

Summer Is PRIME Time for UC San Diego Undergraduates Around Pacific Rim

NSF-Funded Research Program Expands Number of Students, Host Countries and Host Institutions

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A record number of students from the University of California, San Diego are en route to research institutions around the Pacific Rim as part of a program that lets them spend the summer doing hands-on research into cyberinfrastructure and its uses.

The 21 students - 50 percent larger than last year's class - are part of the Pacific Rim Experiences for Undergraduates (PRIME) program. Now in its fifth year, PRIME receives primary funding from the National Science Foundation (NSF) and additional support from the California Institute for Telecommunications and Information Technology (Calit2) and host institutions.

This year's class of PRIME students will work alongside faculty, staff and student researchers at host institutions in Australia, New Zealand, Japan, Taiwan, China and Malaysia. Up to this year, all of the institutions are affiliated with PRIME's parent organization, the NSF-funded Pacific Rim Applications and Grid Middleware Assembly (PRAGMA), a group of leading Pacific Rim research organizations collaborating on advancing grid technology applications.

This year's host institutions include: Osaka University, Japan; the Chinese Academy of Sciences' Computer Network Information Center (CNIC) in Beijing, China; Monash University in Melbourne, Australia; Taiwan's National Center for Research on Earthquake Engineering (NCREE); Taiwan's National Center for High-Performance Computing (NCHC); the Universiti Sains Malaysia, Penang, Malaysia; as well as the University of Waikato and the University of Auckland in New Zealand. PRIME students work with a mentor at UCSD and one at their host site. Students come from a variety of majors (see box), but ultimately their projects must focus on or make use of cyberinfrastructure - the software and physical networking that link together distributed computing, data and observational resources.

The program also combines first-hand research with immersion in a foreign culture as the students learn to live abroad and interact on a daily basis with colleagues in the host country. "I hope to grow on a more personal level as a result of being away from what is comfortable in the United States," said Andrea Cardenas, a third-year mechanical engineering major who will spend the summer in New Zealand at the University of Waikato, a participant in the NSF-funded and PRAGMA-based Global Lake Ecological Observatory Network (GLEON).

New Sites

This is the first year that PRIME has sent UCSD students to New Zealand or Malaysia. In addition to Waikato, the University of Auckland will host two PRIME students: Connie Hong, a third-year biology student, and Sara Richardson, a second-year bioengineering student. They will use the mathematical modeling program CMGUI and a CMGUI-based Zinc Digitiser to address whether there is a correlation between the size and tone of the pelvic floor muscles and difficulties during childbirth. "Experiencing a different part of the world for an extended

amount of time will be amazing," said Hong before departing for Auckland. Added Richardson, who is the new president of the Triton Engineering Student Council at UCSD: "I hope to have the opportunity to explore the Auckland area of New Zealand and see some beautiful beaches and sweeping landscapes. I also hope to learn about the typical New Zealand lifestyle and its culture."

Three students will be doing research in Malaysia at the Universiti Sains Malaysia. Second-year biochemistry and cell biology major Varahenage (Ranmali) Perera will be using Nimrod/K to solve time-consuming calculations across PRAGMA Grid computing resources, in order to enhance the previously designed framework for ligand-protein investigations. "I'm a biology major, so all the computer science jargon has been hard to understand," admitted Perera. "Balancing school work with preparing for the internships is stressful, but definitely worth the work. It's extremely rewarding to be able to see the topics I learn in my biology classes being applied in computer science research."

To prepare herself for living in Malaysia, second-year human biology major Cindy Tran has been reading up on cultural differences ("point with your thumb, not your forefinger, which is considered rude," she says). Her research will involve identifying known drug-resistant neuraminidase mutations and targeting other influenza virus subtypes which are potentially pandemic. "I am interested in international health, particularly medically underserved areas of the world," said Tran. "Through innovative scientific research, I hope to make an impact on global health and improve the lives of others." Tran and third-year human biology major Lihua (Vicky) Yang will share mentors in both Malaysia and UCSD, where Wilfred Li, Executive Director of the NIH-funded National Biomedical Computation Resource, helped prepare them for the summer internships. For Yang, that has meant learning computer programming skills that will allow her to explore the interactions between the potential polymerase inhibitors and active sites of the PB1 sequence of the avian influenza viral polymerase, which mediates viral replication in host cells via mRNA transcription.

Research Preparation

In May, David Abramson, a computer scientist at Australia's Monash University and associate director of the Monash e-Research Centre, visited UCSD to train students on Nimrod, the software his team developed for parameter sweeps and grid computation. Abramson will mentor seven UCSD students.

This spring, prior to their summer research abroad, students spent time in the labs of their UCSD mentors. For Rachel Chu, a third-year structural engineering student, that means working at Calit2 with project scientist Jurgen Schulze, one of the developers of the Collaborative Visualization and Simulation Environment (COVISE). At Osaka University, Chu will integrate COVISE software into the Cybermedia Center's CAVE immersive 3D virtual reality system - as part of an effort to successfully render a teleconference through CAVEs in Japan, Calit2 on the UCSD campus, and at Taiwan's National Center for High-performance Computing, where PRIME student and computer science senior Daniel Tenedorio will use projections of point clouds in test programs that generate triangle mesh grids in order to recreate the camera images. "It has been challenging trying to figure out a mostly self-directed project; most of my classes at UCSD have given me well laid-out specifications for assignments in the past," said Tenedorio before leaving for Taiwan. Despite the challenge, he says, "I hope to gain a deeper understanding of how different research institutions collaborate on large projects, as well as how other cultures work."

Several of this year's PRIME students will work on projects begun by PRIME interns from previous summers, including influenza-related research in China. Second-year human biology majors Michael Wang and Kevin Wu will spend the summer in Beijing, working on projects related to the fight against avian influenza, commonly known as bird flu. They will be working with host researcher Kai Nan at the Computer Network Information Center (CNIC) of the Chinese Academy of Sciences, and both will run the program Autodock on PRAGMA Grid - computers at PRAGMA locations linked together over high-performance networks - to scan for potential compounds that could be useful in drug development. Wang will utilize the program to search for compounds that inhibit neuraminidase (NA), an antigenic glycoprotein, often existing on the membrane surfaces of influenza viruses. For his part, Wu will be screening the entire National Cancer Institute diversity set to discover an effective

inhibitor of hemagglutinin (HA) to allow for a more effective combinational drug therapy where multiple essential mechanisms for influenza infection can be targeted to combat the H5N1 virus.

For the second year in a row, PRIME student volunteers will be briefing the wider UCSD community throughout the summer on how they are faring in a foreign land. From New Zealand, Sara Richardson will supply essays for publication in *This Week @ UCSD*, an e-zine published by UCSD's University Communications and Public Affairs Office. Her reports, and similar updates from Cindy Tran in Malaysia, will be part of a "Dispatches from the Field" series on UCSD students working abroad this summer.

NSF funding for PRIME comes from a variety of units, including the Office of International Science and Engineering (OISE); Office of Cyberinfrastructure; and the Division of Information and Intelligent Systems. Coordinators of the program include Calit2 participant and PRAGMA principal investigator Peter Arzberger; Academic Internship Program assistant director Tricia Taylor-Oliveira; and Gabriele Wienhausen, PI on the PRIME award and associate dean of education for the UCSD Division of Biological Sciences.

PRIME students are required to be U.S. citizens or permanent residents, and must be enrolled as full-time students at UCSD with a minimum GPA of 3.0 (out of 4.0).

PRIME Students 2008

Japan Rachel Chu, Structural Engineering, 3rd year Xian (Simon) Han, Bioengineering, 3rd year Phillip Pham, Bioengineering, 3rd year

Taiwan Daniel Tenedorio, Computer Science, 4th year Lisa Yung, Human Biology, 2nd year Philip Ow, Structural Engineering, 3rd year

China Michael Wang, Human Biology, 2nd year Kevin Wu, Human Biology, 2nd year

Australia Arielle Yablonovitch, Physics, 2nd year David Wong, Chemical Engineering, 3rd year Maria Amalia Prada Fernandez, Bioengineering/Biotechnology, 3rd year Haley Hunter-Zinck, Bioengineering/Bioinformatics, 3rd year Lynn Tai, Biology, 2nd year Randy Lee, Bioengineering, 2nd year Sirvard Nshanyan, Computer Science and Engineering, 3rd year

New Zealand Andrea Cardenas, Mechanical Engineering, 3rd year Connie Hong, Biology, 3rd year Sara Richardson, Bioengineering, 2nd year

Malaysia Varahenage (Ranmali) Perera, Biochemistry/Cell Biology, 2nd year Cindy Tran, Human Biology, 2nd year Lihua (Vicky) Yang, Human Biology, 3rd year

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