

Sigma Xi Today

A NEWSLETTER OF SIGMA XI, THE SCIENTIFIC RESEARCH SOCIETY

Superior Student Presenters

2014 International Research Conference

High School Division

Natural and Social Sciences

Karthik Raju, Mira Loma High School

Physical Sciences and Engineering

Thorsen Wehr, Odessa High School

Undergraduate Division

Behavioral and Social Sciences

Camden MacDowell, Emory University

Bryan Nelson, New York University

Cell Biology, Biochemistry, Physiology, and Immunology

Steven Romanelli, Fordham University

Erin Feeney, Oakland University

Michelle Oberoi, University of California, Irvine

Eden Barragan, University of California, Irvine

Nicholas Farrar, The Ohio State University

Chemistry

Christina Owens, University of California, Irvine

Ecology and Environmental Sciences

Charis Royal, Arizona State University

Claudia Mazur, Mount Holyoke College

Engineering

Taylor Gambon, Clemson University

Iwnetim Abate, Minnesota State

University, Moorhead

Math and Computer Sciences

Katherine Marszalkowski, East Carolina University

Physics and Astronomy

Carl Fields, Arizona State University

Todd Hodges, Arizona State University

Graduate Division

Behavioral and Social Sciences

Avery Russell, University of Arizona

Cell Biology, Biochemistry, Physiology

Manindra Singh, Ohio University

Chemistry

Suntara Fueangfung, Michigan

Technological University

Ecology, Environmental, and Geosciences

Adrienne Godschalx, Portland State

University

Patricio Becerra, University of Arizona

Engineering, Math, and Computer Sciences

Bich Nguyen, Mercer University

Physics and Astronomy

Amanpreet Kaur, Clemson University

From the President

An Energizing Annual Meeting

As Sigma Xi president, I am pleased to report that the Annual Meeting and International Research Conference held recently in Arizona were remarkable successes on many different levels. Perhaps the most exciting events involved the young researchers who presented their posters and engaged extensively with delegates and attendees from throughout the Society. These collegiate and high school students (all remarkably accomplished!) were not only enthusiastic about their own scientific research projects, but were also eager to learn about the work of others. Renewing and expanding the Society's commitment to ensure that these young researchers become and remain active Sigma Xi members is vital to the future of the Society.

The Society also had the privilege of recognizing several individuals who have made significant contributions to scientific research and how science is effectively communicated to the public. These individuals have helped define the importance of scientific research over many decades and have pioneered new ways to convey the significance of science to the public using the still emerging technologies of social media. Detailed information on all these Sigma Xi awards is available at <https://www.sigmaxi.org/programs/prizes-awards>.

Finally, there was important progress made on formalizing a variety of new programs and procedures concerning how the mission of Sigma Xi can become more relevant to the interests of its members and the public in general. The Board of Directors reached decisions that are designed to strengthen the financial well-being of the Society. As we collectively move forward, I encourage all Sigma Xi members to be actively engaged with your respective chapters and with the national headquarters.

In the meantime, I look forward to joining you at the next Annual Meeting in Kansas City in October 2015.


George H. Atkinson



Sigma Xi President George Atkinson, on left, presented a medal to Steven Romanelli of Fordham University November 8 for his Superior presentation in Sigma Xi's 2014 International Research Conference. Other top presenters are listed on the left side of this page. More details about the conference are on page 76. (Photo by Katie-Leigh Corder/Sigma Xi.)

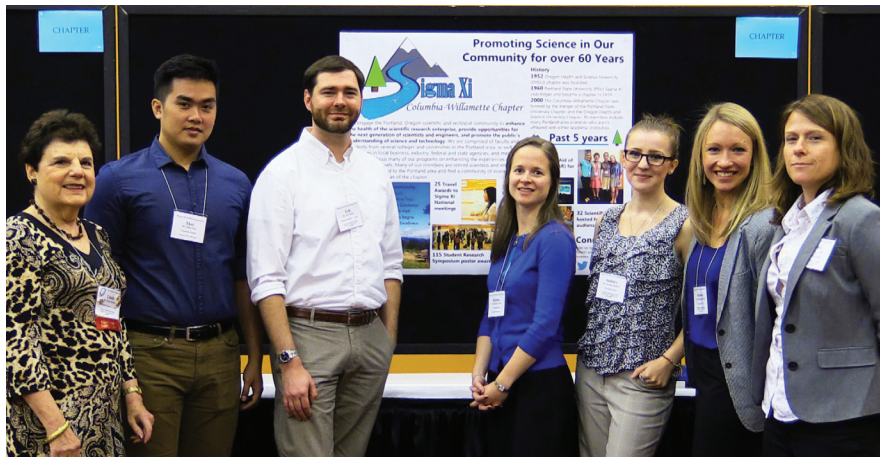
Sigma Xi Meets in Arizona for Annual Meeting and International Research Conference

Sigma Xi members and students gathered in Glendale, Arizona, November 6–9 for the Society's Annual Meeting and International Research Conference.

In addition to undertaking governance tasks for the 115th Assembly of Delegates, participants attended sessions on chapter best practices and effective science communication, and were treated to research presentations from this year's award winners. They also attended two debates about critical issues in water and food. These debates were demonstrations of events Sigma Xi will co-host in 2015 with the Institute on Science for Global Policy to promote the public's understanding of science.

More than 100 high school, undergraduate, and graduate students came from across the country, as well as from other countries, to present posters about their research in the International Research Conference. Sigma Xi members judged the students' posters and ranked 24 as Superior presenters. These students were awarded medals and received an offer of having their initiation fee and first year's dues paid if they accepted an invitation to join Sigma Xi. Nominations for Sigma Xi membership were extended to 93 students who qualified.

The 2015 meeting will be held October 22–25 in Kansas City, Missouri.



Photos (clockwise from top):

William Procter Prize Grant-in-Aid of Research recipient Amy Katz, William Procter Prize for Scientific Achievement winner Jenny Glusker, and Young Investigator Award winner Thomas H. Epps III at the Sigma Xi Annual Meeting.

Top student presenters in the International Research Conference received medals.

Members of the Columbia-Willamette Chapter presented a chapter poster.

Honorary Member Derek Muller, second from right, is host of the YouTube channel Veritasium.

Sigma Xi President George Atkinson moderated debates on water and food.

Rachel Merz, vice president of the Swarthmore College Chapter, talks with other chapter leaders during a workshop about keeping members engaged.

(Photos by Cristina Gouin-Paul, Katie-Leigh Corder, and Heather Thorstensen.)

See more photos at
<http://bit.ly/1zWlr8K>

Chapter Award Winners

Chapter of Excellence Awards have been bestowed on the following chapters for exceptional chapter activity, innovative programming, and true community leadership during 2013–2014. Nominees were chosen by the regional and constituency directors based on chapter annual reports, and winners were selected by the Committee on Qualifications and Membership.

Alfred University

Cornell University

Northwestern Pennsylvania

Swarthmore College

Woods Hole

Charleston (Honorable Mention)*

Pace University (Honorable Mention)*

**Chapters that received a Chapter of Excellence Award are not eligible to win an award again for three years. However, many of these chapters continue their meritorious work in subsequent years. The Committee on Qualifications and Membership provides such chapters with an honorable mention.*

Below: The first students from Tougaloo College in Tougaloo, Mississippi, to join Sigma Xi were inducted in 2014. They join as members of Sigma Xi's Brown University Chapter. (Submitted photo.)

Chapter Program Awards have been bestowed on the following chapters for organizing and/or hosting a single outstanding program during 2013–2014. Nominees were chosen by the regional and constituency directors based on chapter annual reports, and winners were selected by the Committee on Qualifications and Membership.

Charleston Chapter for Piccolo Darwin Week.

Kansas State University for chapter-sponsored Grants-in-Aid of Research Awards.

Louisiana Tech University for a reactivation luncheon.

University of Colorado for chapter-sponsored Undergraduate Research Awards.

Top 15 Electing Chapters

The following chapters are recognized for initiating the most new members in 2013–2014:

CHAPTER NAME	INITIATE COUNT
Brown University	229
Swarthmore College	139
Washington University	110
Princeton	102
Smith College	94
Amherst College	71
Claremont Colleges	56
Oberlin College	53
Mercer University	47
Worcester Polytechnic Institute	44
Denison University	44
Fordham University	42
Williams College	42
Union College	42
Georgetown University	41



Adding Emotion to Computing



Rosalind W. Picard, who joined Sigma Xi in 1986, spoke about her research on emotion-sensing technology at Sigma Xi's Annual Meeting November 7 in Glendale, Arizona. (Photo by Cristina Gouin-Paul.)

Rosalind W. Picard took a risk when she started telling colleagues that technology needed to be able to use and interpret emotions. "‘Emotion’ was not a word or topic anybody serious wanted to be associated with back when I first encountered its important role," she said. She was trying to develop computers that could see and hear like humans when she realized that emotions influence what people see and hear or how they choose language or action—and that was being left out of computing.

For being a pioneer in affective computing, Professor Picard of the Massachusetts Institute of Technology Media Lab received Sigma Xi's 2014 Walston Chubb Award for Innovation. Heather Thorstensen, Sigma Xi's manager of communications, spoke with Picard about her work.



Watch the full interview at <https://www.sigmaxi.org/news/article/picard>

Affective computing sets out to improve interactions between people and technology. It sounds like it also applies to technology that can improve interactions between people.

Ultimately it's about technology that helps us better understand and communicate emotion, whether it's in a human-computer interaction or a human-human interaction or a human-human mediated by a computer. If we can use the technology to help us better understand that emotion and better communicate it and be better understood then that's a great value.

Why do we want computers to have emotional intelligence?

If it's interacting with people face-to-face in any kind of way that involves language or interaction that could be perceived as social, then it's got to have emotional intelligence. People expect that the system will see things—like are things going well, are things not going well—and learn from that.

What do you think about the balance between improving technology and the consequence that we might interact more with technology than we do with other people?

We really need to think about what is human well-being and how do we build technology that serves that? ... One of the things that we've worked on is technology that helps people better understand the emotions of themselves and of others so that they can learn how to better succeed in face-to-face human relationships.

You're the co-founder of Affectiva and that has a tool that marketers can use to measure facial expressions.

The product is called Affectiva, people can go online with a webcam and try it ... We decided we were going to build a better system that could work in face-to-face interaction for people on the autism spectrum. In order to get the technology to work really accurately, we needed more data ... By going into marketing, we actually got customers to pay for people to go online and give us their data. If you go use this application online, you can choose

whether you want to share your data. If you share it, you might show up in a computer vision or machine learning publication where we're actually using your data to build a more accurate machine learning system to help not just market researchers but a lot of people out there who have difficulty reading facial expressions.

Let's talk about Empatica, of which you are the co-founder and chief scientist. It sells wearable sensors that monitor people's bodies [the sensors use photoplethysmography to monitor heart rate and stress, measure electrodermal activity to track emotions such as excitement, record surrounding temperature to provide context of when a person moves from one area to another, and contain accelerometers to measure activity.] What are the key uses for this technology?

It's a product designed for researchers and for some sophisticated users to learn about themselves ... We take all that data and we use machine learning pattern analysis to help interpret it in different situations with a focus today on several medical situations, especially epilepsy, depression, PTSD, and sleep ... Empatica is planning to come out with a device that will allow people to get their seizures detected.

What is your favorite part of affective computing?

One of my absolute favorites has been working with people on the autism spectrum ... they're just so honest and forthright. [One said] "Roz, I think affective computing is a bad idea." And I said, "Really? Tell me more. Why do you think it's a bad idea?" And she said, "Well, you know, I don't like looking at faces. Faces and eyeballs freak me out. And if you're going to make computers more emotional, more like people, then I'm not going to like them as much..." And I'm like, "Well, that's really important feedback." ... We could have a face-to-face interaction, mediated by computer, where you see the parts you want to see and I see the parts I want to see ... so the computer could start to be smart about making that interaction easier.

Meet Your Fellow Companion: Niraj Lodhi

Sigma Xi's motto is the Greek "Spoudon Xynones," or "Companions in Zealous Research." With that thought in mind, we like to highlight Sigma Xi members to learn more about their work. Niraj Lodhi is a postdoctoral associate at Weill Cornell Medical College in New York. He has studied a protein to determine its function and role in controlling cancer cell growth and hopes to develop an inhibitor to eliminate cancer cells.

Please explain your research.

After completing my PhD in plant molecular biology from the National Botanical Research Institute in Lucknow, India, I started my research work on cancer. At the Fox Chase Cancer Center in Philadelphia, I studied the role and function of poly(ADP-ribose)polymerase-1 (PARP-1) in mitosis. PARP-1 is a protein that adds poly(ADP)ribose residues to nuclear proteins by utilizing the coenzyme NAD^+ and regulates DNA damage repair, chromatin remodeling, and transcription. This function of PARP-1 is called poly(ADP-ribose)ylation. In an earlier study, we found that during mitosis PARP-1 remains associated with chromatin, a highly condensed complex that allows DNA to fit inside a nucleus. My research work reveals PARP-1 acts as an epigenetic factor that binds to chromatin during mitosis and memorizes genes for transcription activation after mitosis. [Transcription is the first step of gene expression.] PARP-1 bookmarks the specific genes in chromatin during mitosis, and



Submitted photos

maintains the precise inheritance of gene expression in daughter cells. Upon completion of mitosis, PARP-1 and other proteins loosen the chromatin and reinitiate the transcription of PARP-1-dependent genes responsible for cell-cell communication, cell adhesion, and cell maintenance. We called them cell identity genes.

PARP-1 also bookmarks proto-oncogenes and tumor suppressor genes throughout the genome during mitosis. A proto-oncogene is a normal gene that becomes an oncogene due to mutations or abnormally increased expression. Oncogenes have the potential to cause cancer by transforming a normal cell into a cancer cell. Tumor suppressor genes act opposite of oncogenes. Mis-regulated expression of proto-oncogenes and tumor suppressor genes in different cancer cells can be associated with PARP-1 bookmarking. Therefore, this study can be used to control over-expression of proto-oncogenes to prevent these genes from becoming oncogenes or to design specific PARP-1 inhibitors. This work was published in 2014 in *Nucleic Acids Research*, Volume 42, Number 11.

All presently available PARP-1 inhibitors function as competitive inhibitors to NAD^+ . Because NAD^+ is involved in most metabolic pathways, use of these inhibitors affect physiological activities of cells. Based on our research, I am working to develop a specific inhibitor of PARP-1, independent of NAD^+ . We tested this inhibitor on a human prostate cancer cell line and mouse model and the results are very exciting and promising. For further study, we collaborated with another group to conduct clinical trials.

Recently, I moved to the Weill Cornell Medical College in New York and started work on the role of DNA methylation on non-genetic inheritance of behavior, specifically anxiety, from one generation to the next. Our lab iden-



tified the differential methylated regions (DMRs) in the brain, specially the hippocampus, and I am focusing on three dimensional interactions of DMRs with genomes and how they affect gene expression from generation to generation.

What do you hope to accomplish with the PARP-1 inhibitor?

Recent research shows PARP-1 inhibitors control the growth of breast cancer cells, however after some generations the cells become resistant to inhibitors. The exact mechanism is not known other than PARP-1's role in DNA damage repair. My plan is to continue to explore PARP-1's epigenetic functions and utilize all recent research information to develop a specific inhibitor that can effectively overcome resistance from cancer cells and eliminate them.

What do you enjoy about being a Sigma Xi member?

Since I joined Sigma Xi in 2012, I took advantage of all benefits of membership. The best benefit for me is to get scientific news from all possible sources including email, social media, and the Sigma Xi online community.

The most important thing Sigma Xi provides is the views of fellow scientists for career development. I strongly support Sigma Xi membership to develop my career and I nominated one of my colleagues who is benefiting from membership.

Other members may contact me at lodhiniraj@gmail.com or on Twitter at @nirajlodhi.

Meet Your Fellow Companion: Prasad Bichu

Prasad Bichu, a Sigma Xi member from the University of Missouri Chapter, researches aspects of kidney dysfunction and disease. He is also a medical doctor, treating patients with kidney issues, sometimes printing research papers to educate patients. As director of the Pediatric Dialysis Division of Nephrology at the University of Missouri's Children's Hospital, he is looking for research collaborators to move the science forward.

What are the research projects that you're doing?

My research projects are related with some of the most common risk factors that cause kidney dysfunction. And the most important one that we are seeing nowadays is obesity. Obesity seems to cause a lot of things including high blood pressure, insulin resistance, as well as progressive kidney dysfunction. Conventionally, we have been looking for protein in the urine and worsening kidney function in the form of a rise in creatinine, a protein that goes up whenever kidneys fail. But we are trying to find new modalities in our test to early detect this dysfunction due to obesity. We are hoping that with this early detection we will be able to intervene at an earlier stage so that we can

take care of the problem better.

One of the other research projects that I'm doing is related with one of the most dreadful diseases in childhood of less than five years of age, which is hemolytic uremic syndrome. So far we haven't had any luck in terms of a medication which will cure this disease but recently we've got a drug which may be used in certain situations [to reverse the disease process]. And we're trying to figure out which kids can use this drug with the least complications.

How does hemolytic uremic syndrome affect kids?

Hemolytic uremic syndrome is a disease which is [the most common cause of kidney failure] in the age group of zero to five years of age. It is usually caused by a bug called E. coli 0157:H7, which is usually spread through contaminated food or raw food—unpasteurized milk ... This disease can affect the patient's brain, the heart, liver, pancreas, and lastly the kidneys. It is a very serious disorder. What it really means is that it causes a lot of small clots in the body which can obstruct the blood flow to various parts of our organs.

What are some of the challenges that you're having with this research project?

Some of the challenges that we have with this research project is, number one: the actual cost of this medicine to begin with because this medicine is extremely expensive, it is very difficult to obtain, and not covered by insurance companies. Number two: We are fighting against the unknowns. We are not aware of the long term complications of this medicine. This medicine is actually called Eculizumab, it is a complement C5b inhibitor ... And number three: ... Inhibiting the complement [a part of the immune system] seems to help to decrease the clot formation in this situation. The hurdle is trying to connect the two sites and figuring out why exactly this happens.

Is this something that would have a lot of potential for collaboration with other researchers?

Yes, absolutely. Hemolytic uremic syndrome is more kind of a sporadic disease where you tend to get about 15 to 20 cases in a year in a center so it's really difficult to get the numbers needed to do a large study. It would definitely help to have different centers collaborate. Number two: It would definitely help to collaborate with somebody who does research in complements and complement inhibition.

We are also looking at novel ideas for research in terms of obesity associated with renal dysfunction. So just like cystatin C, we are also looking at other proteins which we could test in these kids to early detect the dysfunction. So we would like to collaborate with anybody who is doing a similar project.

Listen to the full interview with Prasad Bichu at www.sigmaxi.org. Go to "News" then "Meet Your Fellow Companions." He can be reached by potential collaborators at bichup@health.missouri.edu.



Submitted photo

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