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Sigma Xi Today

A NEWSLETTER OF SIGMA XI, THE SCIENTIFIC RESEARCH HONOR SOCIETY

Award Nominations Deadline

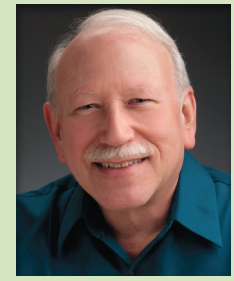
The public may submit nominations by December 1 for Sigma Xi's 2019–2020 prizes and awards program, which recognizes major achievements in science, engineering, and science communication. Most awards include an honorarium and an invitation to present a lecture at the Sigma Xi Annual Meeting. To submit a nomination for the following honors, see www.sigmaxi.org/awards.

- The **William Procter Prize for Scientific Achievement** is presented to a scientist who made an outstanding contribution to scientific research and demonstrated an ability to communicate this research to scientists in other disciplines.
- The **John P. McGovern Science and Society Award** is for an individual who has made an outstanding contribution to science and society.
- The **Walston Chubb Award for Innovation** honors and promotes creativity among scientists and engineers.
- The **Young Investigator Award** recognizes excellence in research by an active member of Sigma Xi within 10 years of his or her highest earned degree.
- The **Evan Ferguson Award for Service to the Society** recognizes outstanding service to the Society and its mission.
- **Honorary Membership** is given to distinguished individuals not otherwise eligible for membership in Sigma Xi and who have served science, or the Society, in a manner that deserves recognition.

Sigma Xi Today is edited by Heather Thorstensen and designed by Justin Storms.

From the President

Defending the Scientific Process



Joel Primack

Will key theories of modern science, including Darwinian evolution in biology and Einsteinian relativity in physics, survive future discoveries? Some people think such survival is impossible, because they believe that new scientific theories always overthrow the previous theories. This misunderstanding has been fostered in part by a famous book first published in 1962—Thomas Kuhn's *The Structure of Scientific Revolutions*, which argued that scientific research proceeds for long periods of time within a certain manner of thinking (a "paradigm"), until too many pieces of evidence have turned up that are unexplainable or even paradoxical. Then suddenly there is a great leap (a "paradigm shift"): The old theory is abandoned for a new theory that explains much more, and the old paradoxes disappear. The concepts of the new theory are so different from the concepts of the old one that they are "incommensurable," because the implicit assumptions have changed. For example, after the Copernican Revolution, when scientists abandoned the idea that the Earth was the immovable center of the universe, the Earth became a planet and the status of the Sun and Moon changed. The old theory was overthrown and never again taught as science.

Kuhn, whose first book was on the Copernican Revolution, appears to have assumed that all scientific revolutions are like that one. His argument implies that no scientific theory can ever be considered true, because it will eventually be overthrown by a bigger and better theory. Because the new theory will eventually be overthrown in its turn, it is ultimately no truer than the old one (even though it is temporarily more useful), so it is questionable whether science actually progresses; perhaps it just keeps changing.

But revolutionary scientific theories do not have to overthrow their predecessors except in the earliest stage of a science, when a scientific theory is replacing earlier ideas that were not well supported by evidence. Once a field of science undergoes the revolution that creates for it a solid intellectual foundation—like the ones that Newtonian mechanics gave physics and Darwinian evolution gave biology—that foundational theory can stand forever. Science then progresses by encompassing the foundational theory in a new and larger theory that explains things beyond the ken of the older theory. An encompassing theory does not overthrow the older theory—instead, it defines the limits within which the older theory is reliably true. Science does not simply toss one theory out for another: it makes real progress toward ever-larger truths. But there is a built-in enforcer of humility in science: We cannot regard something as true until we know about something bigger.

Have you encountered science skeptics who say that scientific research can't be trusted because its theories are constantly changing? If so, what has been your response? Let me know at executiveoffice@sigmaxi.org.

Joel Primack

Members To Elect Sigma Xi's Future President

This fall, Sigma Xi members will choose one of three president-elect candidates to serve a three-year term on the Board of Directors, including a year as president from July 1, 2020, to June 30, 2021. Active members may vote online from October 29 to November 27. The following are abbreviated versions of the candidate statements. For more information about the candidates and voting instructions, see www .sigmaxi.org/2018elections.

Audeen W. Fentiman, Crowley Family Professor in Engineering Education at Purdue University

Scientific research by Sigma Xi members and their colleagues affects the quality of human life around the globe—as well as the health of the planet itself. More effectively addressing the challenges human society faces requires two related changes: 1) more research and 2) more people becoming aware of the research and recognizing its importance. Sigma Xi is well positioned to be central to both of those endeavors through an active partnership between its leaders and the 500 local chapters. I am committed to working with Sigma Xi chapters and members to take significant strides toward those changes. We can accomplish these goals by 1) inspiring, encouraging, and mentoring young researchers and 2) designing targeted programs through which Sigma Xi members help students, teachers, citizens, the media, and elected officials understand the importance of science in their daily decisions.

George Perry, Chief Scientist, Brain Health Consortium; Semmes Foundation Distinguished University Chair in Neurobiology at University of Texas at San Antonio

Sigma Xi must be at the center of scholarly debate on behalf of science in this greatest period of questioning science in generations. Creationism and global warming are just the beginning of a long list of subjects that must be informed by scientific data rather than beliefs from either side. As the leading scientific honor society, Sigma Xi needs to advocate to both scientists and nonscientists that while many of us live most of our life based on belief, that is not scientific truth. Science is fundamentally based on and is subject to observation. Sigma Xi must prevent a return to the dark ages of truth dictated by authority. Success in this area requires greater outreach to nonscientist policy leaders to explain the value of science to society. Greater inclusion of women, minorities, youth, and policy opinion makers in Sigma Xi's leadership is essential.

Sonya T. Smith, Professor in the Department of Mechanical Engineering at Howard University

The most important role for the next Sigma Xi president is to communicate the importance of science-driven policy for the well-being of our planet and its inhabitants. Sigma Xi has an essential role in promoting the value of research and its benefits to the citizens of this country and to the global community. Sigma Xi has produced policy reports on critical issues in science such as water (2008), energy (2009), and food security (2010). … We now have an opportunity to revisit these issues in light of emerging threats. … I will be a Sigma Xi president who can effectively communicate the importance of scientific research to a variety of global communities and constituents. … My record shows that I have been able to raise funds for research projects and transformational initiatives. These projects involved both national and international partners. ...We must support an inclusive research environment.

Grants-in-Aid of Research Award Recipient Profile

Sigma Xi's Grants-in-Aid of Research program awards research grants to undergraduate and graduate students. Application deadlines are March 15 and October 1 annually.

Simona Augyte

Grant recipient: Simona Augyte

Grant awarded: Spring 2015 application cycle

Education level at the time of receiving the grant: PhD candidate

Project results:
The results of this project show that the endemic kelp is undergoing incipient speciation and is a population that is distinct from the regular sugar kelp, *Saccharina latissima*. The kelp was given a new name designation of *Saccharina angustissima*.

How this project influenced her as a scientist:
"It allowed me to delve into the field of molecular biology and answer intriguing questions about the evolution of kelps by the colonization of an extreme habitat. I also had a chance to do field work in remote parts of coastal Maine on islands and ledges exposed to high wave action. Overall, I am excited to continue researching marine macroalgae and the ecological parameters that shape their physiology and evolution."

Where is she now?
In 2017, Augyte received a PhD from the Department of Ecology and Evolutionary Biology at the University of Connecticut. She is currently a postdoctoral fellow in the same department and is working on kelp breeding and genetics for off-shore biomass production funded by the Department of Energy's ARPA-e Macroalgae Research Inspiring Novel Energy Resources program. She is also pursuing several other research projects that look at ecosystem services provided by sustainable aquaculture on near-shore environments. She and her collaborators published research that stemmed from her Sigma Xi-funded project in the *Journal of Applied Phycology* in 2017 and in *Phycologia* this year.

STEM Education and Human Rights

Sigma Xi is a member of the American Association for the Advancement of Science's Science and Human Rights Coalition, a network of organizations for scientists, engineers, and health professionals devoted to communication and partnership on human rights. In honor of Human Rights Day on December 10, let's take a look at what the coalition discussed in 2018.

Science, Technology, Engineering, and Math (STEM) Education
In January, the coalition discussed whether broader integration of human rights topics into STEM teaching would improve learning outcomes, retention, and diversity while maintaining rigor in the teaching of core STEM content. Topics already taught in some STEM courses include voting and accessibility, accessibility and education, environmental justice, economic justice, and migrant choices. Known challenges of including human rights in curricula include accusations of politicizing education. Opportunities include gaining students' attention by talking about issues that have a social purpose and are relevant to their communities; such conversations may attract and retain students who are underrepresented in STEM, including women.

Higher Education and Human Rights
In July, the coalition addressed what colleges and universities currently do, can do, and should do to advance human rights. Speakers focused on issues faced by many institutions, such as addressing harassment on campus; protecting scientific and academic freedom on globally connected campuses; supporting scientists, engineers, and other scholars displaced by conflict; and providing equal and inclusive access to STEM education. Sigma Xi member Jeff Toney presented an invited lecture, "Protecting Human Rights Internationally."

The coalition plans to highlight the human right to science for its 10th anniversary celebration next year.

At the July 2018 coalition meeting, Sigma Xi was represented by member Jeffrey Toney, who is provost and vice president for academic affairs at Kean University, and by a Sigma Xi past president, Tee Guidotti, who is a consultant in health, safety, environment, and sustainability.

New Format for Sigma Xi's Annual Meeting and Student Research Conference

The program for the 2018 Sigma Xi Annual Meeting and Student Research Conference, which will be held October 25 through October 28 at the Hyatt Regency San Francisco Airport hotel in California, has expanded. The business meeting, award lectures, and student research poster competition that have constituted the program in recent years will still be offered. In addition, this year the Society is inviting its members, affiliates, student explorers, and the public to attend symposia and sessions on science communication, the ethical conduct of research, and professional development, as well as a demonstration by the analytics software and services company SAS. These activities will make the meeting more enriching personally and more beneficial professionally. Listed below are examples of the sessions that will be offered.

Tools for Communicating Science

Increasing Data Literacy and Building Science Communication Skills—The Biodiversity Literacy in Undergraduate Education Data Initiative
Lisa D. White, assistant director for education and public programs at University of California Museum of Paleontology, University of California, Berkeley; Anna K. Monfils, professor, Department of Biology, Central Michigan University

Challenges of Sharing Data in Long-Distance Collaborations
Allen Thomas, associate professor of organic chemistry, University of Nebraska at Kearney

Ethical Conduct of Research

Big Data Challenges from Total-Body Positron Tomography to Explore Addiction, Schizophrenia, and Other Diseases
Thomas F. Budinger, professor in residence emeritus, Department of Electrical Engineering and Computer Sciences, University of California, Berkeley

Big Data Ethics: From Writing Code to Coding Rights in an Era of Intelligent Machines
Kenneth W. Goodman, professor and director, Institute for Bioethics and Health Policy, University of Miami; codirector, University of Miami Ethics Programs

Professional Development

How to Survive and Thrive in a Research Career
Chris Olex, corporate trainer and facilitator, The Point; C. Susan Weiler, senior research scientist, Whitman College

Frank Summers

Grant-Writing Workshop
Emma Perry, professor of marine biology, Unity College

Symposium on Big Data in Biology and Medicine

The Importance of Diversity in Big Genomic Data
Dana C. Crawford, assistant director for population and diversity research, the Institute for Computational Biology; genetic epidemiologist and associate professor in the Department of Population and Quantitative Health Sciences, Case Western Reserve University

Network Approaches Identify Brain Regions and Gene Hubs Associated with Genetic Predisposition for Methamphetamine Intake
Ovidiu D. Iancu, research assistant professor, Department of Behavioral Neuroscience, Oregon Health and Science University; Veterans Affairs Portland Health Care System

Symposium on Big Data in Climate, Energy, and the Environment

The Fourth National Climate Assessment: Translating Data to Inform Decisions
David Reidmiller, director, National Climate Assessment, U.S. Global Change Research Program

Reduction of a Manufacturing Plant's Electricity Demand During Grid Consumption Peaks with an Energy Storage System Managed by Neural Network–Based, Big Data–Fed Demand Forecast and a Decision Model
Richard Boudreault, chairperson, Sigma Energy Storage

Symposium on Big Data in Physics and Astronomy

Big Data and Theoretical Astrophysics
Fred Adams, Ta-You Wu Collegiate Professor of Physics, University of Michigan

From Supercomputers to the IMAX Screen: Cinematic Scientific Visualizations.
Frank Summers, senior visualization scientist, Space Telescope Science Institute

SAS Demonstration

SAS Viya Data Mining and Machine Learning is a new product from SAS that showcases a rich set of data mining and machine learning capabilities.

For the full agenda, see www.sigmaxi.org/amsrc. Save the date for next year's meeting: November 14–17, 2019, in Madison, Wisconsin.