

Sigma Xi Today

From the President

Elevating Scientists, Science, and Scientific Understanding—Stepping Up

Sigma Xi members are joules. They are the apotheosis of scientific power and energy. They are a formidable force. Brought together as companions in zealous research, as The Scientific Research Society, they have the potential to effect an epic shift in how science is perceived—by bringing science into a place of high regard, esteemed by youth, by their parents, by policy makers, and by the general public. To shape a world view that respects and values science is a most noble and admirable accomplishment.

This is only possible when those who have been recognized for their contributions to science in turn recognize their peers and when the sum of all those so honored become a leveraged voice for science.

You, distinguished member, have been heralded and the Society treasures your participation in this community that honors science with such distinction. Now, a question for you: Have you accorded your colleagues that same opportunity? How many of the admirable scientists and engineers in your world have you nominated to membership?

This is what we do for each other—lift each other up to a higher level. When we do this, we are lifting science up to a higher level.

In today's world, we are co-creators. Social media has enabled us to create content that is constantly unfolding, being reimagined and rearticulated in communal space. Scientific researchers can claim that space in transformative ways. We can elevate scientific discourse, and this is a hallmark of Sigma Xi. We can contribute stimulating ideas because this is who we are. We can ensure integrity in science because ethics is our banner. We can bring diversity in thinking because we are multidisciplinary. We can bring a wellspring of possibilities for the future because our mission is to nurture the next generation. We can bring gravitas because we have more than 200 Nobel Prize winners who are members.

Sigma Xi is endlessly working to make the power of each of you an unstoppable critical mass in defining the future of science and the role of scientists and engineers in society. There is a vital role for you to play in partnership with this venerable organization as it extends the radius of appreciation for, and understanding of, science. Keep adding to the numbers of the membership and continue to renew your own membership! You are jewels and we treasure you.

Linda Meadows



SAVE THE DATE

Annual Meeting and Research Conference Will Be in Arizona

Sigma Xi's Annual Meeting will be held November 6–9, 2014, at the Renaissance Glendale Hotel in Glendale, Arizona. This is the largest opportunity of the year for members to network and support student researchers. Chapter delegates will attend energizing workshops. Additionally, everyone hears from the 2014 award winners and honorary members.

The International Research Conference, held November 7–8 during the Annual Meeting, offers college and high school students an opportunity to share their research with respected research professionals. Members may volunteer to judge or present their research.

Registration for both events opens August 1.



A 2013 research conference participant discusses his presentation.

The Work of David Rosner

David Rosner uses history to help people and doesn't shy away from testifying in court to do so. He is the 2014 recipient of Sigma Xi's John P. McGovern Science and Society Award, which is given to those whose work transcends their career as a researcher. Rosner has been involved with lawsuits to hold industries accountable for harm they've caused by exposing people to toxins such as silica sand, lead, and asbestos. His books include *Lead Wars: The Politics of Science and the Fate of America's Children*, which he coauthored with Gerald Markowitz. Rosner works at Columbia University's Mailman School of Public Health, where he is the Ronald H. Lauterstein Professor of Sociomedical Sciences. He is also a professor of history and co-director of the Mailman School's Center for the History and Ethics of Public Health. He became a Sigma Xi member in 1977. He is also an elected member of the Institute of Medicine.



What drew you to public health?

Of course, I'm a child of the '60s, meaning that I entered college thinking that science was inherently a force for good. By the end of the '60s, our image of what chemistry was, and what technology could do, were sullied by our experiences in Vietnam. I actually flirted briefly with becoming a chemistry major and remember all too well when my flirtation ended. As a junior at City College of New York when entering my introductory chemistry lecture, I was confronted by a picket line and a friend of mine carrying a picket sign. The sign had a question mark after DuPont's famous slogan, "Better Living Through Chemistry," and a picture of a village burning, ostensibly from a napalm attack.

It was then that I became deeply concerned with the "ethics" and the history of science. I became a psychology major, thinking that this major combined a scientific methodology with deeply humanistic concerns. By the time I graduated, I came to believe that the issues of public health and psychology were intimately connected after working in a research unit with the New York State Department of Mental Hygiene. So many of the children were suffering from issues that were not solely "psychological," as I then understood them, but from basic public health problems.

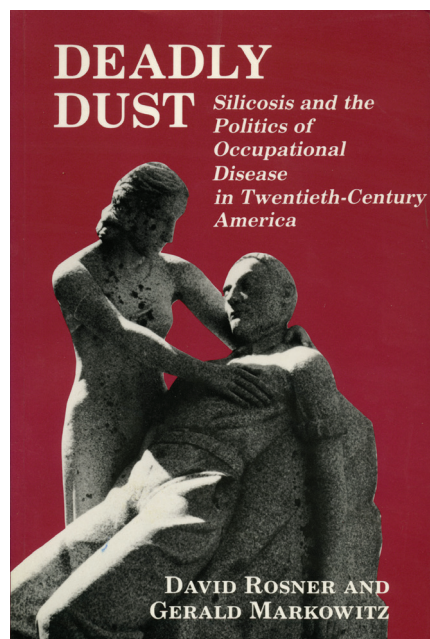
Public health seemed to be a field that could combine good science, great public service, and incredible humanity when properly applied. I became interested in health and society, how disease is a product not just of "natural" process but of the worlds we build and the inequities that are all too often the root of the problems our people face.

There are few fields where you can see such immediate and important outcomes to your technical and scientific work. The field is so rewarding for it is so broad in its approach, whether it be its concrete role in providing pure milk to children, developing systems for the distribution of pure water, or the social science research needed to properly help communities develop strategies to empower themselves to protect themselves from disease. I went back to graduate school at Harvard where my professors encouraged me to try to join history of science and public health and that's been my goal since.

Your first case in court was to testify on behalf of a migrant worker who had silicosis after working with silica sand. What was it like for you to expand your role as a historian to one of a "public expert?"

I'll never forget the experience of meeting the family of a very sick Mexican worker who had worked in the oil fields near Odessa, Texas. He had been hired to clean out the huge storage tanks. He had been sent into the tanks with sandblasting equipment but virtually no personal protection or proper ventilation to blast the tank to clean off old oil residue. I had recently coauthored, with Gerald Markowitz, *Deadly Dust* and was waiting to testify in a trial in which I was going to tell of the long history of knowledge about silica's dangers. It was my first time testifying.

In the area outside the courtroom, the worker's wife and children gathered around me, thanking me for testifying for her husband and their father. It was heartbreaking, for it was going to be a hard case to win, as the exposure was so long before (probably 25 years by that point) and the companies had an extremely well-financed set of lawyers. Further, the jury was almost completely Anglo in an area where migrant workers were not very welcomed. But the family wanted a "voice," so their relative's life would not go unnoticed or his life deemed worthless. They were just telling me that they were grateful that I, a professor from far-away New York, would come to this distant place to acknowledge their husband's and father's suffering.



It was then that I knew I was willing to enter court and to share my knowledge and expertise if asked. It seemed to be my social and professional responsibility to diseased workers, poisoned communities, and future generations of children. Since then Jerry and I studied other industries, such as the plastics (*Deceit and Denial*) and lead industries (*Lead Wars*), and these books too have led to participation in various court cases. I have been particularly proud of my and Jerry's role in a recent California court decision. The court has ordered the lead pigment industry to put \$1.15 billion into a fund to pay for removing lead paint from the walls of tens of thousands of California homes. I'm so proud of the role my historical work played.

What have you learned about effective research communication?

Scientists and scholars have to realize that they are a deeply human social resource, a resource for all of our citizens, and that honestly explaining what scientists do is more than just a sideline of their work. We know that without public support, we won't have the funds to do our jobs. But more importantly, we have to understand how much we owe to our communities and how much we have to give back for their faith in our work. When we truly understand this responsibility, we will undoubtedly find it within ourselves to communicate its importance to our fellow citizens, through our written, oral, and personal actions.

How does history shed light on the question of who should be held responsible for occupational disease—public health agencies, government, labor, or industry?

We have been in a centuries-old debate over the responsibilities for risk and danger in American society. In earlier times, we asked, should the "master" be responsible for taking care of "their" servants, whether they be serfs or slaves? Thank goodness we "settled" that debate by the end of the nineteenth century with the ending of slavery and serfdom in most of Europe. With the development of market capitalism, we seemed to settle on the idea that with freedom came the "assumption of risk" by those who were em-

ployed. And with industrialization, we began to understand that workers could not "assume" the risks of a job when they lacked both the information and technology to do so. There was a responsibility that extended to the employer because it was the employer that controlled the pace of work, the type of work, the equipment that workers had to work with. Our experience with silicosis, in part because of its long latency, help frame the questions we now face about environmental and occupational chronic conditions. How do we apportion responsibility for chronic diseases in the new industrial worlds we have created? We have questions that resonate with the issues we now confront regarding cancer, heart disease, stroke, and other conditions that are killing us today.

What do you think most people would be surprised to learn about the history of occupational disease?

I think most people would be surprised by how many people have sacrificed so much for our long experiment with industrial production. Undoubtedly, our 150-year-long experience with industrial production has provided enormous benefits and gains for us as a society. But, we owe a lot to the millions of workers and their families who have sacrificed so much in life and limb. I think the study of this experience may humble most.

What is your current research project?

I'm writing a history of disease that puts

the human decisions front and center. I'm playing around with two titles: *Building the Worlds that Kill Us* is one. The second title is *The Un-Natural History of Disease*. Both capture the goal of the book, which is to emphasize that our decisions on how we construct our societies—both physically and intellectually—determine in great measure what diseases and disabilities we will die from. It will look at disease as emblematic of the worlds we build. For example, how did we create urban conditions that made cholera, tuberculosis, and other infectious diseases "emblematic" of nineteenth-century American life? How did our experience with the new industrial age feed a new set of diseases and concerns? Or, what is it about our new synthetic worlds that may lead to new problems, from endocrine disruptions and epigenetic conditions not yet identified?

Sigma Xi encourages its members to use their skills to support human rights. What advice do you have for researchers who want to get involved with human rights issues?

Oh my. It is hard to miss the opportunities we have. So many of our concerns from global warming through the impact of poverty on the health and well-being of people around the world are, or should be, the obligation of all Sigma Xi members to address.

Read the full interview with David Rosner at <http://www.sigmaxi.org>.



David Rosner was an expert witness in a 2013 California lawsuit. In the end, the judge called for some paint companies to pay more than \$1 billion so lead-based paint can be removed from California homes.

Science and Human Rights: A Bridge Towards Human Dignity



Jeffrey H. Toney

Each of us wants our research to ultimately make our world a better place, to benefit society. An emerging field bridging science and human rights offers many opportunities for scientists, engineers, and human rights organizations to work together towards their mutual interests.

The goal is simple, compelling, and profound: “recognition of the inherent dignity and . . . the equal and inalienable rights of all members of the human family is the foundation of freedom, justice and peace in the world” as stated in the United Nations Universal Declaration of Human Rights.

Human rights organizations embrace enormous challenges of documenting human rights violations across the globe. They have benefited greatly from a scientific approach. A recent example is Amnesty International USA working with a forensic anthropologist and a digital image analyst to identify conflict regions in Syria. Physicians for Human Rights found the cause of an outbreak of cholera in Zimbabwe to be the centralization of the water system by their own government.

Sigma Xi is a member of the American Association for the Advancement of Science (AAAS) Science and Human Rights Coalition that collectively reaches well over 1 million scientists and engineers. Sigma Xi members are encouraged to contribute to human rights issues.

One opportunity is an AAAS initiative, the On-call Scientists program. It seeks volunteers who have scientific and engineering expertise and links them with human rights organiza-

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tions. You could also contribute to the coalition’s working groups, which are focused on the welfare of scientists; ethics and human rights; service to the STEM community; service to the human rights community; and education and information resources.

Since the launch of the coalition in 2009, members have been working to help the United Nations clarify and bring to life the meaning of the right to “the benefits of scientific progress.” This right is recognized in Article 15 (1)(b) of the UN International Covenant on Economic, Social and Cultural Rights.

The coalition’s efforts recently culminated in a report to the UN. It could lead to a general comment articulating the meaning and steps towards implementation of Article 15 (1)(b). For the 160 UN member states that have ratified this treaty, this could shape global public policy, ultimately obligating UN members to fulfill promises to give their citizens access to science and technology that we take for granted. If achieved, this could be the stone plopped into a still pool, creating ripple effects such as helping people achieve their potential through better education, access to clean water, electricity, more nutritious food, and healthcare.

I invite you to become part of this mission.

Jeffrey H. Toney is a representative of Sigma Xi on the AAAS Science and Human Rights Coalition. He is also the provost and vice president for Academic Affairs at Kean University in Union, NJ. More about the coalition may be found at <http://www.aaas.org/program/science-human-rights-coalition>.

Partnership Fuels Sigma Xi’s New Pre-Collegiate Journal

At the 2014 USA Science & Engineering Festival, held April 23–27 in Washington DC, Sigma Xi was pleased to announce a signed partnership agreement with the National Consortium for Specialized Secondary Schools of Mathematics, Science, and Technology. The consortium fosters, supports, and advances the efforts of specialized schools whose primary purpose is to attract and academically prepare students for leadership in mathematics, science, and technology.

The consortium consists of approximately 100 institutional members (secondary schools), representing nearly 40,000 students and 1,600 educators. These are joined by more than 75 affiliate members (colleges, universities, summer programs, foundations, and corporations) who share the goals of transforming mathematics, science, and technology education.

Sigma Xi’s new pre-collegiate journal, *Chronicle of The New Researcher*, is launching in May of this year and can be found at <http://www.cnr.org>. The alliance with the consortium will ensure that submissions to the journal will include broad representation of the nation’s most outstanding pre-collegiate research and provide teachers with an unprecedented partnership with Sigma Xi, including its chapters and members at large, for their own support for STEM programs. *Chronicle of The New Researcher* received seed funding from DIRECTV, as a part of their Corporate Citizenship program to enrich the educational experience of students within STEM.

Sigma Xi members may become mentors/reviewers for *Chronicle of The New Researcher*. If interested, please contact Dr. Richard Wiggins at managingeditor@sigmaxi.org.



Meet Your Fellow Companion: Darko Cotoras

Sigma Xi's motto is the Greek "Spoudon Xynones," or "Companions in Zealous Research." With that thought in mind, we like to highlight "Fellow Companions" to learn more about their work and what the honor of induction to Sigma Xi has meant for their careers. Chile native Darko Cotoras (SX 2011) is fascinated by natural history, evolution, and biodiversity. For his PhD in integrative biology, he is studying how spiders in Hawaii and other places have diversified over time.

Do you have a particular teacher who inspired your love of science?

My parents are microbiologists. They have been a huge, positive influence to get me interested in exploring the natural world. I have learned from them that the social recognition of your work shouldn't be in the center of your attention. Instead, developing good science and your contribution to create a better world should be always on the horizon.

What is your current research project?

Currently, thanks to a Fulbright/CONICYT scholarship, I am working toward a PhD in the Department of Integrative Biology at the University of California, Berkeley. I am studying the temporal dynamic of the adaptive radiation of the *Tetragnatha* spiders in the Hawaiian archipelago. This genus evolved more than 60 species in less than 5 million years. Taking advantage of the different ages of the islands, it is possible to examine different stages of the diversification process.

The questions that drive my research are: (1) How does a radiation get started? (2) What are the posterior

changes in the number of lineages and morphological variation?

I am using the *Tetragnatha* spiders as a system to test: (1) the effects of the volcanic history of the Big Island on the genetic and morphological variation, (2) evidence for past speciation processes in the Maui Nui complex, and (3) the biogeography and diversification patterns of the *Tetragnatha* spiders from different remote archipelagos in the Pacific Ocean.

I am also doing studies on endemic spiders from the Juan Fernández archipelago and characterizing the spider community of Easter Island.

This work aims to provide evidence of how explosive diversifications develop through time.

Has Sigma Xi helped your career?

Absolutely! I got research funding from its Grants-in-Aid of Research program, which I used for my PhD fieldwork in the Hawaiian Islands. Working on Hawaii is extremely expensive. The economic support of Sigma Xi allowed me to accomplish an important part of the most expensive logistics of collecting samples. Among those activities were taking a helicopter and renting a four-wheel-drive vehicle for several days. Without that economic support, I wouldn't have been able to get those samples.

What advice do you have for young people who wish to work in your field?

The most useful advice that I received was: "Be honest to yourself and enjoy what you do." The study of natural history is one of the most beautiful and rewarding activities. However, it can be an extremely difficult path to follow. Many times you will find yourself pretty much alone trying to pursue something that not many other people or funding agencies care about. This is



not because that aim is irrelevant, but because not many people will appreciate it. Many people will still not be able to understand the value of these new discoveries. It becomes important to remember what really matters to you as a scientist and stick to that.

What advances do you see in your field of research over the next 125 years?

It is alarming how common it is to see biologists who haven't ever seen their organisms. I have felt how the pure description of the natural world tends to be left behind. It seems to me that it has been replaced with an "obsession" with new technologies.

I hope that in the next years new technologies and techniques will be appreciated but not overrated. If not, I think in the next 125 years the only species that we will know something about are the ones that live in the lab.

Read the full interview with Darko Cotoras at <http://www.sigmaxi.org>. Click on "About Sigma Xi," then "News," then "Meet Your Fellow Companions."



Meet Your Fellow Companion: Jayalakshmi Govindan

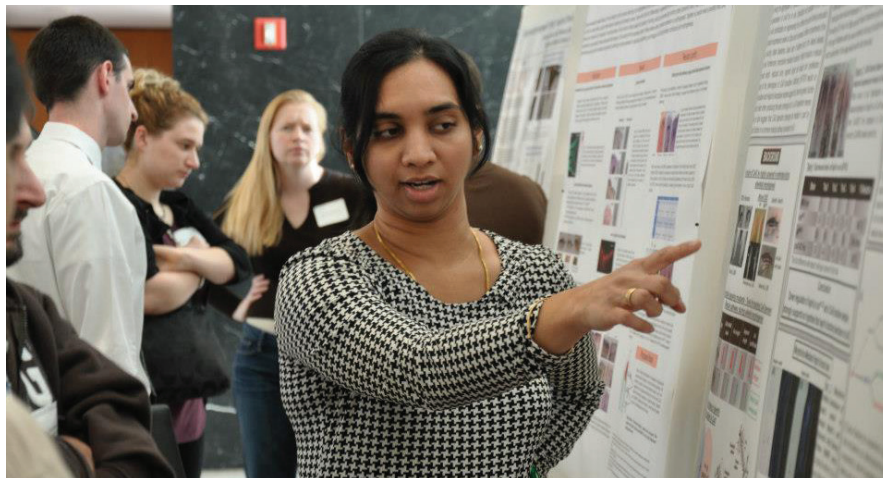
As a doctoral student, Jayalakshmi Govindan (SX 2013) is investigating how zebrafish regenerate their fin skeletons in the hopes of one day making this type of bone regeneration possible for humans.

Tell us about your background.

I received my master of science and master of philosophy degrees in microbiology in India. Currently, I am a fourth-year graduate student in the Department of Biological Sciences at Lehigh University in Bethlehem, Pennsylvania. I am pursuing a PhD in the field of molecular biology. In my lab, we study the role of Cx43 (a gap junction protein that facilitates direct cell–cell communication) during bone regeneration and skeletogenesis. We use zebrafish as a model system for its remarkable ability to regenerate several of its body parts, including the tail fin. Mutations in the *cx43* gene results in reduced tail fin length in zebrafish. Interestingly, mutations in human *CX43* also result in defective skeletal morphogenesis, revealing that the function of Cx43 is highly conserved. We are interested in understanding how defects in gap junctional communication lead to defects in bone growth and identifying the underlying genetic and molecular pathways.

What is your current research project?

Our lab has shown that Cx43 plays a dual role during skeletal growth in regenerating zebrafish fin. It regu-



lates both cell proliferation and joint formation. I am working with a gene called *hapln1a* which I have shown to function downstream of *cx43*. My work is to study the mechanism by which Hapln1a is mediating Cx43-dependent phenotypes.

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

Tailed amphibians like newts are capable of regenerating limbs, tails, jaws, eyes, and a variety of other internal organs. Likewise, zebrafish are capable of regenerating a variety of organs. When there is a wound or amputation, the cells in the wounded area become activated and start to remodel tissues and organs back to the normal existing state. But in the case of humans, the body reacts by covering that wound site with thick scar tissue to prevent infection. This leads to a long-standing scientific question—can these extraordinary regenerative powers of animals be mimicked in humans?

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

Sigma Xi has played an important role in increasing my awareness about diversity of research and the beauty of this diversity. Personally, the funding for my project from Sigma Xi's Grants-in-Aid of Research program has increased my self-confidence.

Becoming a member of Sigma Xi has motivated me to take part in promoting STEM education by participating

in volunteer activities and increasing the awareness among school students regarding science and research.

What advances do you see in your field of research over the next 125 years?

Whenever I try to explain to someone about bone regeneration or regenerative medicine, the first question that arises is "Is it possible to make humans regenerate a body part if it is damaged or lost (like an amputated limb or a toe or a finger)? Or will it be as tedious as an organ transplant?" This, in fact, shows how exciting regenerative medicine is for the public. I think that therapies involving regenerative medicine are already in use on a small scale and for a few specific kinds of treatment, like cell-based therapies to stimulate the process of healing. Regenerative medicine research is widespread across the globe. In another 125 years, I envision that regulation of bone regeneration with strategies that exactly mimic the normal cascade of events during normal bone formation would have been established and will not be a question outside the realm of possibility anymore.

Read the full interview with Jayalakshmi Govindan at <http://www.sigmaxi.org>. Click on "About Sigma Xi," then "News," then "Meet Your Fellow Companions."

Editor's note: Proteins may have the same name as genes. Human genes are written with capitalized letters and italicized. Fish genes are lowercased and italicized. The first letter for a protein is capitalized but the word is not italicized.

