“Where Has the Summer Gone?”
7th High School Student Internship Program Ends

With an impressive poster session on August 12 as the final event, SDSC closed out another successful summer of its Research Experience for High School Students (REHS) program, where students work with mentors to help them gain experience in various areas of computational research and activities.

Some fifty students from high schools across the county presented their projects on topics that included data mining, the ‘Internet of Things’, topography, scientific visualization, science writing and videography, app development, cancer and Parkinson’s research, and more. REHS is intended to serve as a stepping stone for students who are considering a computational science curriculum when they enter college.

“This was another outstanding year in which we had students with a wide diversity of backgrounds and interests in all areas of computational science,” said Ange Mason, SDSC’s education program manager and founder of REHS. “It’s very gratifying to know that more county high schools are promoting computational science as a rewarding field of study, as well as a rewarding career choice.”

[See acknowledgements on Page 7]
I couldn’t agree more with the headline on the front page of this issue—where has the summer gone? We’ve been busy on just about every front at SDSC, from bringing home notable funding grants to helping area high-school students chart a course in computational science. This newsletter is first and foremost about the people who make great things happen at SDSC, so let me begin by offering some well-deserved kudos.

First, congratulations to Nancy Wilkins-Diehr and her colleagues from all over the nation for securing a five-year, $15 million National Science Foundation grant to establish a Science Gateways Community Institute. Their goal is right in line with what we strive to do at SDSC every day: substantially lower the barriers to computing for all researchers. The Institute’s aim is to increase the number, ease of use, and effective application of gateways for the greater research and engineering community. Work begins in earnest this month, and more details are on Page 3 of this SDSC Innovators issue.

Congratulations to Ange Mason and all staff involved for another successful Research Experience for High School Students (REHS) program! Some 50 high school students from across San Diego created an outstanding array of posters for their final presentation earlier this month, following an eight-week internship in which students worked with SDSC mentors to help them gain experience in various areas of computational research and activities. Hard to believe that REHS is now in its seventh year, but it’s easy to see why it has been so successful in attracting both students and mentors.

Last but certainly not least, congratulations to Yifeng Cui, who was unanimously selected as SDSC’s third π Person of the Year. We named this award after the mathematical symbol, and in this case interpret it as having one leg in information technology, one leg in a scientific domain, and a bar across the top that represents his or her ability to bridge these two distinct communities with applied research. A profile on Yifeng is on Pages 4 and 5 of this issue.

Let me close by mentioning another significant project that’s nearing completion: A comprehensive strategic plan that will guide SDSC during the next several years. This plan builds directly on SDSC’s core strengths as a key resource for high-performance computing and interactions with the computational science community to develop new capabilities and increase our value to campus, the UC system, the state of California, and of course the national research community. More information about this plan will be forthcoming in the next newsletter.

Meanwhile, please enjoy what’s left of summer 2016!

Michael L. Norman
SDSC Director
NSF Awards $15 Million to Create Science Gateways Community Institute

The National Science Foundation (NSF) recently awarded a five-year $15 million grant to a collaborative team led by SDSC to establish a Science Gateways Community Institute to accelerate the development and application of highly functional, sustainable science gateways that address the needs of researchers across the full spectrum of NSF directorates. The Institute’s goal is to increase the number, ease of use, and effective application of gateways for the greater research and engineering community, resulting in broader gateway use and more widespread engagement in science by professionals, citizen scientists, students, and more. A science gateway is a community-developed set of tools, applications, and data services and collections that are integrated through a web-based portal or suite of applications. “Gateways foster collaborations and the exchange of ideas among researchers and can democratize access, providing broad access to resources sometimes unavailable to those who are not at leading research institutions,” said Nancy Wilkins-Diehr, SDSC associate director and principal investigator for the project.

Read more at http://goo.gl/DxOcJk

SDSC, UC San Diego Health Sciences to Launch Year 2 of Mentoring Program

SDSC, in collaboration with the UC San Diego Division of Health Sciences, is preparing to launch the second year of a new mentoring program designed to provide a pathway for high school students to gain access to experts in their field of interest. Called MAP for Mentor Assistance Program, the initiative is focused on creating mentoring relationships to enhance students’ desire to learn, teach, and conduct research in a variety of fields, including science, technology, engineering, and mathematics (STEM). The first phase of the program, co-founded by SDSC Education Program Manager Ange Mason and Kellie Church, assistant professor in the Department of Reproductive Medicine within UC San Diego’s School of Medicine, was celebrated at a symposium at SDSC last spring. The event drew almost 300 guests, including school district administrators, principals, teachers, and parents and family members of students. “That symposium was one of the proudest moments of my professional career,” said Mason. The MAP application process opens to high school students in grades 11 and 12 on September 1, with a deadline of September 30, 2016.

Read more at http://goo.gl/uzx1kA

The five key areas for the Science Gateways Community Institute to increase the number, ease of use, and effective application of gateways to serve the greater research and engineering community.

Credit: Ben Tolo, SDSC
Yifeng Cui Named SDSC’s $\pi$ Person of the Year

By Jan Zverina, SDSC

SDSC Researcher Yifeng Cui was recently named SDSC’s third “Pi Person of the Year” for his research on computationally challenging problems in seismic research. Named after the $\pi$ symbol, this award recognizes researchers who have one ‘leg’ in a science domain and the other in cyberinfrastructure technology.

Cui, who joined SDSC in 2001, is the founding director of the High Performance GeoComputing Laboratory at SDSC, and an adjunct professor at San Diego State University. He is an internationally recognized expert in the development of large-scale earthquake simulation software and helped to establish the Southern California Earthquake Center (SCEC) as a world leader in advancing high-performance computing activities in earthquake system science. Cui also directs the new Intel Parallel Computing Center at SDSC and has presented more than 40 invited talks at international conferences and prominent venues. Cui received his B.S. in Meteorology from Nanjing Institute of Meteorology, and a Ph.D. in Hydrology from the University of Freiburg.

Q: What is the thrust of activity at the High Performance GeoComputing Laboratory?

Cui: Modeling of earthquake dynamics is one of the most challenging computational problems in science today. State-of-the-art large-scale ground motion simulations require the most powerful supercomputers to solve equations that involve hundreds of billion elements, or unknowns. To be accurate, simulations must span an enormous range of geographic scale, from just a few meters near an earthquake’s source to hundreds of miles across a region. We also need time scales from hundredths of a second to capture the higher frequencies.

Q: How has the accuracy and effectiveness of earthquake simulations improved over the years, and what are the main drivers for such improvements?

Cui: Producing realistic seismograms at high frequencies requires advanced physics. We cannot predict earthquakes, but realistic, physics-based earthquake ground motion simulations can help answer questions such as what will be the shaking intensity in
the Los Angeles basin from a magnitude 7.8 earthquake on the southern San Andreas fault. The full three-dimensional treatment of seismic wave propagation allows us to identify the ruptures that dominate the hazard at a particular site, and to retrieve the actual seismograms, which can then be used to drive full-physics engineering models. The 3D modeling brings the computational challenges of physics-based probabilistic seismic hazard analysis into sharp focus. Even in today's world, where supercomputers can perform one quadrillion calculations per second and sift through data at speeds never thought of, earthquake simulations still require orders of magnitude more compute power, especially for higher-frequency seismic events, along with steady advances in physics research to improve the accuracy of those simulations.

Q: What are some of your key goals in seismic research?

Cui: One goal is to create more accurate simulations of earthquakes that occur at higher frequencies. We can run 2-Hz wall-to-wall scenarios on a southern California region with today's computing capabilities, but our goal is to include frequencies as high as 10-Hz. That is when our research becomes relevant to things such as designing and engineering more resilient buildings. Pipes, electrical systems, and critical infrastructures such as those in hospitals or nuclear power plants can be sensitive to higher frequencies. California comprises 75 percent of the nation’s long-term earthquake risk. Our practical goal is to translate the advanced modeling capabilities to improve operational earthquake forecasting, and help identify effective ways to reduce seismic risk.

Q: What do you do for relaxation or fun when you need a seismic-free day?

Cui: I enjoy hiking and bicycling. I'm fortunate to be in San Diego, a perfect place for outdoor activities!
The National Science Foundation (NSF) has renewed funding for OpenTopography, a science gateway that provides online access to Earth science oriented high-resolution topography data and processing tools.

The award, “Collaborative Research: OpenTopography – A Cyberinfrastructure Facility for Topographic Data, Services, and Knowledge”, provides $1.365 million during the next two-and-a-half years for the third phase of the project (OT3) managed by SDSC, Arizona State University’s School of Earth and Space Exploration, and UNAVCO, a non-profit university-governed consortium facilitating geoscience research and education in Boulder, Colorado.

OpenTopography (OT) provides earth science-related, high-resolution topography to a large and varied user community advancing research and education in areas ranging from earthquake geology to ecology and hydrology. These data are essential for the study of the earth’s surface, its vegetation, and man-made structures.

“Expanding high-performance computing integration in OT3 ensures that the growing community demand for more compute-intensive algorithms and larger job sizes are met,” said Viswanath Nandigam, the project’s principal investigator and associate director for the Advanced Cyberinfrastructure Development group at SDSC. “Having OpenTopography based at SDSC, which houses Gordon as well as NSF’s most recent Comet petascale supercomputer, has the added advantage of leveraging a wide range of HPC expertise in-house.”

Other SDSC researchers contributing to OpenTopography include software developers Minh Phan and Kai Lin. Christopher Crosby, Geodetic Imaging manager at UNAVCO, is a co-investigator and project manager; as is Ramon Arrowsmith, co-investigator for the project and an associate geology professor in ASU’s School of Earth and Space Exploration.

Learn more about OpenTopography at www.opentopography.org

Read more at http://goo.gl/r2A2gy
Meet Nathan Lian, 18, a recent graduate from Torrey Pines High.

Like many kids his age, he loves music and sports, plays guitar or piano for fun; after school he heads out to the local park for a friendly game of lacrosse or soccer. Fairly typical, right?

But then you hear that Lian was named coauthor of a paper published in the July 16 online issue of *Oncotarget* describing how underlying molecular networks are offering potential new targets to treat brain cancer. Not so typical anymore.

Lian's research contributions were part of a summer internship program at SDSC called Research Experience for High School Students (REHS), under the mentorship of SDSC Research Scientist Igor Tsigelny.

"My father was diagnosed with thymoma (cancer of the thymus gland) back in 2013 and doing research was one of the ways in which I dealt with his diagnosis," said Lian. "It made me feel like I was at least doing something to help on the medical side of things."

In a recent paper on brain cancer by Tsigelny and Valentina Kouznetsova, associate project scientist at SDSC and UC San Diego, Lian’s primary responsibility was the creation of gene cluster models, self-organized maps, and protein models. "The main thing I like about him is his ability to work independently and without close supervision," said Tsigelny. “Nathan is really good at reading scientific articles and extracting the necessary information himself.”

Lian will attend Columbia University in the fall as an Egleston Scholar, majoring in biomedical engineering with a possible minor in economics or computer science. His long-term career goal: a physician-scientist. “I hope to one day become a physician-scientist so that I can not only interact with and treat patients, but also do biomedical research to advance current diagnostic and treatment techniques,” he said.

More details about the recent brain cancer research findings by Igor Tsigelny and Valentina Kouznetsova can be found at http://goo.gl/P2G1IK

More details about the recent brain cancer research findings by Igor Tsigelny and Valentina Kouznetsova can be found at http://goo.gl/P2G1IK
Though we are still in the summer season, we are already gearing up for a busy fall for our industrial program. San Diego continues to solidify its position as one of the top biotechnology centers in the nation, if not the world. Evidence of this is a slate of life sciences events coming to the city this fall.

From September 19-21, San Diego will host the Festival of Genomics. The festival is a free-to-attend event focusing on science and education in genomics, and features a lineup of plenary speakers, presentations, rapid-fire talks, exhibits and demonstrations. The SDSC industrial program is proud to be a sponsor and exhibitor at the festival, and if your interest is in life sciences research and genomics we hope you’ll consider attending. More information is at festivalofgenomicscalifornia.com. On September 29, SDSC and Biocom also will host a breakfast event about “SDSC’s Big Data Resources for Biotech Research.” During this event we will introduce local biotechs to the resources and expertise available at SDSC. Please see eiseverevywhere.com/ehome/168437 for information and registration details.

From October 24-26, the Converged IT Summit comes to the Hilton San Diego Resort and Spa. This event addresses the intersection of IT and science to accelerate discovery in the life sciences. SDSC researchers will be speaking at the summit, and SDSC’s industrial program is pleased to be hosting a tour and reception for attendees on the afternoon of October 25. More details are at convergeditsummit.com.

During the following month we will make our annual sojourn to the IEEE’s Supercomputing Conference, taking place in Salt Lake City, Utah, November 13-18. Please see sc16.supercomputing.org for more information.

As always, SDSC will be out in force and participating in a big way, with exhibits, demos, talks, and other activities. It’s going to be an exciting fall, with plenty of opportunities to interact with new and prospective industrial partners. We look forward to seeing you at one or more of these events.

Ron Hawkins
SDSC Director of Industry Relations