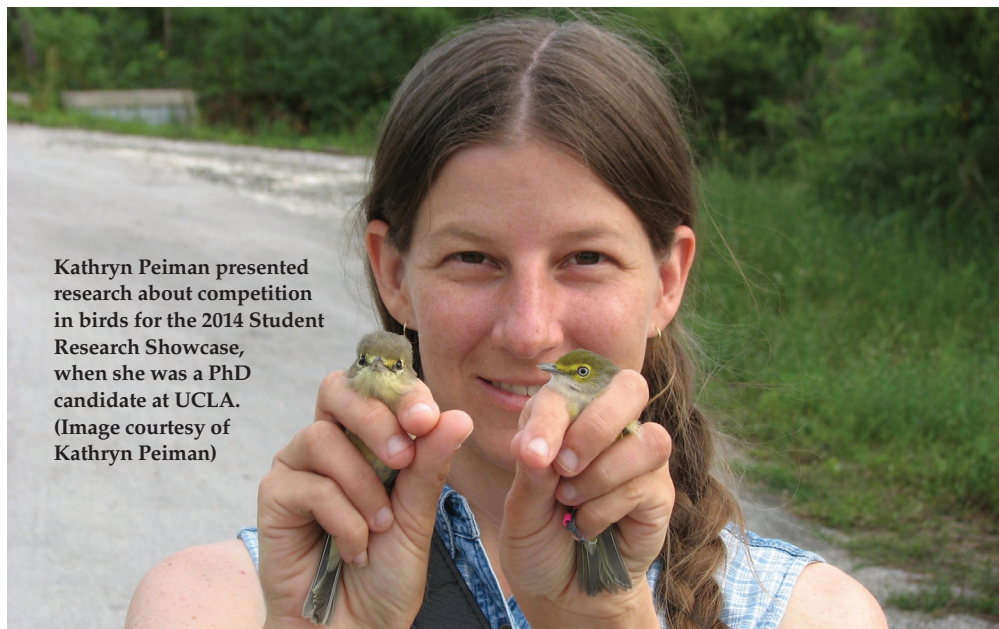
Do it. It's a really good experience. Not only is it something nice to have in your CV, but just the practice to be able to think about your project, both

Volunteer as a Judge

Sigma Xi members are encouraged to volunteer to judge the Student Research Showcase. If you are a member, please email meetings@sigmaxi.org by March 16 with the subject line "Showcase Competition Judge" for more information.

Judging sections include:

- Behavioral Sciences
- Biochemistry
- Cellular & Molecular Biology
- Chemistry
- Ecology & Evolutionary Biology
- Engineering
- Environmental Sciences
- Geosciences
- Math & Computer Science
- Physics & Astronomy
- Physiology & Immunology
- Social Sciences



Kathryn Peiman presented research about competition in birds for the 2014 Student Research Showcase, when she was a PhD candidate at UCLA. (Image courtesy of Kathryn Peiman)

in a small and large scale, to present it in what are really three quite different mediums. The personal video is something that, as a scientist, you don't get a chance to do that often and social media is so important nowadays that those types of interactions are going to become even more important. The abstract: just practicing writing and conveying the important points. And then the technical slideshow, that's usually how we present things at conferences, lab meetings. So all of these methods of communicating are really important.

What was involved in the process of putting together your presentation?

Going through a lot of pictures. [Competition in birds] is obviously a very visual medium to present and so I had to get material together, both pictures and video that I had taken in the field ... One of the tricks is to remember to actually take photos and videos, especially of you doing these things, just to show other people what you're actually doing.

What were the main points that you wanted to get across in your personal video?

My goal with the video was to put [my research] in a much bigger picture. The slideshow and stuff, that's for the details. The [video] I was viewing as showing

people why I was excited about what I was doing. So it's me talking, and hopefully conveying, that I was really excited to do this and that I think it's the coolest thing in the world ... One of my goals is to link it to something they might have experienced before, link it to things that they can see on a day-to-day basis and they don't have to go to my specific study site in the Bahamas and see this bird to be able to actually understand what it is that I'm interested in.

What did you think about the type or the amount of feedback that you got from judges?

That was actually one of the coolest things about this is that I got a lot of really good feedback. Some of it was things that I had forgotten to include that was a "my bad" kind of thing. Other ones were things that I had been thinking about and it was great to just have a discussion with the judges ... it was more of a back-and-forth and it was really nice to have all those people reading and thinking about what I was doing.

For more information on the showcase, visit www.sigmaxi.org/student-research-showcase. Sigma Xi will host Google Hangouts about science communication to help students prepare their presentation sites. See the schedule on the showcase webpage in the 2015 competition timeline.

Members Connect in New Online Community

If you're a Sigma Xi member who paid annual dues or you're a life member, you already have access to the Society's new online community, The Lab: Members to Members. It is a space for discussions with other members about science and engineering. You can login to community.sigmaxi.org by using the email address associated with your membership and creating a password. We invite you to join the conversations!

Below are a few posts from a recent discussion about exoplanets.

From: A Sigma Xi Member
Subject: Exoplanets



Recently the existence of a number of exoplanets has been discovered. Some of those are in the life habitable region of their stars ... I suppose the SETI [Search for Extraterrestrial Intelligence] project is trying to listen for intelligent signals from these planets? The SETI projects looks for signals in the radio and microwave regions of the electromagnetic spectrum. If there are intelligent exos, will they communicate with signals that radiate into space? ... How can we communicate with beings several hundred light-years from us?

From: A Sigma Xi Member
Subject: RE: Exoplanets



Good questions. It is unlikely that our electromagnetic leakage will be detected by alien civilizations. It would require a huge antenna pointed in our direction. On the other hand, for a few billion \$\$ we could construct a solar powered laser array that would be able to send messages to the nearest stars (Gliese catalog). We have never tried communication, just listening. If all races in the galaxy take that approach we will remain incommunicado.

From: A Sigma Xi Member
Subject: RE: Exoplanets



Someone recently hypothesized that Mars evolved into a habitable planet before Earth, evolved life, and seeded Earth through meteorites blasted off the Martian surface. The recent discovery of Martian meteoritic material with organic materials, almost certainly not terrestrial contamination, supports that speculation as does the recent Curiosity rover detection of spikes of atmospheric methane in Gale Crater, possibly generated by methanogens.

From: A Sigma Xi Member
Subject: RE: Exoplanets



Simulation experiments on the biochemical evolution of life suggests that carbon compounds were among the first to show up, but the processes that winnowed them down to 20 alpha amino acids and single stereo-isomers took a long time. Relevant selective forces are difficult to imagine. These experiments also show that proto-biochemical evolution probably ran backwards, i.e. proteins pre-dated RNA which ran the show before DNA. Recent manipulations of prokaryotic nucleic acids suggest that additional, synthetic nucleotides may code for different aa's but I don't know much about them. That may mean that extra-earthly life forms that are nucleic-acid-based may have very different RNAs if not DNAs. Point: carbon compounds in Martian meteorites are to be expected and do not necessarily predict Martian organisms, though they probably contributed to whatever life may have evolved there. Water is important here, but elsewhere? Any methane-based life would be very different from what we've got. Will we be able to recognize it? Autocatalysis is key, and simulation experiments suggest that proteins-only can do it—slowly and with relatively low probabilities. Absent competition, that might be enough.

Chapter Collaborative Platforms Launched

Sigma Xi chapters have been unleashed in the virtual world using Sigma Xi's newest resource, online chapter communities.

"I sent out our first notice and got some pretty positive responses. And it is so easy to use!"

*Dr. James Bidlack,
University of
Central Oklahoma
Chapter Officer*

An online chapter community is an exclusive, customizable collaborative platform that allows members within a chapter to communicate, brainstorm, and strategize chapter matters, 24/7, as well as upload and exchange documents and share event information. For a chapter to promote its events and activities outside of the chapter, there is a portion of the community that can be viewed by the public.

As of this writing, nearly 40 chapters were setting up their communities. Congratulations to the University of North Carolina–Chapel Hill Chapter and the University of Central Oklahoma Chapter for being the first to launch their chapter communities.

Members interested in learning about using social media to promote their chapter may email memberinfo@sigmaxi.org.

American Scientist's January-February 2015 cover story featured NASA's New Horizons' trip past Pluto.

Meet Your Fellow Companion: Holly Haberstroh Ioset

Sigma Xi promotes companionship among researchers so we highlight our members through the Meet Your Fellow Companions series. Holly Haberstroh Ioset is a second-generation Sigma Xi member. She joined the Society in 1977 and currently works for the Occupational Safety and Health Administration as a compliance officer in North Syracuse, New York.

Please explain your field, which is industrial hygiene.

It's not a very well-known field, it's a specialty field in the family of environmental studies. An industrial hygienist focuses on the health of the worker, not the environment. So we're focused on what the exposure is to a worker relating to everything from dust, silica, noise, respiratory hazards, radiation, biological hazards. One of the specialties of an industrial hygienist is monitoring and measuring the contaminants to really determine what the hazard is to the worker.

What made you want to get involved in this field?

I came across it through my hometown of Midland, Michigan, the home of Dow Chemical. After I finished my bachelor's degree in biology, I worked in the toxicology lab at Dow Chemi-



Holly Haberstroh Ioset joined other OSHA employees at the World Trade Center after the September 11, 2001, attacks to monitor the health and safety of recovery workers. (Images courtesy of Holly Haberstroh Ioset)

cal and was surrounded by a group of very interesting scientists. There, I came across this field of industrial hygiene which I thought was neat because it involved the science of toxicology, research investigation, but you also get out into the real world. You go to the workplace to do these investigations so it's not really a lab job, usually.

You helped at the World Trade Center after the September 11, 2001, attacks. Can you talk a little bit about that?

I had just started with OSHA. I had previously been with Syracuse University for many years as an industrial hygienist and the month after I switched to OSHA, the World Trade Center was attacked. I had the opportunity, as did many of the compliance officers, to go and serve at the World Trade Center as health and safety monitors. We did air testing, we trained people on how to use protective gear and respirators. We walked out there on the pile and advised people doing testing, hands-on out there where people were working on the recovery. And it was a life-changing event. It helped me understand that we, the United States, had been attacked and that truly was a war zone. The devastation was amazingly huge beyond what you can imagine until you've walked across that pile of rubble. But it also made me very, very proud to be doing what I do, proud to be serving the worker and trying to keep the workers, the recovery workers, safe during that hard job they were doing.

This is an industry that you returned to after you took some time off to have kids. How much time did you take off and what was it like for you to come back to the workforce?

I had been with OSHA early on in my career. My baby girl was due. I was actually on limited duty for a while, as you can imagine. I wasn't out there in the workplaces with the contamination and the uncertainty. So during my pregnancy, I had limited duty. Then after, I got into this new role. I realized I needed to take some time off. I had the desire and the need to be there, taking care of my little one. So I took six years off. I was not working in in-



dustrial hygiene for that many years. And it was a little scary. I wasn't sure how my re-entry into my field would go. But I started looking and a terrific job came along that suited my background perfectly. So I jumped in, went back to full-time work, and it took a little while. I would say the first couple months I felt just a little ... I didn't remember all the terminology and I was a little rusty. But it can be done, ladies—and dads and moms.

How did you come to know about Sigma Xi?

My dad, well both my parents, were scientists. My dad—they're gone now—but he was a chemical engineer, PhD. My mom was a doctor. My dad worked in chemical engineering research for many years and he had been a member of Sigma Xi through his career. And I came across Sigma Xi's magazines, *American Scientist*, and even in junior high and high school I would read the magazine. I just loved it. To this day, I love reading about all the disciplines, the new cutting-edge discoveries and technologies. But it's the warmest memory of my father because he was a true scientist. He traveled the world for Dow Chemical, trouble-shooting, opening new chemical engineering factories and plants. I'm proud of what he did and I'm proud of his scientific mind.

Are you interested in being interviewed for our Meet Your Fellow Companion series? Please contact us at memberinfo@sigmaxi.org.

Meet Your Fellow Companion: Magesh Thiyagarajan

Magesh Thiyagarajan is a Sigma Xi member who is an associate professor of engineering at Texas A&M University–Corpus Christi. He is the director of the university's Plasma Engineering Research Lab, where he leads research involving cold plasma. He joined Sigma Xi in 2008.

Can you start by explaining what cold plasma is?

Cold plasma is nothing but plasma in near-room temperature. Plasma itself is nothing but an ionized form of a gas. We traditionally know the three phases of matter: solid, liquid, and gas, based on how much energy that you feed into it. And when we add more energy to gas, they reach an excited state and from there it reaches an ionized state. So plasma is a collection of ionized particles, such as electrons, ions, and some of the gas particles itself.

One of the projects that you're working on with cold plasma is to fight cancer. Please explain how cold plasma is used to fight cancer.

We had been working on cold plasma and seeing their biochemical properties, working with microorganisms and so on. We've also been very aware that the cold plasma produces reactive species. So while exploring the cancer research we found that some of the cancer cells, they actually require these reactive species for them to go through a self-induced death process, known as apoptosis ... So when we explored it, we actually found that with a certain amount of plasma exposure, or a certain amount of reactive species exposure, the cancer cells can actually choose to go through an apoptotic method. And when we have, of course, prolonged exposure or over-exposure, the cancer cells go through a necrotic process, which is a sudden destruction of cell structure ... We could actually begin to see these cancer cells go through this apoptotic, or self-induced, death process in 24 hours or 48 hours.

Sigma Xi Today is edited by Heather Thorstensen and designed by Spring Davis.

What would be some of the benefits of treating cancer with cold plasma rather than using more traditional methods?

One challenge with the existing technologies is the severity of the treatment itself, such as the radiation and chemotherapy. It can be very harsh on the patients due to the overexposure or full exposure of the human body ... However, cold plasma is more localized and it doesn't expose other tissues or the overall body itself, where you may impact lots of healthy cells through the treatment.



Image courtesy of Magesh Thiyagarajan

Another medical application that you're working on with cold plasma is infections. How are infections and cold plasma related?

It also requires a similar reactive species that the body itself generates for healing purposes. When the cold plasmas, which produce a similar reactive species, is supplied externally around the wounds, it does two things. One is it sterilizes the area by killing any potential bacteria that may be present which could actually further worsen the wound. So when we clear the area with cold plasmas, then the cold plasma-supplied reactive species also aides the wound to accelerate the healing process by absorbing the externally supplied reactive species and it also triggers some other biochemical reactions for these cells to send signals for asking for more species for tissue repair.

Other researchers are working on cold plasmas. What is the unique part about your project?

We develop cold plasmas with atmospheric air so they don't require an additional supply of gases as an operating supply. And we try to make it as portable as possible for other military-related applications [such as wound healing].

Food sterilization is another area that you're working on with cold plasma. Is that very similar to the wound healing, where you're using the cold plasma to remove the bacteria?

The principle of operation is similar but with a different mechanism. The cold plasma produces the reactive species. They also have the tendency for reacting with bacterial cell surfaces as well as their functioning itself. So once you rupture the cell surfaces as well as their functioning mechanisms, you could actually kill colonies of bacteria in a very, very short period of time.

To learn about Magesh's research on laser-induced plasma, see his demonstration of cold plasma devices, and watch videos about the Plasma Engineering Research Lab, visit <https://www.sigmaxi.org/news/meet-your-fellow-companions/magesh-thiyagarajan>.