Newsletter

College of Physical and Mathematical Sciences

2008 Spring Research Conference

The BYU College of Physical and Mathematical Sciences sponsored its 22nd annual Spring Research Conference Saturday, March 15, 2008.

With 49 sessions, the event allowed more than 300 students to present their research to their faculty and peers.

"It gives them an opportunity to practice presenting their research in a conference setting similar to professional conferences," said Lynn Patten, the executive secretary for the college.

In addition to showcasing the work of BYU students, the college also invited other organizations to participate. The Center for Undergraduate Research in Mathematics brought 22 students from other universities to present their research in two sessions, which were chaired and judged by visiting faculty from around the country.

"It allows the students to all meet each other, talk about math, and learn from it," said Thomas Garrity, a student at Williams College in Massachusetts.

One session featured Concordia University's Miracle Okoye and Amy Stockman, and their research on "How to become 'Set for Life'. They studied the underlying math concepts of the game show "Set for Life," where contestants can win up to 40 monthly payments, determined by the color of stick they draw.

"By defining a player's risk factor, we identify the best strategy a player can utilize in order to receive the highest number of expected monthly payments," said Okoye and Stockman in their abstract.

Like so many of its presentations, this year's conference also served to gather the results of a new experiment. For the first time, students and teachers from local high schools were invited to attend the conference, which held general sessions just for them. In one of these sessions, Drew Johnson, a BYU student, explained the "Mathematics of Bubbles," while Jackie Murray illustrated "New Star Trek, Tricorder for Combating Terrorism."

"We have felt a need to promote more math and sciences further down," Patten said. "We want them to see the opportunities they can have, to expose them to a wider vision of what can be."

The experiment subjects (the high school students) reflected positive results.

" It's a good idea for those who want to major in a science" said Cami Cartwright, a student at Provo High planning on majoring in chemistry. "We can see what they are doing, what kind of research they are looking at, and so we have an idea of what we should know before getting here."

Autumn Buys from The Daily Universe

BYU Math Department
Professors #1 in US Fulbright Recipients

Senior Banquet for College
Thursday April 3, 2008
6pm in 3220-3224 WSC

According to the Institute of International Education, during the last eight years the BYU Mathematics Department has received more Fulbright Awards than any other Mathematics department in the nation. In the past three years, only 18 Fulbright Scholars were selected from within the field of mathematics, and of these, three were awarded to BYU Mathematics professors. Wayne Barrett, Gregory Conner, and Michael Dorff were selected as Fulbright scholars from 2005-2008. Their receipt of this award places them among the elite scholars of the 20th and 21st centuries, including more than 30 Nobel laureates.

Supported by the United States State Department, the Fulbright program customarily selects eight hundred top scholars and teachers from all disciplines around the nation to teach and research in other countries. Among the former grant recipients are 34 Nobel laureates including Riccardo Giaconni, Bengt Samuelsson, John Steinbeck, Milton Friedman, and Henry Kissinger. Other Fulbright alumni include Ruth J. Simmons, president of Brown University, graphic designer Milton Glaser, and poet Sylvia Plath.

From the thousands of universities, and hundreds of thousands of faculty nationwide, the Department of State selected these three professors from BYU to receive the Fulbright Award. This choice illustrates the quality of teaching, depth of knowledge, and future potential of these outstanding faculty at BYU.

Peter Vidmar to speak at Senior Banquet

The annual college senior banquet will take place Thursday April 3rd at 6:00pm and Peter Vidmar will be the guest speaker. Vidmar has attained multiple titles, with the height of his career taking place at the 1984 Olympics where he received a silver medal in individual all-around competition, as well as a Gold for his performance on the pommel horse. As captain, he lead his teammates to win America's first team Gold. Following his success as an Olympic Gold Medalist, Vidmar currently travels as a motivational speaker. With a speaker possessing as much talent and experience as Vidmar, the senior banquet will be an event to attend.

PHD Students: Corpus Creation Project

In Prague, the traditional and contemporary collide. In this "city of a hundred spires," telephone lines interlace before facades of centuries-old gothic cathedrals, while in the streets businessmen in suits pass Czech *babickas* on their way to market. This city, at once ancient and modern, was an ideal setting for the Conference on Electronic Corpora of Ancient Languages, held on November 16 and 17 of 2007. Two BYU Computer Science students, James Carroll and Robbie Haertel, traveled to the conference and presented papers.

James, a member of Dr. Kevin Seppi's Applied Machine Learning Laboratory, is also a part-time faculty member in BYU's Department of Ancient Religion. Robbie, who researches with Dr. Eric Ringger in the Natural Language Processing Laboratory, is a recent graduate of the masters program in BYU's Linguistics Department. While in Prague, Robbie was able to present his master's thesis, a paper on a Wikipedia-like interface for a database of Mayan hieroglyphs. Both James and Robbie are seeking PhDs in computer science as a means to combine their divergent interests in ancient languages and modern technology.

James was the primary author on the paper, entitled "Utility Issues with Active Learning for Annotation of Ancient Language Corpora." Robbie, fellow student Peter McClanahan, and Drs. Ringger and Seppi are listed as co-authors. As the name indicates, corpora (singular: "corpus") are large bodies of text. Corpora are often tagged with linguistic information, such as parts of speech. Tags on words allow researchers to quickly and efficiently search through the text for particular word usage in specific contexts. This enables the gleaning of important information and analysis from the writings. In recent years, scholars in BYU's Center for the Preservation of Ancient Religious Texts (CPART) completed such a project involving the Dead Sea Scrolls. Current research is focused on bodies of writing in the Syriac language, which is a dialect of Aramaic, one of the languages spoken by Christ and His disciples in the meridian of time. A number of early Christian documents, including a huge body of work written by a man known as Ephrem the Syrian, were written in the Syriac language. Creating a corpus of these writings should unlock new insights into the life of Christ and His early followers as well as into the nature of early Christian churches in the Near East.

However, the act of tagging, or the process of actually annotating corpora, is arduous and costly when performed by humans. The costs of human annotation can be reduced through machine learning techniques; however computerized annotation can be less accurate. As a result, it is difficult for researchers to decide when to let computers do the work of annotation and when it is necessary for humans to take over. James' and Robbie's paper analyzes the interactions between human and machine, and creates a statistical model of the annotation process using a Bayesian approach. Their model shows when computers should shoulder the task of annotation, and when it's best for humans to step in. The model also shows researchers places where humans should tag the text in order to most effectively teach computers to do the work in the future. By using this Bayesian approach, James and Robbie are able to minimize human annotation cost and better implement machine learning techniques. Their discoveries may act as a guide for researchers as they plan future corpus creation projects.

BYU licenses chemical sniffing device to Utah company

The Department of Homeland Security and the military are buying a new device developed by Brigham Young University that probes and sniffs out dangerous chemicals within seconds. Today, BYU announced the licensing of the new technology to a Utah-based company.

In this era of potential biological or chemical attacks, the government is looking for devices its first responders can run with to quickly identify what weapon is being unleashed. For sci-fi fans who remember Spock using the "Tricorder," well this is the real thing!

Developed by BYU chemist Milton Lee, and now licensed to a Utah company called Torion, the device can sample hazardous chemicals on the spot--in the air, on a table, on a chair, on clothing, in water, in food, in the soil. The list goes on!

"Most explosives and nerve agents, and drugs of abuse, toxic chemicals, flammable solvents in arson investigations, these are all chemicals that can be analyzed by this technology," Lee explained.

Again, with all these devices, what the military and homeland security are looking for is portability. In this case, 28 pounds, and this is only about the size of a large briefcase.

A syringe-like device is easily used in one hand, even by a first responder wearing gloves and protective clothing. He pushes the plunger, and a small metal fiber coated with a polymer film comes out to soak up whatever's out there.
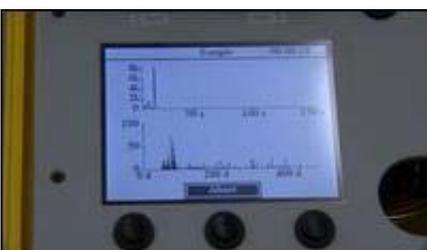
He injects the sample into the machine, pushes three buttons, and that's it. Within 65 seconds to five minutes at the most, the detector shows all, even multiple, compounds.

Instead of a big, bulky machine in the lab, everything is miniaturized. Even the specially-designed metal ring inside that captures the samples is smaller than a quarter. Looking for toxic benzenes in water? The time is even less. "It comes from petrochemical products. It comes from solvents that are used. We can detect benzene in water, for example, in about 20 seconds," said Dr. Douglas Later, President of Torion Technologies, Inc.

Development of BYU's device was funded by the Defense Threat Reduction Agency, an arm of the U.S. Department of Defense. Thirteen of the first 15 machines have been bought by the military and homeland security.

Ed Yeates and Randall Jeppesen reporting from KSL

College Publications

Chemistry & BioChemistry

William R. Smith, <u>Douglas Henderson</u>, Peter J. Leonard, John A. Barker, and Ernst W. Grundke, "Fortran Codes for the Correlation Functions of Hard Sphere Fluids", Molecular Physics,**106**,3-7 (2008).

Computer Science

Geological Sciences

Mathematics

Mathematics Education

Lauren A. Katz, C. Addison Stone, Joanne F. Carlisle, <u>Douglas L. Corey</u>, Ji Zeng, "Initial progress of children identified with disabilities in Michigan's reading first schools," *Exceptional Children*, Vol. 74, No. 2, pp. 235-256, 2008.

Gary L. Musser, William F. Burger, <u>Blake Peterson</u>, <u>Mathematics for Elementary Teachers: A Contemporary Approach</u>, 8th Edition, John Wiley and Sons, 2008.

Physics and Astronomy

M. Turner, N. Brimhall, <u>M. Ware</u> and <u>J.Peatross</u>, "Simulated laser-pulse evolution for high-order harmonic generation in a semi-infinite gas cell, "Opt. Express 16, 1571-1576 (2008).

Statistics