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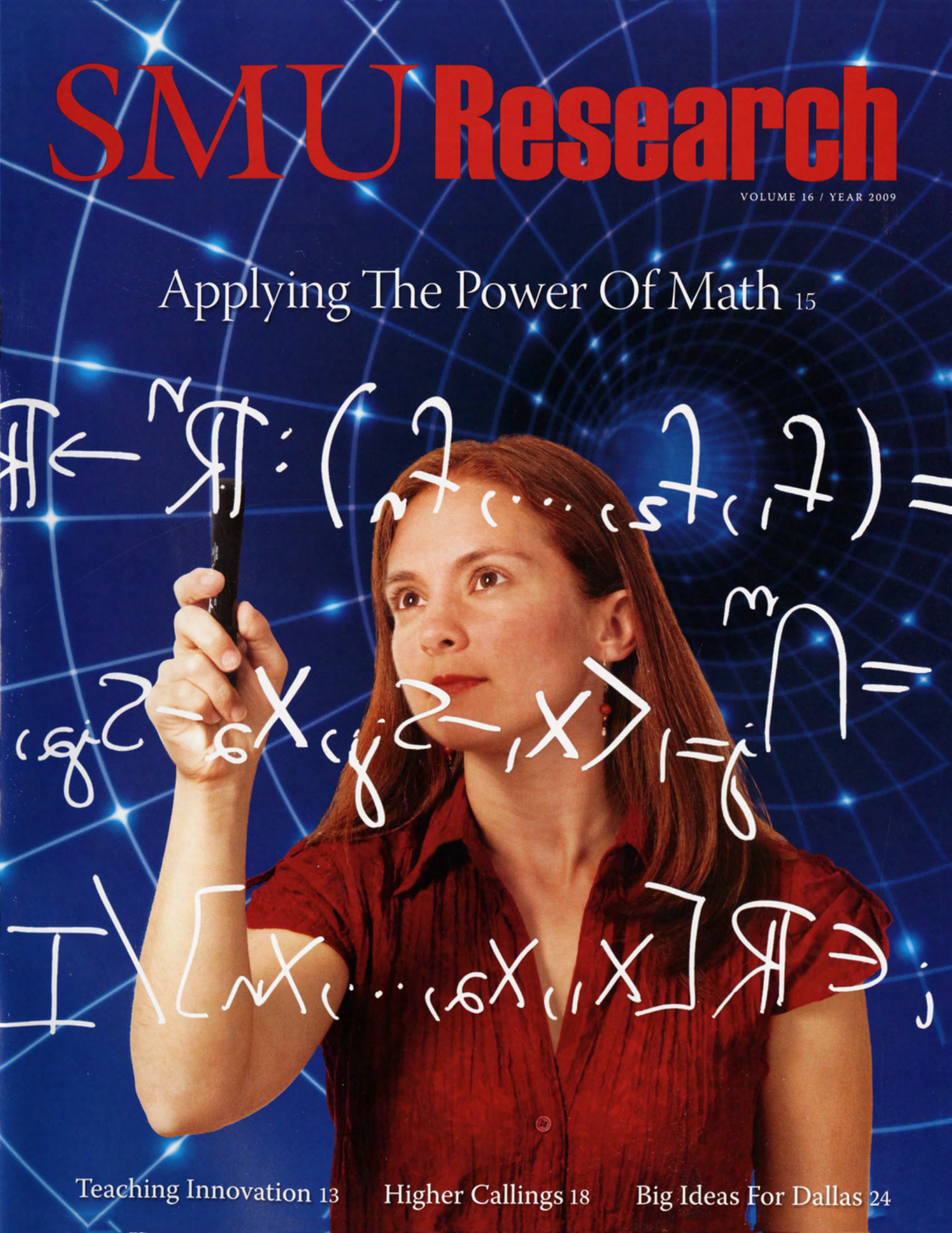
SMU Research, Volume 16

Office of Public Affairs

SMU Research

VOLUME 16 / YEAR 2009

Applying The Power Of Math 15



Supporting Research, The American Way


Dean James E. Quick

It is my pleasure to introduce this issue of *SMU Research*, which for the first time highlights student research on our campus. Student research is central to SMU's mission as a research university and contributes to two major goals of its Centennial Strategic Plan: "to strengthen scholarly research and creative achievement and to enhance the academic quality and reputation of the University."

As a society we have benefited enormously from the synergy between research and economic expansion. Consider just one invention – the microchip. Since the first prototype was developed in 1958, inventions made possible by the microchip have transformed medicine, communication, information technology, space exploration and military technology. In addition, innumerable devices dependent on microchips, from automobiles to personal computers, have improved our lives.

In the 2007 report "Rising Above the Gathering Storm, Energizing and Employing America for a Brighter Economic Future," the National Academy of Sciences cites independent studies indicating that as much as 85 percent of our nation's economic growth has resulted from advances in science and technology. Clearly, maintaining research leadership has become essential to the nation's economic well-being.

The research university has played a central role in the emergence of U.S. leadership in science and technology. The number of American universities granting Ph.D.s increased from 90 before WWII to 392 by the end of the 20th century. During this period, patents awarded each year in the United States more than tripled, and Nobel Prizes in physics, chemistry and medicine awarded to American scientists increased from 14 before WWII to 204 by 2008.

The most important contribution of American universities has been training of our nation's future research leaders. Graduate education is a crucial activity. Constituting the workforce that conducts research projects proposed and directed by the faculty, graduate students enter the university as researchers in training and exit as colleagues of their professors.

"Science and technology have never been more essential to the defense of the nation and the health of our economy." – *President George W. Bush (From remarks he made to high-tech industry leaders, March 28, 2001.)* *

Since WWII, the number of Ph.D.s awarded per year in the United States has increased by a factor of 10, with nearly half of the new Ph.D.s in science and engineering in recent years entering the private sector where they drive technological advances. To continue to produce adequate numbers of American scientists and engineers, exposure of undergraduate students to research opportunities is also essential. That way they will experience the excitement of discovery that can lead them to continue their education in science and engineering fields.

*Source: "Rising Above the Gathering Storm, Energizing and Employing America for a Brighter Economic Future," www.nap.edu/catalog.php?record_id=11463#toc.

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SMU Research

www.smu.edu/researchmagazine

SMU Research is produced annually by the Office of Public Affairs for the Office of Research and Graduate Studies of Southern Methodist University. Please send correspondence to Office of Research and Graduate Studies, SMU, PO Box 750240, Dallas TX 75275-0240, or call 214-768-4345.
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Brandilyn Stigler is one of four new members of the Mathematics Department who are applying their expertise and research across disciplines. See article on page 15.

Anthropology Chair Elected To NAS

SMU Anthropology Chair **David Meltzer** has been elected a member of the National Academy of Sciences (NAS) for his achievements in original scientific research. Membership in the NAS is one of the highest honors given to a scientist or engineer in the United States.

Meltzer, the Henderson-Morrison Professor of Prehistory in Dedman College and director of QUEST Archaeological Research Program, is the third SMU professor to be inducted into the NAS. All have come from the University's Anthropology Department: emeritus faculty members Lewis Binford and Fred Wendorf were elected in 2001 and 1987 respectively.

"One of the hallmarks of top universities is the election of their faculty to the prestigious National Academy of Sciences," says Paul Ludden, provost and vice president for academic affairs.

"It's an honor to be in that wonderful company," Meltzer says.

David Meltzer

His work centers on the origins, antiquity and adaptations of the first Americans – Paleoindians – who colonized the North American continent at the end of the Ice Age. He focuses on how these hunter-gatherers met the challenges of moving across and adapting to the vast, ecologically diverse landscape of Late Glacial North America during a time of significant climate change.

Meltzer's archaeology and history research has been supported by grants from the National Geographic Society, the National Science Foundation, The Potts and Sibley Foundation and the Smithsonian Institution. In 1996, he received a research endowment from Joseph and Ruth Cramer to establish the QUEST Archaeological Research Program at SMU, which will support in perpetuity research on the earliest occupants of North America.

His research has appeared in more than 130 publications, and Meltzer has written or edited half a dozen books, including *First People in a New World: Colonizing Ice Age Americans*, recently published by The University of California Press. He received his Ph.D. in anthropology/archaeology from the University of Washington in Seattle and joined the SMU faculty in 1984.

For more information: smu.edu/anthro/faculty/meltzer.html

Four Dedman Researchers Receive Ford Fellowships

Four 2009 Ford Research Fellowships were awarded to the following Dedman College of Humanities and Sciences faculty:

The 2009 Ford Research Fellows are (from left) Ben Johnson, Carolyn Smith-Morris, Fred Olness, and Larry Ruben.

Ben Johnson, associate professor of history and associate director of SMU's Clements Center for Southwest Studies, channeled his research interest in the environment, borderlands and modern U.S. history into two books – *Revolution in Texas: How a Forgotten Rebellion and Its Bloody Suppression Turned Mexicans into Americans* (2003) and *Bordertown: The Odyssey of an American Place* (2008). *Bordertown* received an award from the Popular Culture and American Culture Association as well as SMU's 2009 Godbey Lecture Series Authors' Award.

Fred Olness, professor of physics and chairman of the Faculty Senate, specializes in elementary particle physics phenomenology with an emphasis in quantum chromodynamics, the force that binds nuclei. He was elected a Fellow of the American Physical Society in 2005 and has worked with the Theoretical Physics Group at Fermi National Accelerator Laboratory in Batavia, Illinois, and at the Large Hadron Collider in Geneva, Switzerland. He is co-author of the textbook *Mathematica for Physics*, now in its second edition.

Larry Ruben, professor of biological sciences, has done extensive research into the signal properties of *Trypanosoma brucei*, which causes the lethal disease commonly known as sleeping sickness that infects humans and livestock and potentially affects more than 60 million people in 36 countries. His current research looks at unique processes in the trypanosome, which can be used to design new therapies that may prevent infection cells from successfully dividing and reproducing.

Carolyn Smith-Morris, assistant professor of anthropology, focuses on medical anthropology, American Indians, diseases of development, gender and health. For more than 10 years, she has worked with the Gila River Indian Community in Arizona, researching the diabetes epidemic among the Pima Indians and the community response to the health crisis. She documented her findings in *Diabetes Among the Pima: Stories of Survival* (2006).

Established in 2002 through a $1 million pledge from Gerald J.

Ford, former chair of SMU's Board of Trustees, the fellowships help the University retain and reward outstanding scholars. Each recipient receives a cash award for research support during the year.

Sumerlin Receives Prestigious NSF Award

Brent Sumerlin, assistant professor in the Department of Chemistry in Dedman College, has earned a prestigious National Science Foundation Faculty Early Career Development Award. The award is given to junior faculty members who exemplify the role of teacher-scholars in American colleges and universities.

Sumerlin will receive $475,000 over five years for two nanotechnology research projects – one relates to diabetes treatment and the other involves self-healing polymers. The award includes support for an education outreach program to help prepare and attract underrepresented minority students for SMU chemistry internship positions. He is working with Dallas area school districts to identify academically qualified students.


Brent Sumerlin

Sumerlin works with an SMU team of postdoctoral research associates, graduate and undergraduate students who fuse the fields of polymer, organic and biochemistries to develop novel materials with composite properties.

With one project, he hopes to combine two aspects of diabetes treatment – blood-sugar monitoring and medicating with insulin – into a single feedback-controlled mechanism. The other project entails making polymers with the ability to come apart and put themselves back together again – a technique that Sumerlin believes can be used to make materials that are self-repairing.

Both research projects utilize "the same interaction; we're just taking it in two different directions," he says.

For more information: faculty.smu.edu/bsumerlin

Industry, Universities Form Research Consortium

SMU is a partner in the National Science Foundation research consortium aimed at building both military and commercial superiority by making technology faster, better and smarter.

The Net-Centric Software and Systems Industry/University Cooperative Research Center will focus on improving how complicated information is gathered, shared and used from the battlefield to the boardroom.

The consortium is one of approximately 40 such centers nationwide that develop long-term partnerships among industry, academia and government. Academic partners are SMU, the University of North Texas and the University of Texas at Dallas. The center's industry partners are Boeing, Cisco, Codekko Software, EDS/HP, Fujitsu, GlobeRanger, Hall Financial Group, Lockheed-Martin Aero, Raytheon, Texas Instruments and T-System.

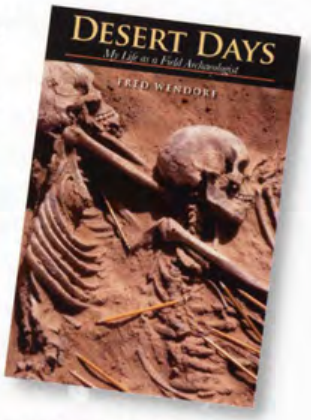
"Net-centric" describes a continuously evolving, complex community of people, devices, information and services interconnected by a communications network that can instantaneously measure and apply all available resources to a particular challenge. It is becoming increasingly important for the realization of important defense, commercial, health care, education, communication, social networking and entertainment applications.

"We envision this consortium becoming a leading research alliance in the United States," says Jeff Tian, associate professor of computer science in SMU's Bobby B. Lyle School of Engineering. "Because we can cooperate with the expertise of academic institutions and high-tech companies, we have much greater research capabilities than any one institution working alone."

For more information: netcentric.cse.unt.edu

Desert Ways

Renowned archaeologist and SMU Professor Emeritus of Anthropology **Fred Wendorf** has put down his trowel to record the adventures of his 60-year career. His book, *Desert Days: My Life as a Field Archaeologist*, has been published by SMU Press in cooperation with the William P. Clements Center for Southwest Studies in Dedman College.



Wendorf is notable for many important discoveries, including most of what is known about the Stone Age prehistory of Northeastern Africa. He also helped preserve archaeological sites in the American Southwest when natural gas pipelines were laid in New Mexico. His excavations in that state unearthed the remnants of Fort Burgwin, established by the U.S. Army in 1852 near Taos. He reconstructed the fort based on the archaeological evidence he found of the original vertical log buildings. Today, Fort Burgwin is the site of SMU-in-Taos.

The author of more than 30 books, Wendorf joined the University in 1964. In 1987, he became the first SMU faculty member elected to the National Academy of Sciences. For more information or to obtain a copy of the book, visit www.tamu.edu/upress/BOOKS/2008/wendorf.htm.

Book Honed At SMU Wins Bancroft Prize

Pekka Hämäläinen, a 2001-02 Bill and Rita Clements Fellow for the Study of Southwestern America, received a 2009 Bancroft Prize for *The Comanche Empire* (2008). The book was published in cooperation with SMU's William P. Clements Center for Southwest Studies in Dedman College. The esteemed Bancroft Prizes are awarded annually by Columbia University to authors of distinguished works in American history and diplomacy.

Now an associate professor of history and co-director of the Center for Borderlands and Transcultural Studies at UC-Santa Barbara, Hämäläinen worked on the revelatory book about the nation-changing power of the Comanche Indians while at SMU.

In the acknowledgments section, the author notes that the book would not exist without the counsel and encouragement of SMU's David Weber, Robert and Nancy Dedman Professor of History and director of the Clements Center, and the manuscript workshop that brought together prominent scholars to discuss his project.

Established in 1996, the Clements Center annually provides postdoctoral fellowships for scholars studying the American Southwest and the U.S.-Mexico borderlands. Fellowships to emerging and senior scholars have resulted in 22 books published by 16 major university presses.

For more information: smu.edu/swcenter

Notes From The Underground: South Texas Is Hot

Researchers with the Geothermal Laboratory in Dedman College of Humanities and Sciences are putting Texas' underground hot spots on the geothermal map.

The team includes W.B. Hamilton Professor of Geophysics **David Blackwell**, lab coordinator **Maria Richards**, Ph.D. candidate **Patrick Stepp** and junior **Ramsey Kweik**, a double major in mechanical engineering and earth sciences. They are completing a geothermal assessment of a region of the state bounded by I-35 and Texas' eastern border. The Texas State Energy Conservation Office funded the study with a $200,000 grant.

Using data from existing oil and gas wells, including temperature readings taken when wells were drilled initially, they identified "extensive and diverse geothermal resources" for a series of temperature maps taken at varying depths.

"One of the surprises was how hot South Texas wells came in," Richards says. "There were many over 300 degrees Fahrenheit; most Texas wells registered in the 200- to 350-degree range."

Although the Gulf Coast is the most likely location for large-scale geothermal energy production, South Texas wells show potential for enhanced systems. Such systems give nature a boost by drilling into hot rock, circulating fluid through the fractured layers, and pumping the resulting hot water and steam back to the surface to drive turbines and produce electricity, Richards explains.

Thousands of East Texas wells are ideal for smaller, site-specific projects similar to the SMU geothermal plant proposed by Andres Ruzo '09 and junior Elizabeth Corey (see article on page 24).

The findings will be published in the Geothermal Resources Council Transactions and presented at the Council's annual meeting in October.

A recent $45,000 grant from the Department of Energy will support further temperature study in the state's existing hydrocarbon fields. Blackwell, Richards and Stepp, joined by junior geology major **Katelyn Verner**, will compile a comparison of equilibrium temperature logs to improve temperature corrections from oil and gas well logs.

"Temperature readings are taken from the top to the bottom of a well every so many feet after the well has returned to its in situ conditions," Richards says. "We are looking for wells over 9,000 feet to measure."

A professional well-logging company will collect data. SMU's team will finish logging in September and complete the analysis in December. The research will assist in future temperature calculations, Richards says.

The projects add Texas data to the U.S. Geothermal Map of subterranean energy potential being updated by SMU's geothermal team. Last August, Blackwell received a grant of $489,521 from Google.org, the philanthropic arm of the Silicon Valley Web company, to update the U.S. portion of his 2004 Geothermal Map of North America. The funding will allow researchers to provide information on regions where data has been spotty or unavailable.

Maria Richards and David Blackwell are putting Texas' underground hot spots on the geothermal map.

For more information: smu.edu/geothermal

Might vs. Right: Economist Tests Trade Rules


Kamal Saggi

The World Trade Organization's rules governing the multilateral trading system may pass legal litmus tests, but from an economic standpoint, do they work?

Kamal Saggi, chairman of SMU's Department of Economics, has been examining international trade and the effects of multinational companies on developing countries since graduate school at the University of Pennsylvania. Lately he's also been delving into the legal layers of trade. A recent research focus has been India's burgeoning pharmaceutical industry.

"India has one of the most advanced pharmaceutical industries in the developing world and is poised to be a world player," says Saggi, Dedman Distinguished Collegiate Professor of Economics and a 2003 Ford Fellowship recipient. "But pharmaceutical patents have been a big area of controversy."

Divergent approaches to intellectual property (IP) have often caused friction between Indian and global pharmaceutical companies. "In India, you could patent a process but not a product," says Saggi, who grew up in India. By developing alternative production procedures, Indian companies cleared their country's legal hurdle to produce cheap, generic drugs that could meet local demand and be exported to other developing countries.

In 1995, member countries of the World Trade Organization (WTO) successfully negotiated a multilateral agreement that "basically says all members have to adopt the same rules and regulations regarding patents, trademarks and copyrights," he says.

The WTO ruling protected the status quo for U.S. and European enterprises, but the benefit to firms in emerging economies was debatable, Saggi says. "Developing countries were asked to ratchet up their legal coverage of IP, but the question was: Why should they?"

His study of that complex issue appears in the paper "Intellectual Property Rights, Imitation, and Foreign Direct Investment: Theory and Evidence" (National Bureau of Economic Research, 2007). Saggi, who chose a career in economics over engineering, built a mathematical model that captured the essence of the problem – was it economically worthwhile for developing country members of the WTO to adopt its new rules regarding IP?

He and three co-authors – Lee Branstetter, Carnegie Mellon University; Raymond Fisman, Columbia University School of Business; and C. Fritz Foley, Harvard Business School – then plugged firm-level data on U.S. multinational companies collected by the Bureau of Economic Analysis into the model to "theoretically and empirically analyze the effect of strengthening intellectual property rights in developing countries."

The economists determined that there were more gains than risks to the budding economies. "In some instances, it may be a case of trading apples for oranges. For example, a developing country may say, 'If we reform our IPR, then you'll open up agricultural trade to us,'" Saggi says.

Or, as in the case of Indian pharmaceuticals, it may be an apples for apples exchange. "We found IPR reform in developing countries had a pretty substantial effect," he says. "Where the IP laws have been strengthened, there has been a measurable increase in multinational investment." For example, some multinationals split

aspects of research and development, such as clinical trials, into separate operations in collaboration with Indian companies.

He's investigated numerous other angles of international trade regulation including "Tariff Retaliation versus Financial Compensation in the Enforcement of International Trade Agreements," the subject of a co-authored paper published in the *Journal of International Economics* (2008), for which he is an associate editor; and the consequences of the Most Favored Nation (MFN) clause, which levels the playing field among competing international exporters in WTO member countries.

A frequent World Bank consultant, Saggi presented an economist's perspective on case studies of two international trade disputes – one involving olive oil, the other concerning stainless steel – in June at the American Law Institute WTO Case Law Project meeting in Geneva. Later in the month, he delivered a keynote address on the theoretical rationale of the WTO's MFN clause at the Valuing International Trade Rules Conference in Zurich.

Saggi continues to explore the ramifications on the developing world of policies defined by the WTO's General Agreement on Tariffs and Trade (GATT) and other negotiations. "Are these good rules from an efficiency point of view? Why do we have them? Asking these kinds of questions and finding some answers – that's my broad research agenda."

For more information: faculty.smu.edu/ksaggi

Domestic Disturbance In Paradise

Domestic violence knows no boundaries. It exists even in French Polynesia, the chain of South Pacific islands that includes the tropical paradise of Tahiti.

Cultural anthropologist **Victoria Lockwood**, an associate professor in Dedman College, has been studying the lives of the island women for 28 years. She focuses primarily on the impact of modernization and globalization among the women of Tahiti and its tiny neighbors Tubuai (pronounced TOO-boo-eye) and Rurutu (Roo-ROO-two).

In the course of her work, the women also have disclosed to Lockwood they have arguments with their husbands that can result in physical violence. The revelations intrigued her. Psychologists and sociologists have studied domestic abuse for decades. But among anthropologists, she says, such research is rare.

Victoria Lockwood

"The word on the street, at least in American society, is that domestic violence doesn't go away; 'Once an abuser, always an abuser,' and that the abuse escalates over time. But that wasn't the case in Tahiti."

So on her last journey to the islands in 2005, Lockwood conducted some preliminary research with the hope of applying for a National Science Foundation (NSF) grant. She interviewed husbands and wives from 25 families about domestic violence.

As it turns out, those surveys helped Lockwood win a three-year, $128,000 NSF grant. With that funding, she will investigate the prevalence, causes, meanings and consequences for victims of domestic violence on the islands.

To carry out the next stage of her research, Lockwood left in June for the rural islands of Tubuai and Rurutu, where she first traveled in 1981 to work on her doctoral degree from UCLA. In the past three decades Lockwood has made seven trips to the islands, in particular Tubuai.

"Because I've worked on this island so long, I know these families, and they've already talked to me about the abuse," she says.

The islands are a fairly gender-egalitarian society, Lockwood says. Domestic violence is no more common there than anywhere else. The women told her the assaults usually stop after the early years of marriage.

That is not the common stereotype of domestic violence, Lockwood notes. Consider Oprah's advice this spring to pop star Rihanna, telling her to break up with boyfriend Chris Brown because he surely would assault her again.

"The word on the street, at least in American society, is that domestic violence doesn't go away; 'Once an abuser, always an abuser,' and that the abuse escalates over time," Lockwood says. "But that wasn't the case in Tahiti. And that's what got me interested in looking at the issue in Tahitian society."

Psychologists and sociologists have acknowledged the distinction for about 15 years. They refer to short-lived domestic abuse as "situational couple violence." They describe it as abuse that occurs early in a marriage as a couple attempts to work out balance-of-power issues and decision-making. The violence is initiated by either the husband or wife, which then fades away.

The other kind of domestic violence is called battering, is typically enduring, and the husband is normally the aggressor. Battering escalates, with the husband obsessed to control every aspect of his wife's behavior, using verbal as well as physical tactics, Lockwood says.

One of a few anthropologists to study domestic violence, Lockwood says her research seems to confirm the existence of two different types.

"If we don't acknowledge there are two different kinds of domestic violence, then we'll never understand what the causes are," she says. "The causes are very different, so if we wish to devise policies or social programs, we need to be doing two different things to address the issues."

For more information: smu.edu/vlockwood

Speaking *Tsalagi*: Preserving The Cherokee Language

Fresh out of the University of Texas at Austin with a Ph.D. in theoretical linguistics, **Bill Pulte** found a job that would shape his academic career for the next 38 years. He became project director for the Cherokee Bilingual Education Program, in Tahlequah Oklahoma, headquarters of the 50,000-member Cherokee Nation. It was one of the first projects funded by the U.S. Bilingual Education Act of 1971.


Bill Pulte

His two years in Tahlequah launched a career dedicated to preserving the Cherokee language and developing the best way to teach all children a second language.

"Forty years ago, most of the Cherokee children in the Tahlequah schools spoke Cherokee better than English," says Pulte, associate professor of education, Annette Caldwell Simmons School of Education and Human Development. "However, the classes were conducted only in English. A dictionary was one of the first things that teachers needed to create a bilingual program."

With his co-author, Cherokee tribal linguist Durbin Feeling, Pulte edited *The Cherokee-English Dictionary* and the *Outline of Cherokee Grammar* (Cherokee Nation of Oklahoma, 1975).

Research published in the January 1982 issue of the *Journal of American Indian Language* found that over a five-year period, the children who participated in the Cherokee Bilingual Education Program scored significantly higher in reading and mathematics than children in the Cherokee Nation who were taught only in English.

"My own thinking about how children learn their first and second languages crystallized after my years in Tahlequah," Pulte says. "It is important for children to receive school instruction in their native language. Research shows it takes five to six years for a student to master a new language."

Pulte joined the Department of Anthropology in Dedman College in 1973 as a linguistic anthropologist and in 1975 became head of SMU's bilingual education program focusing on English and Spanish. In 1977 he received the first of what has eventually totaled $8 million in grants from the U.S. Department of Education to certify teachers in bilingual education and to provide advanced training to certified teachers. Since then, Pulte has directed bilingual education training at SMU for more than 800 teachers. The Texas Association for Bilingual Education presented him the Higher Education Honoree Award in 2005 for his efforts in the field.

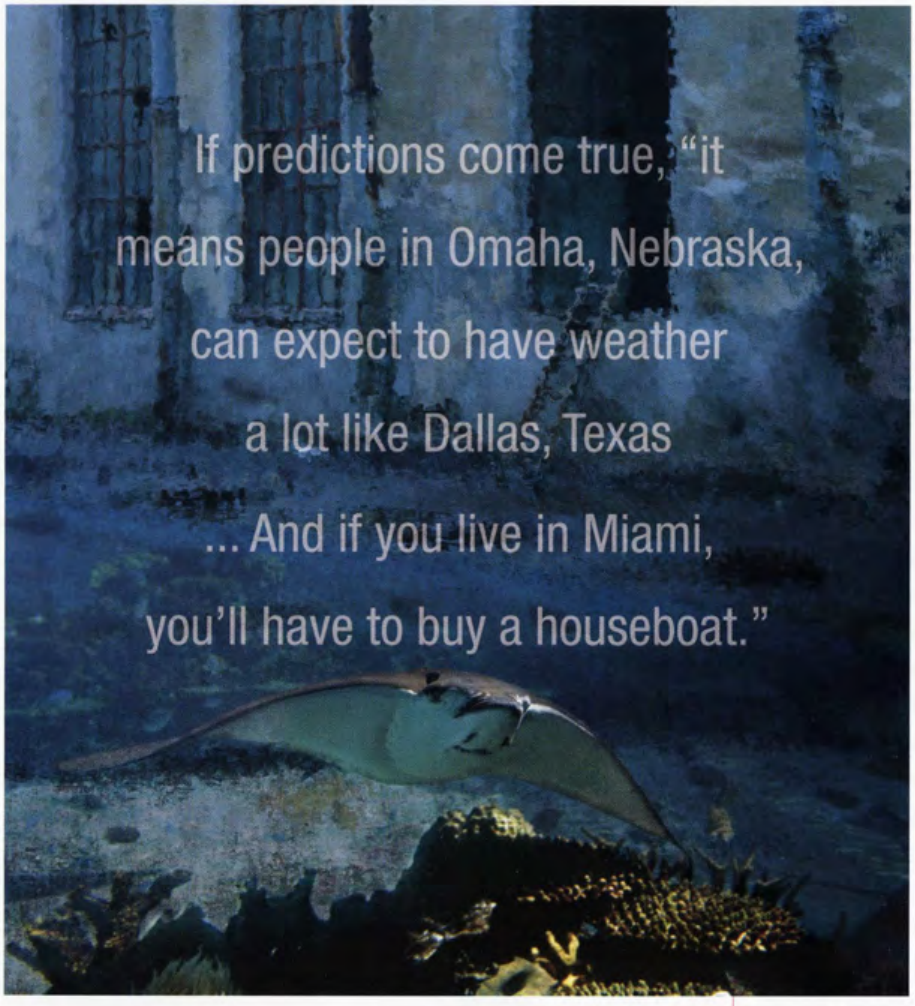
Today Pulte continues his work with the Cherokee language. He and Feeling are transcribing and translating 25 Cherokee narratives including diaries, legal documents and legends for a new book. Their dictionary and grammar guide are still in use as the Cherokee language faces a new challenge. A Cherokee Nation survey in 2002 found no fluent Cherokee speakers under the age of 40 and predicted the language could become extinct in one to two generations. Pulte and Feeling's work has become the core resource for the new Cherokee language revitalization project.

> A Cherokee Nation survey in 2002 found no fluent Cherokee speakers under the age of 40 and predicted the language could become extinct in one to two generations.

"In the opinion of some linguists, 90 percent of the world's 2,000 languages will die out by 2100 because of urbanization and globalization," Pulte says. "It's important to learn what these languages have in common because that tells us something about the mind. The study of languages is very much linked to neuroscience and cognitive psychology."

For more information: smu.edu/education/teachereducation/faculty/pultebill.asp

Weathering Rocky Change In The Climate



About 251 million years ago, the Earth experienced one of the largest mass extinctions of life that has ever occurred. More than 95 percent of sea species and more than 70 percent of land species expired – and scientists still do not know exactly why.

Neil Tabor's research on ancient soils and climates may help to bridge that knowledge gap. His work has taken him to every continent. Now his focus has turned to West Texas and the geologic formations of Caprock Canyon and Palo Duro Canyon. Their rock exposures date from an interval of time called the Permian-Triassic Boundary, during which that catastrophic die-off occurred.

"This area and I have a long history together," says Tabor, an assistant professor in the Roy M. Huffington Department of Earth Sciences in Dedman College. Tabor, who received his Ph.D. from the University of California-Davis, made his first field excursion as a graduate student to the Caprock and Palo Duro sites.

"I've wanted to return to these strata for about 13 years now," adds Tabor, who began his current research there this spring. "It's fortunate that we have these rocks in Texas because there aren't many places on the planet that still have them from that particular age."

Tabor and a team of students are collecting samples and analyzing their chemical composition in SMU's labs. From the data he plans to collect over the next several years, he hopes to reconstruct the environment of the Permian-Triassic Boundary and how it changed. That timeline may help reveal whether those climate changes triggered the catastrophic population collapses of life forms that existed during that period.

The data Tabor has collected from similar sites in Argentina, Ukraine and northwest China show "a very, very strong relationship" between estimated atmospheric carbon dioxide (CO_2) levels and temperature. "When CO_2 rises, it appears that temperature rises in the atmosphere. And polar ice sheets are breaking up in direct response to the increased concentration of atmospheric CO_2," he says.

Scientists can estimate an era's temperature through the isotopic combination of minerals that form in the soil, Tabor says. What they see is that over the past 65 million years, CO_2 levels appear to increase as temperatures rise. Tabor's research suggests that for each doubling of atmospheric CO_2, "we can expect temperatures to increase on the order of about 2 to 3 degrees Celsius," he says.

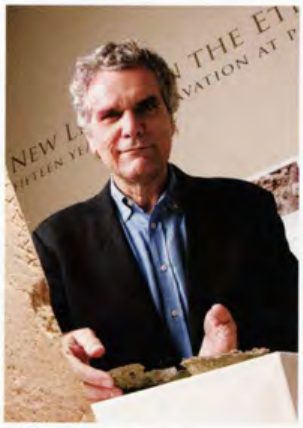
Currently, researchers anticipate a doubling of pre-industrial CO_2 levels by 2100. If those predictions come true, "it means that people in Omaha, Nebraska, can expect to have weather a lot like current-day Dallas, Texas, by that time. And if you live in Miami, you'll have to buy a houseboat, because many coastal areas will flood."

Additional research could have important implications for global climate change policy and action, Tabor says. "I think the best way to evaluate how increased atmospheric CO_2 levels and emissions will affect our global climate is to go back through the geologic record," he says. "It's the best way to assess how to adjust policy and practice for the future."

For more information: smu.edu/earthsciences/people/faculty/tabor.asp


Neil Tabor

Digging The Etruscans: 15 Seasons And Counting


P. Gregory Warden

P. Gregory Warden, University Distinguished Professor of Art History, has just celebrated the 15th anniversary of the Mugello Valley Archaeological Project, an Etruscan dig 20 miles northeast of Florence, Italy. The Etruscan civilization existed from 1000 B.C. to 50 B.C. and eventually was subsumed by the Romans. He serves as principal investigator and co-director of the project's Poggio Colla Field School, an internationally recognized research training center in which SMU has participated since 1995 with the University of Pennsylvania Museum of Archaeology and Franklin and Marshall College.

For the first time, the Meadows Museum at SMU displayed nearly 100 Etruscan artifacts discovered at Poggio Colla during the spring semester. In the following Q&A, Warden talks about Poggio Colla and its discoveries.

Q. Why study the Etruscans?

I was born in Florence and lived in Tuscany until I was 10 years old. My father was very interested in archaeology. For me, Mediterranean history is everywhere in Tuscany. Wherever you go in an Italian town, there are visible Roman ruins and Etruscan walls. It didn't seem at all esoteric. I had worked all over the Mediterranean – I studied the Greeks in Libya and the Romans – but the Etruscans are my first love. Because we're excavating in the valley where I grew up, that is a great advantage to me as a scholar. I knew the area intimately, it was archaeologically interesting and there was a lot to be discovered.

Q. What are among the significant discoveries at Poggio Colla?

The Poggio Colla site spans most of Etruscan history, from 700 BCE to the town's destruction by the Romans around 178 BCE, which makes it very rare. The Etruscans picked beautiful, easily defended hilltops for their settlements. As a result, many Etruscan sites are used as cities today. That means many have 2,000 years of other civilizations on top of Etruscan artifacts. Poggio Colla, however, represents an entire settlement – including tombs, a temple, a pottery factory and an artisan community. One significant discovery is the Podere Funghi complex, a terrace below the acropolis sanctuary, where we found a habitation area with kilns and artisan production. A surprise has been the discovery of a fortified sanctuary of a temple that was destroyed. The temple is revealing much new information about the Etruscans, who had a theocratic social structure and were considered the most religious peoples of the ancient Mediterranean.

Q. Both undergraduate and graduate students are included on every dig. What have they contributed to the research?

We attract spectacular students who come from universities all around the United States. We train them on site in the actual physical aspects of archaeology. It takes about a week for them to get comfortable. Our students are our eyes and hands, excavating intelligently. They are finding primary sources such as ceramics, figural bronzes, the remains of a destroyed temple such as stone bases or parts of the foundation, and even gold jewelry and silver coins. They have to document everything carefully and be able to reconstruct where every piece was found. They also spend time in the onsite lab cataloging and processing all the finds that come down in great numbers. The students are surrounded by experts who are there to help them learn the process and who can mentor them. A few come back every year. (For more information on the 2009 dig, visit blog.smu.edu/StudentAdventures/archaeology_in_italy_2009.)

Q. What are the ongoing plans for Poggio Colla?

After 20 years, we'll stop digging. We could dig for 100, there's so much stuff around there. But the ethical thing to do is to stop at some point and publish. You have to publish your data before you excavate more. We've discovered so much in the lab that we didn't know before, like the kinds of activities going on in the artisan area, the types of pottery being made. Questions like who destroyed the temple and why was it destroyed aren't going to be answered by digging. We're going to answer those questions by analyzing all the items that we found and their context.

Q. What do you hope SMU's legacy will be to Poggio Colla?

We're passionate about training people who care about the past and saving the Etruscan culture and heritage. That includes our students, because even though many of them won't go on to become archaeologists, they will still understand why preservation is important. The project also brings in Italian high school students from the region to attend lectures and to excavate with us. When we leave, hundreds of students will know why this site is important and will let other people know, so that it won't be destroyed. Italy's cultural heritage is disappearing. We can't preserve it all, but we do what we can.

For more information: smu.edu/poggio

Seeking Justice For War Crimes

Growing up in Bulgaria, bordered by the Balkan nations of Rumania and Old Yugoslavia, **Jenia Iontcheva Turner** could not help but be influenced by the region's political upheavals in the 1990s. As a teenager she came to the United States in 1994 with her parents. Today Turner is an associate professor in Dedman School of Law, immersed in the work of international tribunals and the legal networks that help investigate and prosecute cases of war crimes and genocide.


Jenia Iontcheva Turner

She was only 12 when the Berlin Wall and the communist bloc that controlled Eastern Europe fell in 1989. "It was a pretty defining moment in my childhood," Turner recalls. "It shaped my interests."

Turner's research frequently brings her back to one big question: Is justice best served by seeking legal punishment at the international level, or healing for the victims through something like a truth commission or criminal proceedings at the national level?

"A criminal trial is not always the best way to serve multiple goals," Turner says. But it is important to hold leaders accountable for their criminal behavior, she adds, if only to give victims a voice in the process.

"It was critical for Bulgaria (her country's long-serving Communist leader Todor Zhivkov was tried for corruption after he was forced out of office) and it was critical for Iraq to see that even leaders are subject to the law. The message is that conflict will be resolved through the law, not by force."

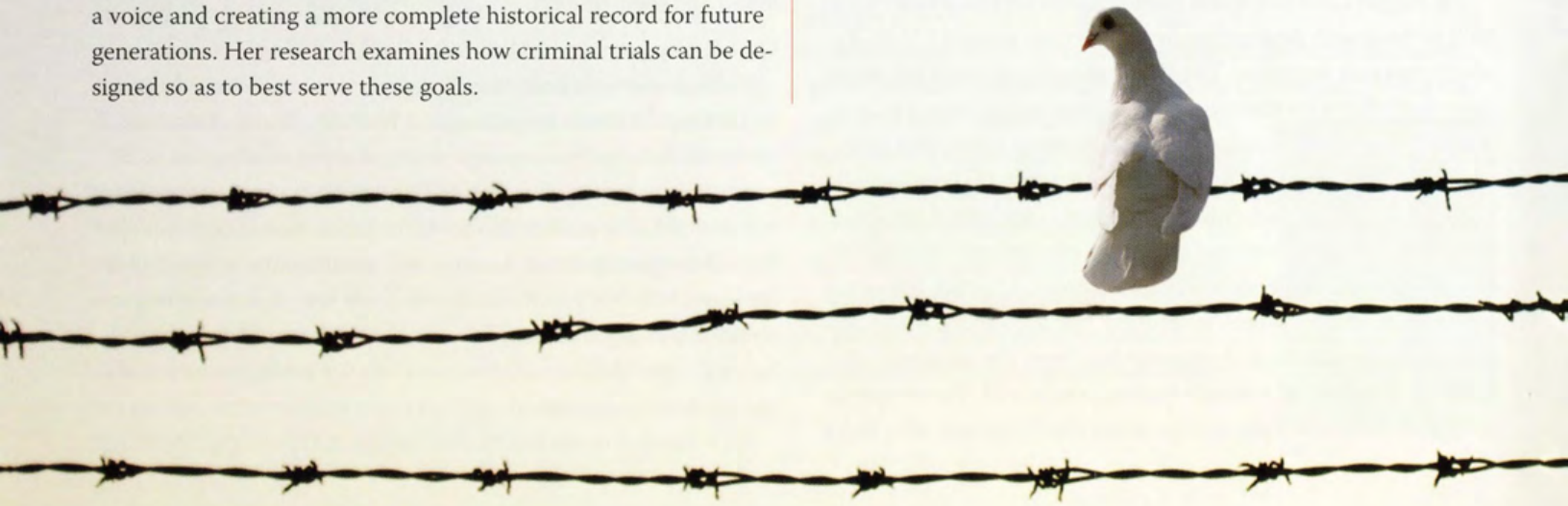
Criminal trials are frequently the approach of last resort because they are expensive and time-consuming. Once a criminal trial is chosen, however, Turner says it should be structured to serve the various goals of international criminal justice – adjudicating guilt and imposing punishment, promoting the rule of law, giving victims a voice and creating a more complete historical record for future generations. Her research examines how criminal trials can be designed so as to best serve these goals.

Turner attended law school at Yale, where she was a Coker Fellow and articles editor for the *Yale Law Journal* and the *Yale Journal of International Law*. After her first year of law school, she was a summer clerk at the Appeals Chamber of the International Criminal Tribunal for the former Yugoslavia. The court heard charges against a long list of individuals, but its highest profile defendant was Slobodan Milosevic, former president of Serbia and Yugoslavia, who was charged with crimes against humanity for his role during the wars in Croatia, Bosnia and Kosovo.

In October Turner will deliver the Maguire Center for Ethics and Public Responsibility's Public Scholar Lecture on "Ethical Dilemmas of International Criminal Defense Attorneys." U.S. legal ethics rules and guidelines tend to allow criminal defense attorneys to engage in conduct that is on the extreme margins of zealous advocacy – such as attacking the credibility of truthful witnesses or introducing evidence (specifically the defendant's testimony) that they believe is false. Her lecture will examine whether similar treatment should be accorded to attorneys who represent clients in international criminal tribunals.

Is justice best served by seeking legal punishment, or healing for the victims through something like a truth commission?

For more information: www.law.smu.edu/Faculty/Turner



'If It Keeps On Rainin', Levee's Goin' To Break'*

Usama El Shamy was teaching at Tulane University when Hurricane Katrina hit Louisiana and Mississippi. His research into the impact of floodwater on levee systems in general had led him to conclude that their failure in New Orleans was an imminent possibility. And then the worst-case scenario unfolded before his eyes.

Now an assistant professor of environmental and civil engineering in SMU's Bobby B. Lyle School of Engineering, El Shamy is breaking new ground in his levee systems research. The first problem with most existing systems is their age, he says. For example, the levees that stand between the petrochemical plants of Texas City, Texas, and the next Hurricane Ike were built in the 1960s, and their construction shows it.

"It's unfortunate that these crucial structures have been designed with such outdated concepts."

To counter those problems, El Shamy and a team of students are conducting advanced research with basic materials – examining and modeling soils at a particle scale to capture their interactions with flowing water and to predict the potentially disastrous shifts that may result when floodwaters saturate a levee.

Usama El Shamy

"I envision a worst-case scenario and use computer modeling to try to fix it."

El Shamy focuses on levee systems that are built on saturated sand. "Plenty of those levees exist now," he says. "We have them here in Dallas, in fact. And they're not only susceptible to floodwater, they're also susceptible to intense rainstorms. I want to find out how that kind of storm impacts a levee system."

To that end, El Shamy is using computer-modeling tools to develop an inventory of characteristics that make stronger levees. Standard levee modeling puts too much focus on the impact of flowing water, he says. "Water seepage will make the soil move and deform, but the levee also has weight – and this weight is trying to sink even as the water is flowing." The combination of seepage and sinking accelerates structural failure if the effect of the weight is ignored or underestimated, he adds. By taking the impact of that weight into account, engineers will be able to create much safer systems.

"I envision a worst-case scenario and use computer modeling to try to fix it," he says.

In a similar vein, El Shamy also is part of a nationwide university team investigating the impact of seismic activities such as earthquakes on building foundations. The group, which includes researchers from Rensselaer Polytechnic Institute (RPI), the State University of New York-Buffalo and the University of California-San Diego, is funded by the National Science Foundation.

"When pile foundations are subjected to seismic motion, their responses are very unpredictable. We're trying to understand their behavior by examining different aspects of the problem," El Shamy says. His work focuses on micromechanical simulation, while other institutions are working with large-scale systems and computational simulations.

El Shamy earned his Ph.D. degree in civil engineering from RPI under a National Science Foundation-funded project in which he first began modeling soils at a micro scale. At SMU, he says, "I have found a place where I can excel in my work and do the things that I like."

For more information: lyle.smu.edu/ence

** (From a blues song recorded in 1929 by Kansas Joe McCoy and Memphis Minnie in reaction to the devastation caused by the Great Mississippi Flood of 1927.)*

Life In The Fast Lane: The Mechanics Of Locomotion

Peter Weyand made 2008 Olympic headlines – and never set foot in Beijing during the games.

Weyand, associate professor of applied physiology and biomechanics in the Annette Caldwell Simmons School of Education and Human Development, hosted an international team of experts who conducted groundbreaking research on double amputee Oscar Pistorius of South Africa. Some of their findings were released for the first time in the *Journal of Applied Physiology*, published in June.

Outfitted below the knee with j-shaped carbon fiber blades called Cheetahs, the world-class sprinter became known as "Blade Runner." In 2008, the International Association of Athletics Federations (IAAF) disqualified him from international competition against able-bodied runners, which included the Olympics, because of the prosthetics, claiming they provided a competitive advantage and should be considered a technical aid.

Then director of Rice University's Locomotion Laboratory, Weyand and his collaborators put Pistorius through a series of tests. It was an important research opportunity "because achieving near-Olympic level running performance with artificial limbs was so unprecedented that we had no idea whether the blades were replicating the function of biological limbs or behaving in some very different and advantageous manner," Weyand says.

The team concluded that the IAAF's specific claims of a competitive advantage were scientifically unfounded, and the Court of Arbitration for Sport determined that Pistorius could compete.

The recently published paper expounds on the differences between natural limbs and prosthetics: Pistorius' physiology – energy cost and fatigability – is similar to that of intact-limb athletes, but his sprint-running mechanics are markedly dissimilar.

"Legs must perform different functions during the stance and swing phases of the stride, as well as during the start, acceleration and relatively constant-speed phases of sprint running. Collectively, the results underscore the difficulty of providing these multiple mechanical functions with a single, relatively simple prosthetic design."

Although he didn't make the final cut for South Africa's team, Pistorius cleared a historic hurdle – thanks to Weyand and others who took the case pro bono.

Weyand, himself a 15-year track and field competitor, earned a Ph.D. in exercise physiology from the University of Georgia in 1992. He subsequently directed research efforts at Harvard University's Concord Field Station, a large-animal facility specializing in terrestrial locomotion research, before joining Rice in 2003.

Lured by the challenge of helping to chart the direction of SMU's Department of Applied Physiology and Wellness, Weyand arrived at the University last August. He is helping develop a new undergraduate major in applied physiology and sports management and a graduate program in applied physiology.

This summer he is setting up a lab where he'll continue to examine the relationships between muscle function, metabolic energy expenditure and human physiology.

Weyand and colleagues have noted that large animals enjoy better locomotor economy – the thriftiness of energy output for a given physical task – on a per pound basis than small animals. "A mouse expends 30 times more energy than an elephant in proportion to their weight," he says. "The trend is the same for people: Large people have better locomotor economy on a per pound basis than small people or kids."

His investigations into the links between the whole-body mechanics of movement and metabolic energy expenditure using the "mouse to elephant" approach have a variety of applications. Among them are emerging sensor technologies, new methods for field estimates of energy expenditure and more sophisticated techniques for assessing physical and metabolic fitness in humans.

He holds a patent on a performance prediction method using foot signals and heart rate to forecast a person's aerobic fitness, and was instrumental in developing technology incorporated into the Nike + iPod Sport Kit, which uses a sport-shoe sensor to calculate distance, pace and calories burned.

Weyand's studies are relevant to elite athletes, weekend warriors and even soldiers in training. "After testing many different animals, we figured out that we could make very accurate predictions about the metabolic energy expense of walking by using body weight and the amount of time the foot is in contact with the ground," he says.

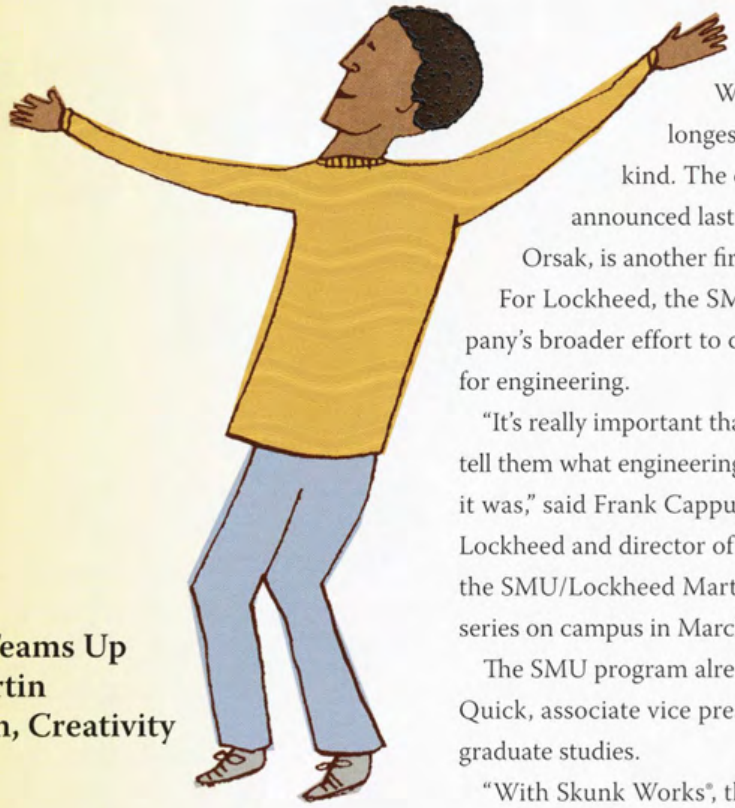
With research funded by the U.S. Army Medical Research and Materiel Command, Weyand hopes to apply those prediction methods in shoe-mounted sensors that will assess and monitor soldiers' physical fitness in the field and bring improved assessment techniques to the general population as well.

For more information: smu.edu/peterweyand

Peter Weyand adjusts equipment worn by Oscar Pistorius of South Africa.

ILLUSTRATIONS BY JON CANNELL

IN THE WORKS



SMU Engineering Teams Up With Lockheed Martin To Teach Innovation, Creativity

By Margaret Allen

Can students be taught to be innovative thinkers? SMU's Bobby B. Lyle School of Engineering is betting they can.

The Lyle School has launched the SMU/Lockheed Martin Skunk Works® Program, a progressive plan for teaching innovation to attract bright students into engineering. It targets two national crises: an unprecedented demand for emerging technologies to solve critical global problems such as housing, energy, global development and national defense, and a rapid decline in the number of new engineers.

The program is a partnership with the acknowledged leader in innovative thinking – aerospace defense contractor Lockheed Martin Skunk Works®. The Skunk Works® process originated in 1943 with work for the military that was conducted in secret. The name emerged when a team member began answering the phone "Skonk Works," the name of a secret still for making "joy-juice" in Al Capp's then-popular newspaper comic strip "Li'l Abner."

Lockheed's lab is known for working under extremely short deadlines to develop the fastest, most sophisticated military aircraft. Unmatched in its success, Lockheed's Skunk Works® was the first – and now longest-running – innovation lab of its kind. The company's partnership with SMU, announced last fall by Lyle School Dean Geoffrey Orsak, is another first for Lockheed.

For Lockheed, the SMU program expands on the company's broader effort to cultivate in students an enthusiasm for engineering.

"It's really important that we bond with the freshman and tell them what engineering is, as opposed to what they thought it was," said Frank Cappuccio, executive vice president at Lockheed and director of Skunk Works®, who helped launch the SMU/Lockheed Martin Skunk Works® Program lecture series on campus in March.

The SMU program already is turning heads, says James E. Quick, associate vice president for research and dean of graduate studies.

"With Skunk Works®, the Lyle School is stating that it's emphasizing innovation to train the next generation of engineers," Quick says. "This emphasizes collective problem-solving. Every engineer in the United States knows about Skunk Works®. They'll see that we're taking bold directions."

The program will combine research and innovation. "Innovation creates an entirely new approach or solution to a problem in such a way that changes the way others look at the world or engage the problem," Quick says.

Delores Etter, director of SMU's Caruth Institute for Engineering Education, is director of the SMU/Lockheed Martin Skunk Works® Program and is leading development of the

curriculum. It will include lectures on the Skunk Works® philosophy in courses for first-year engineering students; a Skunk Works® Lecture Series featuring business and government leaders; and visiting professorships in innovation. In addition, a laboratory will be developed where students will work round-the-clock in small teams to solve an assigned problem within a specific time frame, ranging from one or two weeks to a semester. The curriculum initially will target engineering undergraduates but eventually will include all disciplines.

Nathan Huntoon, a Ph.D. candidate in electrical engineering, is developing the innovation lectures. They will start in fall 2009 and will include case histories of innovative products and immersion projects.

"We'll provide students with the environment, the tools and the problems that will challenge them," Huntoon says. "By experiencing that process, students will realize what is possible. Everyone can be innovative, but they have to be in the right environment."

Students can participate in their first year. Etter is working with the U.S. Navy to secure a variety of authentic projects that students can tackle.

"Some projects are going to be more successful than others, and with each project they'll get a lot of feedback from faculty and their customers from the public or private sector. That will help students improve their design abilities," she says. "I want to increase students' confidence, which occurs by doing things that are successful, but also by understanding why something didn't work well."

Students will work in the Lyle School's 10,000-square-foot Innovation Gymnasium – a flexible lab space in the new $22 million, 65,000-square-foot Caruth Hall, now under construction. The building is set for completion in December. A spacious room with high ceilings, the gymnasium will be stocked with computers, electronic testing equipment, table saws and other materials and resources. Large glass windows will open to an interior public corridor, allowing passers-by to observe students at work.

The gymnasium also will include an "idea room" with audio-visual equipment for videoconferences and teleconferences. Student researchers can meet there with customers and faculty advisers.

Design projects may start at the end of this summer in existing lab space. All projects will address a critical need, Orsak says.

"We are committed to graduating students who bring innovative engineering skills with a passion for leadership and a strong social conscience," he says. "Skunk Works® assignments will provide a fantastic opportunity to make that connection by challenging students with demanding problems that address global challenges."

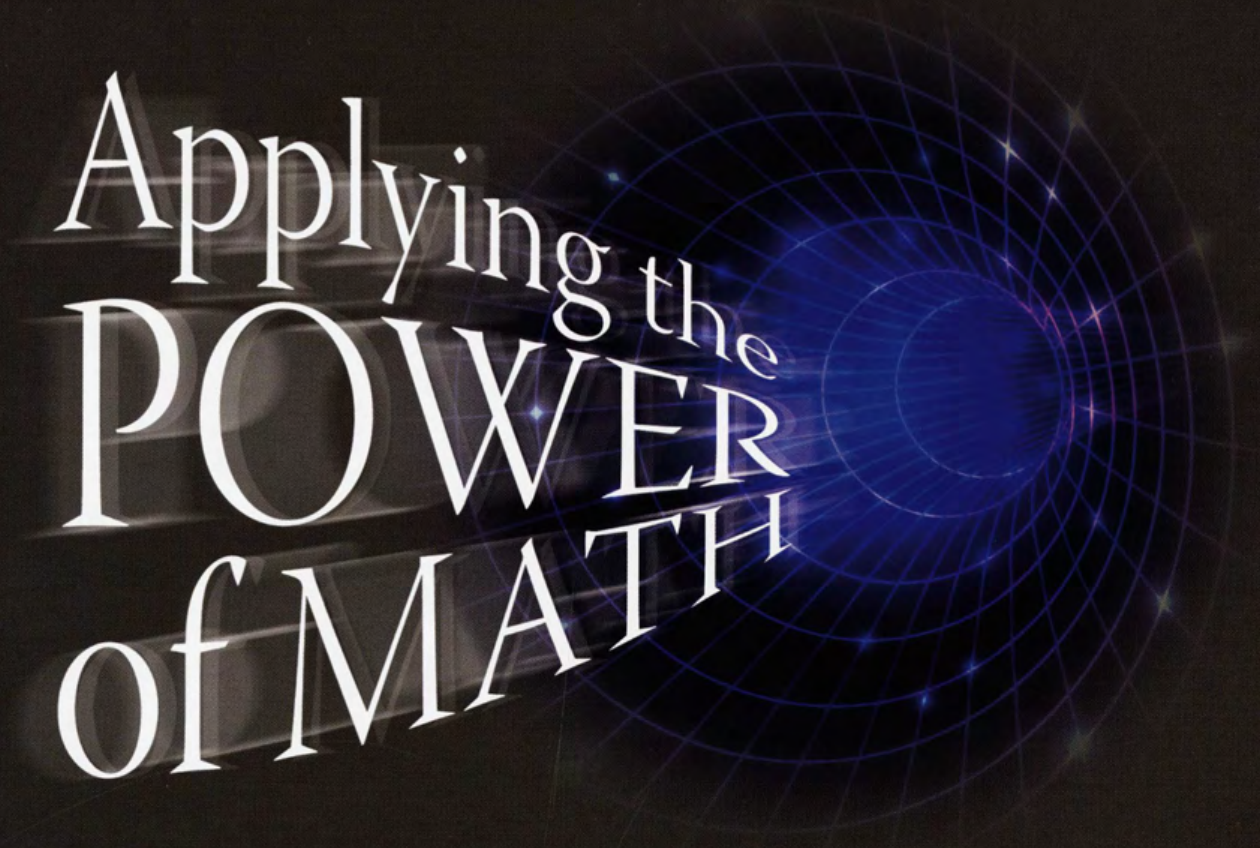
An important element of Orsak's and Etter's vision is to broaden the program beyond the University. Each semester a visiting professor from another university will be invited to participate in the program, probably starting in spring 2010. They believe that scholarly cross-pollination will bring new ideas to SMU, as well as send faculty back with a passion for implementing an innovation gymnasium at their universities.

Ideas from many sources have helped Lockheed Skunk Works® succeed, as the company hires graduates of numerous universities, Cappuccio said at the lecture series.

"It takes people to make things happen," he said. "That's where the magic of innovation comes in – the willingness to accept ideas from many people and to integrate the ideas to get a better product."

For more information: www.skunkworks.com

Applying the POWER of MATH



New Faculty Expand Department's Cross-Disciplinary Efforts

By Deborah Wormser

Four new faculty members with the Mathematics Department in Dedman College – Thomas Hagstrom, Alejandro Aceves, Brandilyn Stigler and Daniel Reynolds – are expected to build on the department's strengths and help it expand cross-disciplinary efforts.

Math faculty are working with SMU colleagues in the Mechanical Engineering, Electrical Engineering and Chemistry Departments. Applied mathematics is helping researchers across disciplines solve questions that range in scale from the vastness of the cosmos down to the cellular level, says professor and former department chair Peter K. Moore, who recently was named dean ad interim of Dedman College of Humanities and Sciences.

"Mathematical modeling, simulation and analysis can lead to greater efficiency in interdisciplinary projects by indicating which direct experiments are likely to provide the most useful results."

The Highs And Lows Of Wave Propagation

Professor Thomas Hagstrom, who holds a Ph.D. from the California Institute of Technology and comes to SMU from the University of New Mexico, specializes in using computational science – mathematics that harnesses the power of computers – to devise the most efficient methods of solving partial differential equations for wave propagation. The equations have applications in a variety of cross-disciplinary settings including acoustics, seismics, electrical engineering and astrophysics.

Just like waves in the ocean, sound waves in the field of acoustics and electromagnetic waves such as radar are made up of peaks and valleys that are described by their wavelength, which is the distance between successive peaks, he says. "When you look at something or listen to something, the peaks and troughs of those waves are carrying the information to your eyes, ears or, in the case of radar, to a machine that augments your own senses."

Hagstrom's greatest success has been in developing algorithms – instructions for solving complex programs – that limit the size of the sampling region in models of so-called wave-scattering problems. For instance, if an airplane is the object of interest, his algorithms can maximize the efficiency of simulating a radar system by curbing the computation to the airplane, rather than sampling everywhere in the sky, he explains.

In addition to teaching a graduate course that focuses on applying computational methods to wave propagation phenomena, Hagstrom taught a Calculus I course last fall.

"I haven't taught any students below senior level in more than 12 years," he says, describing the opportunity as one of the unique aspects of teaching at SMU. "One unfortunate trend at a lot of state universities has been to cover much of the lower level teaching with either lecturers or adjunct faculty, whereas at SMU, senior faculty teach those classes."

Laser Lightning Rods

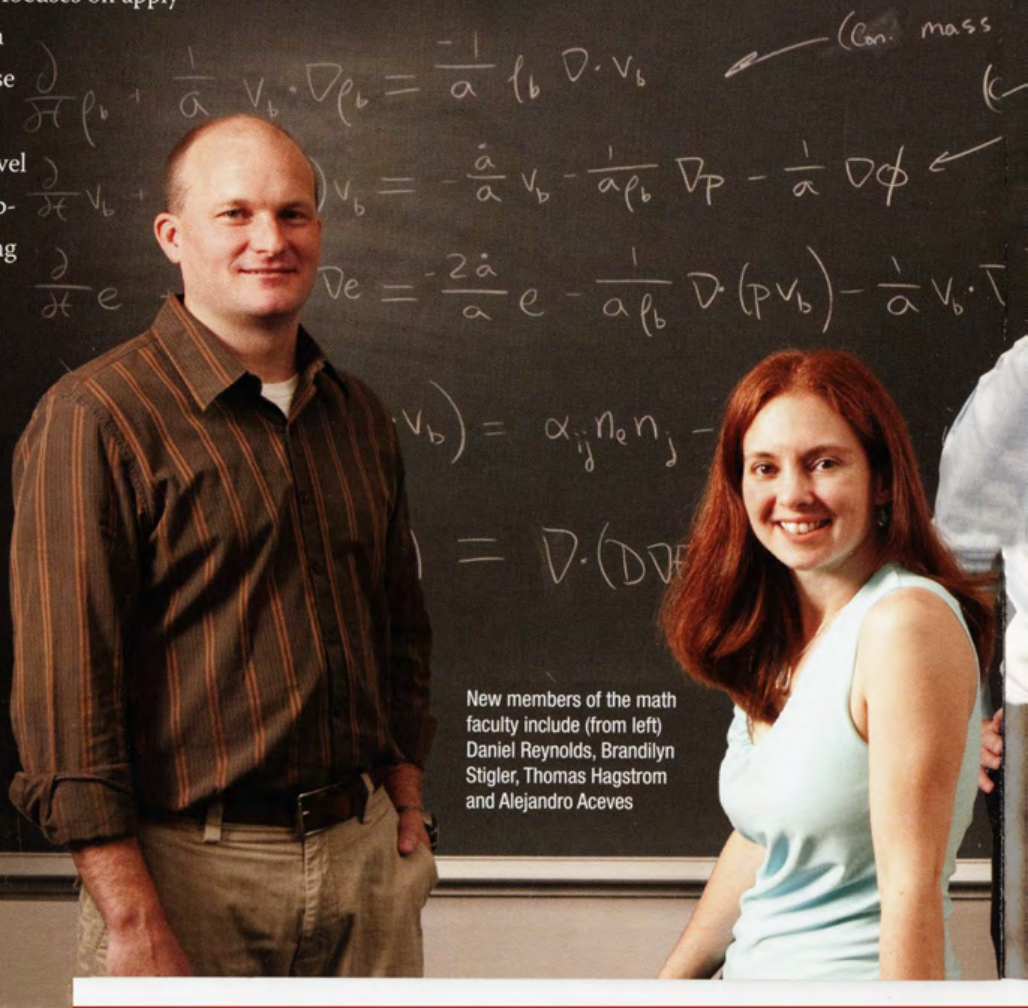
Professor Alejandro Aceves also came to SMU from the University of New Mexico, where he served as chair of the mathematics department. His specialty is nonlinear optics and lasers: the science of the visible and near-visible spectrum of light at energy levels so large they distort the propagating medium – the medium through which the energy travels, such as the atmosphere.

Aceves is continuing one project with University of New Mexico experimental physicist Jean Claude Diels on ultraviolet (UV) laser beams as they travel over great distances through the atmosphere. The project may someday lead to laser sensors that identify explosives at a distance, says Aceves, who earned his Ph.D. from University of Arizona.

Another application of this research would use high-energy laser pulses as a conduit to collect and channel lightning, basically improving on Benjamin Franklin's lightning rod. "Lightning is a random effect because you don't know where it's going to hit. There is always a danger of it hitting in the wrong place, like a house or where individuals are standing," he says. "If you send one of these lasers into the atmosphere it acts like a channel, so now the lightning will propagate where the channel travels."

Making Biology More Precise

Assistant Professor Brandilyn Stigler comes to SMU fresh from a postdoctoral position at the Mathematical Biosciences Institute (MBI) at The Ohio State University. MBI is one of only a handful of National Science Foundation (NSF)-funded mathematical research institutes in the country and the only one devoted to the mathematical biosciences, which include computational



New members of the math faculty include (from left) Daniel Reynolds, Brandilyn Stigler, Thomas Hagstrom and Alejandro Aceves

epidemiology and neuroscience, Stigler says.

At SMU, she specializes in applying algebraic techniques to the study of biological systems. "I'm interested in taking data from genetics studies and making mathematical models that represent the behavior of the genes within the cells," she says.

Her work involves reverse engineering, which she describes as being similar to the parlor game Twenty Questions, in which players try to discover a secret word by asking yes/no questions.

"In molecular biology, a biological network such as the immune system plays the role of the secret word and laboratory experiments take the place of the questions," she says. "The goal is to discover the network through the experiments with the hope of gaining deeper insight into a particular phenomenon."

Her computational approach uses experimentation, such as recent work testing the reaction of yeast cells to toxins that cause oxidative stress response genes to activate. These genes also are used by the immune system to fight pathogens.

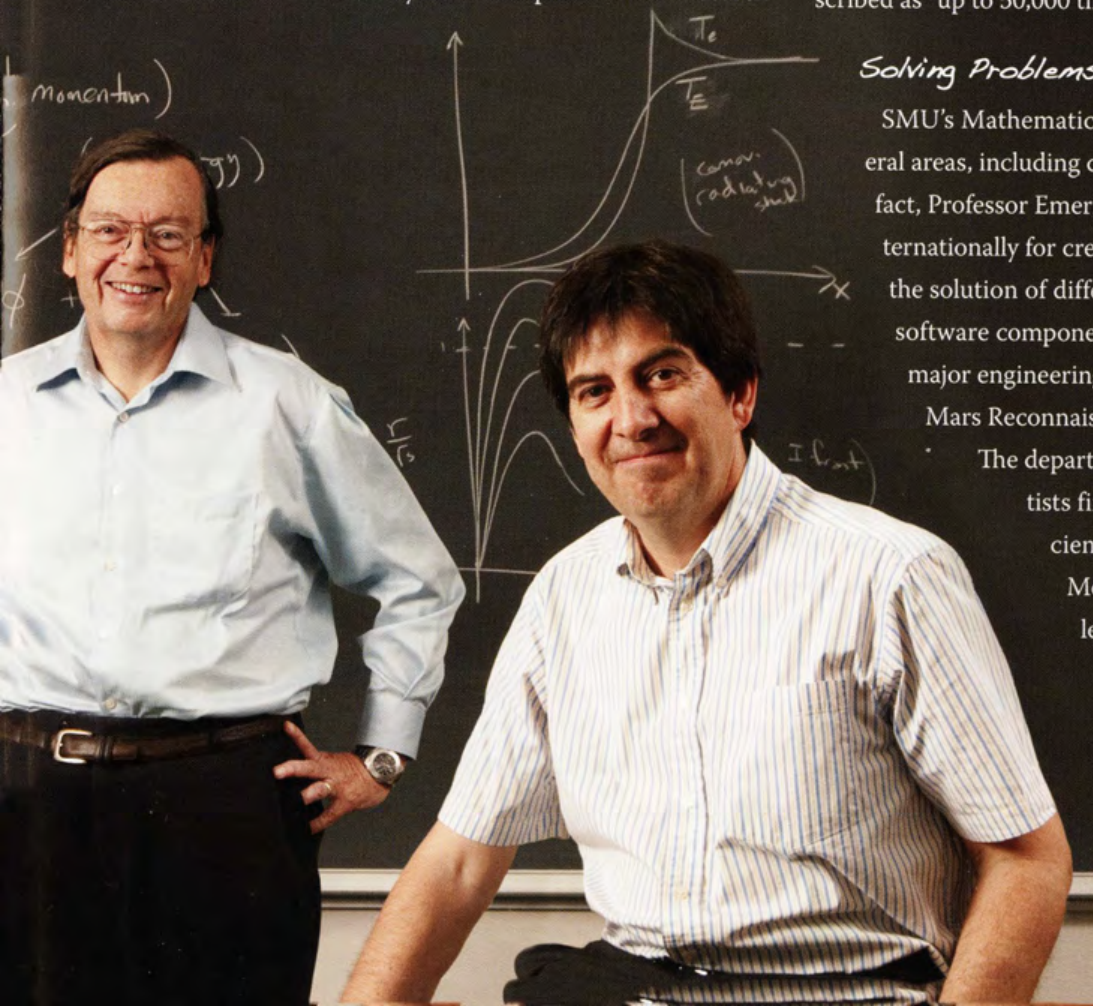
Moore points out that biological researchers have an enormous ability "to get very accurate data on the systems they study, but they need mathematicians to help them analyze and interpret that data."

Computing With The Stars

Assistant Professor Daniel Reynolds held postdoctoral research posts at Lawrence Livermore National Laboratory and at the University of California at San Diego before joining SMU. He works on large-scale computational problems in astrophysics and fusion energy, the energy created when atomic nuclei fuse as in the sun and other stars. His specialty is using parallel computers, so-called supercomputers, on large team projects to model and simulate experiments that would be prohibitively expensive and take years to solve with conventional computers.

Reynolds received an $80,000 grant from the Department of Energy for his part of a $3.1 million collaborative project involving five universities and four national labs to design algorithms to model fusion processes. Those models could aid in fusion reactor design for nuclear energy and perhaps even help explain how stars are born and how they die. In addition to studying supernovae (exploding stars), Reynolds has a $65,000 annual grant from the NSF to model star formation in the early universe.

To help solve some of these problems, Reynolds has allocated time on the world's largest supercomputer for open science research: the Ranger system unveiled at the University of Texas at Austin in 2008. At its dedication, Ranger was hailed as the first of the new "Path to Petascale" computer systems that NSF will provide to ensure U.S. leadership in computational science. Ranger's 15,744 computer processors, which work simultaneously, were described as "up to 50,000 times more powerful than today's PCs."



Solving Problems Across Disciplines

SMU's Mathematics Department has long excelled in several areas, including differential equations, Moore says. In fact, Professor Emeritus Lawrence F. Shampine is known internationally for creating much of the computer code for the solution of differential equations in Matlab, a crucial software component of the Math Works website used by major engineering projects around the world such as the Mars Reconnaissance Obiter.

The department will continue to help other scientists find clever ways to improve the efficiency and dependability of their projects, Moore says. "A lot of mathematical problems are too large or complicated to be solved by typical analytical techniques these days."

For more information:
smu.edu/math

Higher Callings

Doctoral Students Search For New Solutions To Age-Old Problems

By Kara Kunkel

Graduate research in diverse disciplines is fundamental not only to finding solutions to significant global problems but also to enriching the human experience. One of today's SMU Ph.D. candidates may find a key to the origin of the universe while another may provide new insight into the pathology of violence.

More than 415 Ph.D. candidates enrolled in SMU's 25 doctoral programs conduct research year-round in fields ranging from applied science and anthropology to religious studies and statistical science. More than 50 graduate from SMU each year.

The students, who come from around the world, forge bonds with fellow Ph.D. candidates, faculty mentors, SMU and Dallas, says James E. Quick, associate vice president of research and dean of graduate studies. "But preparing them to make contributions to academia and to society is one of the University's greatest achievements. The measure of that success is a broad range of research conducted about issues that are important to society."

Read how six future experts from Dedman College of Humanities and Sciences will make their marks on our world.

For more information about graduate programs at SMU, visit smu.edu/graduate.

NESE SARA Economics

Nese Sara developed a passion for understanding the intricacies of international trade while taking a course on international trade from Kamal Saggi (see story on page 5), chairman of the Economics Department and Dedman Distinguished Collegiate Professor of Economics. He later became Sara's mentor and chair of her dissertation committee.

Sara has assisted Saggi in research projects and co-authored a paper about non-discrimination trade agreements that was published in the *International Economic Review* in 2008. She also made presentations about their study at two prestigious regional economics conferences in 2007 – the Southern Economic Association Meetings and the Midwest Theory International Economics Meetings.

Her dissertation examines the conditions under which a bilateral free trade agreement would be attractive for countries of dissimilar sizes that produce similar goods of differing qualities.

"I found that product quality and market size play a central role" in whether two countries decide to sign a free trade agreement, Sara says.

A free trade agreement benefits a country if its export market gain exceeds the loss resulting from tariff elimination, her study concluded. Sometimes, the most attractive trade agreement would not be bilateral free trade but free trade for a smaller, less developed country and a positive tariff for a larger, more developed country, she says.

In the fall Sara will begin teaching at the University of Cincinnati, where she has accepted a position as an assistant professor of economics and will continue her research.

CATHERINE DODSON Psychology

Observers sometimes ask whether certain research has real-world applications. For Catherine Dodson, experiences in the real world put her on the road to a research-centered career.

After earning a Bachelor's degree in classical languages and archaeology, Dodson worked as a technical writer and systems analyst for an Internet company in Colorado. In her spare time, she volunteered as a victim's advocate for the police department in the Denver suburb of Northglenn. Family situations were sometimes so complicated that it was difficult to determine whether a person she interviewed was a victim, a perpetrator or both.

"The line often is blurry, depending on the circumstances," Dodson says. She began to wonder: "What life circumstances or personality traits lead one to become a violent criminal?"

Dodson is particularly interested in whether childhood experiences contribute to future aggression and how and when society should intervene to correct antisocial behavior.

She says she is drawn to forensic psychology and would like to work with the legal system. "I want to be involved in pragmatic research that answers questions related to societal issues."

Dodson has worked with clients at SMU's Family Research Center in collaboration with clinical faculty such as Renee McDonald, associate professor of psychology and one of her advisers. Dodson and McDonald have studied children who are callous and unemotional and the impact of their behavior on the parent-child relationship. The pair presented a paper on this topic at the International Family Aggression Society Conference in 2008. Dodson also wrote about the issue in her Master's thesis.

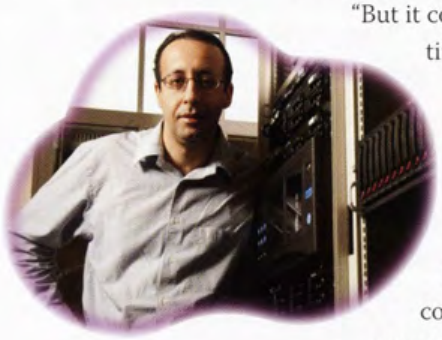
"If these traits occur in severe groups such as violent families, they probably occur in other families as well," McDonald says. "Catherine sees that this group of children is not homogeneous. Poor parenting contributes to the development of child antisocial behavior, but there are a number of other ways that children develop antisocial behavior."

AZEDDINE KASMI Physics

Millions of research hours have been devoted to the quest for the elusive Higgs boson, a theoretical subatomic particle that is the missing piece of the Standard Model of particle physics. So far, the Higgs is the only particle in the Standard Model that has not been proven to exist, and it is considered a key to explaining the origin of the universe and how particles gain mass.

Azeddine Kasmi, a doctoral candidate in SMU's Physics Department, is developing an algorithm that could increase the amount of usable data studied when seeking evidence of the Higgs particle and potentially speed its discovery. The algorithm would use data gathered from high-energy particle accelerators such as the Large Hadron Collider on the border of France and Switzerland, where SMU scientists are participating in research with the ATLAS particle detector.

"So far, it's a feasibility study," Kasmi says. "But it could shorten the detection time by 20 to 40 percent."



Kasmi has been fascinated with particle physics since his undergraduate studies at the University of Oujda in Morocco. He says SMU's commitment to this highly competitive field and the opportunity to work with ATLAS drew him to Dallas.

For two years, Kasmi has worked closely with Robert Kehoe, assistant professor of physics, and has spent part of each year at the LHC in Switzerland preparing ATLAS for its launch. It could be several years before sufficient data has been analyzed to prove or disprove the existence of the Higgs particle. If Kasmi is on the right track, it could take less time.

Kasmi has presented his results internationally, most recently at the American Physical Society's meeting in April, and was well received, Kehoe says. "Azeddine has made a good case for his approach."

KAYLA WALKER EDIN English

Kayla Walker Edin is following a passion for literature that started soon after she learned to read and fulfilling a dream inspired by a fourth-grade teacher who, impressed with her writing, suggested that she earn a doctorate.

As a child, Edin was fascinated by adventure novels and captivating narratives such as Joseph Conrad's classic *Heart of Darkness*. Edin has been working with Professor Ross Murfin on edits of the third edition of Conrad's 1902 novella for the Case Studies in Contemporary Criticism series published by Bedford/St. Martin's.

"This is a transitional text between two periods I'm interested in ... late Victorian and early modernist writing," says Edin, a member of the English Department's first group of Ph.D. candidates.

Her interests include women's literature, which began to intrigue her after she read Virginia Woolf's classic 1929 essay "A Room of One's Own" while enrolled in a study abroad program as an undergraduate.

"As a student and a traveler, you're always with other people and very confined," she says. "Her essay talks about the importance of women needing a room of their own to write and be creative."

With several years of doctoral study ahead, Edin hasn't chosen a dissertation topic, but she expects to find inspiration in Woolf's writing and in the 150 or more books she is reading and discussing with Dennis Foster, the D.D. Frensley Professor of English and the department's director of graduate studies. He and Edin's assigned mentor, Associate Professor Nina Schwartz, provide advice and guidance.

"I really can't overstate the kind of support we get from faculty," says Edin, who taught undergraduate English courses in Portland, Oregon, before coming to SMU.

"I want to teach," she says, "and I want to continue my research and publish. That's a door that a Ph.D. can open."

HELEN MCLURE History

Truth often is darker than fiction, as Helen McLure discovered some years ago when she read a history article that described the lynching of six women and girls in a Parker County family over a period of days in 1873.

"I had never heard of this, and I have never met a native Texan who has heard of the Parker County lynchings," says McLure, a doctoral candidate in the Clements Department of History. The mysterious killings became part of local folklore. In the absence of official reports or investigations, locals spun rumors and gossip into stories about horse theft and wild behavior.

The unexplained massacre became the subject of McLure's Master's thesis and changed the way she thinks about American history. Old newspaper articles are among her favorite sources, but sometimes they are more fanciful than factual, she found. And illegal activity that was tacitly approved by a community often escaped scrutiny.

The fears that drove some communities to verbally and physically assault individuals they disapproved of or did not understand was "part of a whole culture of mob violence that goes back to the very beginning of settlement" in the United States, McLure says.

She has studied and written about women and lynching, notorious killings, outlaws and vigilantes in the American West and Midwest. She also wrote chapters about a variety of these topics for *The Old West: History and Heritage*, edited by Edward Countryman, University Distinguished Professor of History. And she is a research assistant on the subject of Texas lynchings for William Carrigan, a professor at Rowan University in New Jersey. Carrigan's research, funded by the National Science Foundation, examines the lynching of people of Mexican origin and descent.

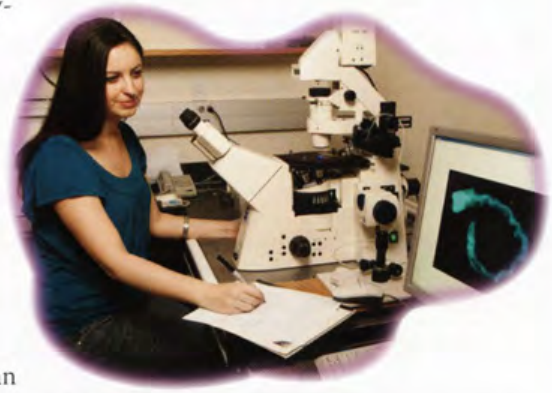
McLure is completing her dissertation, which looks at the involvement of women and children in lynchings, vigilantism and mob violence in the American West from 1850 to 1930. "I want to put women and children back into the picture," she says.

In 2005, the Coalition for Western Women's History awarded McLure's Ph.D. project the Irene Ledesma Prize for graduate research in gender and women's history, and McLure hopes to turn the dissertation into a book.

CHRISTINA PAULSON Biological Sciences

While an undergraduate majoring in dance at Tulane University, Christina Paulson broke her ankle. Sidelined from her dance classes for a semester, she took biology courses and discovered a new love.

"I think everything about biology is interesting. You can see it in everything around us. I'm just curious about what's going on one step smaller than we can see," Paulson says.



At SMU, she is focusing on worms, in particular a tiny nematode called *C. elegans*. The worm is one of the most useful creatures in the laboratory for a number of reasons, including the length of its life cycle – three days.

Paulson and her adviser, Assistant Professor of Biological Sciences Jim Waddle, thought that the worm might be useful for laboratory toxicity screening. "You normally apply chemicals to individual cells or mice. We wanted to use worms because they're a nice compromise. They tell us much more than cells, but are much cheaper and have a faster developmental process than mice."

Worms, however, are filter feeders, which creates problems when testing drugs, Paulson says. They live in the dirt, eating and excreting everything too quickly for toxins to have any effect. So Paulson doused the nematodes with mutagenic chemicals. Then she examined them and thousands more, looking for worms with abnormal intestines. Finally she found a worm that had outpouchings all along the intestine. Paulson and Waddle tested the mutant worm strain and found that it did, indeed, show sensitivity to toxins. This strain of mutant worms some day may be used by pharmaceutical companies to test new, better drugs to treat cancer or heart disease.

Paulson presented the results of their research to the International *C. elegans* Meeting at UCLA in 2007.

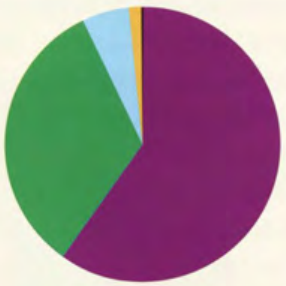
In the meantime, Paulson has continued to examine more worms that have been chemically treated and has discovered three more with mutant intestines. "They have mutations in different genes, but all have weird intestines," she says. "The hope is that we can figure out how these different genes relate to one another and figure out how this affects drug sensitivity."

In academic year 2007-08, sponsors awarded $19,453,060 to SMU for direct and indirect costs of research and sponsored projects. Totals in the three previous years were: $20,534,253 in 2006-07; $15,454,165 in 2005-06; and $14,675,605 in 2004-05.

Funding sources were federal agencies, $11,719,352; corporations, $6,330,032; foundations, $1,126,855; state and local governments, $265,821; and other, $11,000.

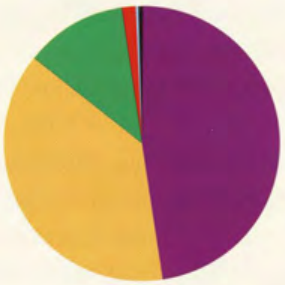
The Bobby B. Lyle School of Engineering received $9,277,802 in 48 awards; Dedman College of Humanities and Sciences received $7,399,749 in 58 awards; Annette Caldwell Simmons School of Education and Human Development was awarded $2,322,250 in nine awards; Perkins School of Theology received one award of $315,000; and Meadows School of the Arts received $31,259 in two awards. Non-academic departments reporting to the Office of the Provost and others received a total of $107,000.

Of the 79 project directors/investigators, the following faculty received $100,000 or more in aggregated funding. They are listed in alphabetical order.



Funding Sources

A Federal $11,719,352
B Corporations $6,330,032
C Foundations $1,126,855
D State/Local $265,821
E Other $11,000



Distribution Of Funds

A Engineering $9,277,802
B Dedman College $7,399,749
C Education and Human Development $2,322,250
D Theology $315,000
E Arts $31,259
F Provost Office $107,000

Alfredo Armendariz, Environmental and Civil Engineering, "Control of Workplace Diesel Exhaust Particulate," Centers for Disease Control Grant, Department of Health and Human Services

David Blackwell and **Maria Richards**, Geological Sciences, "Geothermal Resource Assessment of the Commonwealth of the Northern Mariana Islands," U.S. Department of the Interior

Ronald Butler, Statistical Science, "Saddlepoint and Bootstrap Methods in Stochastic Systems and Related Fields, National Science Foundation (NSF)

Marc Christensen, Electrical Engineering, "Active Illumination with Micro-Mirror-Arrays for Computational Adaptive Multi-Resolution Sensing (AIM-CAMS)," U.S. Army

Marc Christensen, **Gary Evans** and **Jerome Butler,** Electrical Engineering, "High Performance Coherent Fiber-Optic Link – Photonic Phase-Locked Loop (Modification 1, University of Texas at Dallas/Drexel University/Office of Naval Research)," U.S. Navy

Gary Evans and **Jerome Butler**, Electrical Engineering, "Integratable-Optical-Waveguide Isolators Using a Resonate Layer Effect (U.S. Army, RDECOM)," U.S. Army

Ping Gui and **Jingbo Ye**, Electrical Engineering, "ATLAS Maintenance and Operations (Columbia University/NSF)," NSF

Richard Gunst and **William Schucany**, Statistical Science, "Gulf War Neuroimaging Core Statistical Innovations Subcore (University of Texas Southwestern Medical Center (UTSMC)/U.S. Department of Veterans Affairs)," USVA

Richard Gunst and **William Schucany**, Statistical Science, "Biostatistical Research Interns," UTSMC

Eugene Herrin and **Paul Golden**, Geological Sciences, "Operation and Maintenance of TXAR Array (AFTAC)," U.S. Air Force; "Operation and Maintenance of Three IMS Primary Seismic Arrays," Comprehensive Testban Treaty Organization;" and "Analysis of Infrasound Signals from Rocket Explosion Calibration Experiments at White Sands Missile Range (University of Mississippi/Army)," U.S. Army.

Yildirim Hurmuzlu, Mechanical Engineering, "Multiphase Flowmeter and Specifications," ARAMCO Services Company

Bonnie Jacobs and **Neil Tabor**, Geological Sciences, "A Geosystems Approach to Paleobotany, Isotope Geochemistry and Paleoecology of the

Late Oligocene Chilga Deposits, Northwest Ethiopian Plateau," NSF

Ernest Jouriles and **Renee McDonald**, Psychology, "Reducing Mental Health Problems Among Children Exposed to Domestic Violence," U.S. Department of Justice

Robert Kehoe, Physics, "Software Infrastructure for ATLAS Online Monitoring," U.S. Department of Energy

Jeffery Kennington and **Eli Olinick**, Engineering Management, Information and Systems, "Using Mathematical Programming for Optimal IP Routing," U.S. Navy

Radovan Kovacevic, Mechanical Engineering, "Siemens Software Project," Siemens PLM Software

Radovan Kovacevic, Mechanical Engineering, "Fellowship Program in Lasers and Plasmas for Advanced Manufacturing (Graduate Assistance in Areas of National Need)," Department of Education

Jose Lage and **Paul Krueger**, Mechanical Engineering, "Experimentally Guided and Validated Model for Simulating Turbulence in Porous Media Flow," NSF

William B. Lawrence, Theology, "Center for the Study of Latino/a Christianity and Religions," The Henry Luce Foundation Inc.

Patricia Mathes, Teaching and Learning, "Continuous Progress Monitoring of Early Reading Skills," Collins Foundation; "National Council on Economic Education-English Language Acquisition Evaluation Research Program (Project ELLA)," Department of Education

Patricia Mathes and **Jill Ailor**, Teaching and Learning, and **Ian Harris**, Statistical Science, "Maximizing Literacy Learning Among Children with Mild to Moderate Mental Retardation (Project Maximize)," Department of Education

William Orr, Biological Sciences, "Glutathione, Oxidative Stress and Aging," National Institutes of Health (NIH)

Geoffrey Orsak, Electrical Engineering, "A Comparative Analysis of the American Diploma Project (ADP) Benchmarks and the Trends in Mathematics and Science Study (TIMSS) Framework," Bill & Melinda Gates Foundation

Volkan Otugen, Mechanical Engineering, "Development of a Micro-Optical Shear Stress Sensor for Fluid Mechanic Research (Polytechnic University Transfer Award)," NSF

Dinesh Rajan, Electrical Engineering, "Power Efficient Design of Wireless Networks with Delay Guarantees," NSF

Tammy Richards, School of Engineering, "Texas Youth in Technology Grant Program – SMU School of Engineering (Texas Workforce Commission/U.S. Department of Labor)," Department of Labor

Hector Rivera and **William Pulte**, Teaching and Learning, "English Language Acquisition: National Professional Development Program," Department of Education

Ne'Shaun Robinson-Jones, Teaching and Learning, "Classic Upward Bound," Department of Education; "Early College Access Institute," Texas Guaranteed Student Loan Corp.

Larry Ruben, Biological Sciences, "TRACK Regulates Cytokinesis in *Trypanosoma brucei*," NIH

Ryszard Stroynowski, Physics, "High Energy Physics (Experimental, Amendment #A007)," Department of Energy; "ATLAS Maintenance and Operations," "R&D Program to Develop Novel Cryogenic Tracking Detectors for Underground Experiments" and "ATLAS Maintenance and Operations," (Columbia University/NSF), NSF

Ryszard Stroynowski and **Fredrick Olness**, Physics, "High Energy Physics (Theory, Amendment #A007)," Department of Energy

Brian Stump, Earth Sciences, "Seismo-Acoustic Monitoring (ACRN AG Only)" and "Force Performance Assessment of Multi-Array Processing with Ground-Truth for Infrasonic, Seismic and Seismo-Acoustic Events: Application to Event Localization," Air Force

Steven Vik, Biological Sciences, "Structure-Function Studies of E. coli F1Fo-ATPase," NIH

Pia Vogel, Biological Sciences, "The Stator Subunits of the ATP Synthase," NSF

Paige Ware and **William Pulte**, Teaching and Learning, "English Language Acquisition: National Professional Development Program," Department of Education

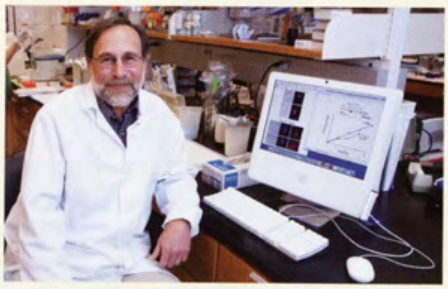
David Willis, Mechanical Engineering, "Laser Machining Research," Southwest Research Institute

David Wills and **Paul Krueger**, Mechanical Engineering, "Research Experience for Undergraduates Site: Experimental Methods in Mechanical Engineering," NSF

Jingbo Ye, Physics, "ATLAS R&D (Detector Research and Development)," NSF

Yunkai Zhou, Mathematics, "Design and Implementation of New Scalable Algorithms in Nano-Scale Materials Science," NSF

Student Jason Stegall (center) provides support to David Willis (left) and Paul Krueger in the Mechanical Engineering lab.



Larry Ruben, Biological Sciences, conducts research on *Trypanosoma brucei*, which causes the lethal disease commonly known as sleeping sickness.

Young Researchers Have

BIG iDEAS For Dallas

Andres Ruzo '09 and junior Elizabeth Corey think SMU could be sitting on its own energy source.

Ruzo, who earned Bachelor's degrees in geology and finance in May, and Corey, an environmental engineering and pre-law major, are investigating possible geothermal resources located under campus, with hopes of laying the groundwork for a geothermal power plant at SMU.

"People don't know how much energy is right beneath their feet," says Ruzo, who has examined the logs of water, oil and gas wells in North Texas, charting rock layers, water temperatures and flow rates. He adds that geothermal energy is a sustainable, zero-emission green technology.

Ruzo and Corey were awarded a $5,000 grant this spring for their "SMU Geothermal Project" through Big iDeas, an undergraduate research program launched by the Provost's Office in 2008. The students competed to be one of 10 interdisciplinary teams awarded a stipend to investigate important Dallas issues such as health care, the environment, education and energy.

For Corey and Ruzo, now a geophysics graduate student in the Huffington Department of Earth Sciences, the stipend has supported computer resources; access to well log libraries, maps and databases; and a presentation to the Geothermal Resources Council's international conference this fall in Nevada. The students also plan to present their findings at SMU's Geothermal Conference in November.

"A geothermal power plant on the campus would move the industry from talking about a paradigm shift into the actuality of mass production," says Maria Richards, SMU Geothermal Lab Coordinator and an adviser on the research project. "When SMU turns on its geothermal power plant, corporations across the Gulf Coast will realize that they, too, can power their headquarters with local, clean, reliable geothermal energy."

Other Big iDeas projects include "Real Fuel on Campus," an effort to reduce emissions by converting SMU's food service waste vegetable oil to biodiesel for a campus biodiesel fueling station; "Omega Delta Phi's Young Knights," a mentoring program to encourage at-risk Dallas high schoolers to pursue college; and "Profiting from Nonprofits," a study of Dallas' nonprofit sector in a tough economy. They will report on their progress at a fall symposium.

"Big iDeas allows students to develop their interests and career paths while also building bridges between SMU and the Dallas community," says Provost Paul Ludden.

Several of this year's full-grant recipients are continuing work begun last year, when they were awarded $1,000 Big iDeas planning grants to further develop their projects. Among them are Julene Fleurmond '09 and Christy Vutam '09, who propose reaching out to at-risk students with lessons on entrepreneurship and art through their "Young Dreamer Enterprises."

"Young people get a feeling of accomplishment when they create," says Fleurmond, who earned a Bachelor's degree in journalism, with minors in advertising and art. "When they also can market and sell their creations, they learn they have the power to support themselves and do anything they put their minds to."

Fleurmond and Vutam used last year's planning grant to investigate youth learning programs nationwide and to determine which age group to target. They found a partner in the local chapter of Network for Teaching Entrepreneurship (NFTE), and they plan to launch their curriculum in a Dallas middle school this fall with the help of SMU student volunteers.

"Middle school students look up to and connect with college students," says Karen Ezell, Dallas' NFTE program director, who advised the research team. "In addition to teaching business planning, the SMU students will demonstrate how important it is to get an education, pursue dreams and be successful lifelong learners."

Fleurmond, who plans to pursue a Master's degree in public health next year, says the grant has allowed her to put into action her passion for working with young people. "Big iDeas is a great way to enrich the Dallas community and SMU students' lives."

For more information: smu.edu/bigideas

North Texas isn't considered an earthquake-prone region, yet more than a dozen tremors have been located in the area since Halloween by the U.S. Geological Survey, the federal agency that tracks earthquakes. While the tremors were no great shakes – most registered magnitude 3.0 or less, which is considered mild – they present an important research opportunity, says seismologist Brian Stump.

Stump, the Claude C. Albritton Jr. Chair in Geological Sciences in Dedman College, along with geophysics research projects director Chris Hayward and junior earth sciences major Ashley Howe are deploying 10 portable seismographs in North Texas to capture data on seismic activity over the next six months. The equipment is on loan to SMU from the PASSCAL Instrument Center operated by the Independent Research Institutions in Seismology and funded by the National Science Foundation. The equipment has been installed at five locations in the Irving-Euless-DFW Airport area, where minor seismic events have occurred sporadically since last fall.

WHAT'S ROCKIN' NORTH TEXAS?

SMU Researchers Study Area ✭ Earthquakes

Additional stations have been positioned in and around Cleburne, about 50 miles southwest of Dallas. That area experienced six small earthquakes in June.

Stump refers to the study as a "nights and weekends project" because it has to be sandwiched into the already-full research schedule. "SMU has a seismic program, so when we have an earthquake in our backyard, we can't ignore it," he says.

Howe signed on to work for Stump before the Cleburne quakes. Now she's at the epicenter of what she considers "a launching pad to graduate research.

"I help maintain the stations, test equipment, analyze data; I get to do just about everything they [Stump and Hayward] do," she says.

"Ashley's making primary observations that will still be referred to in 10 years," Hayward says. "She's making a lasting contribution as an undergraduate."

Data collected during the course of the project may help provide some answers about the earthquakes' causes. "Current information about these earthquakes cannot provide a definitive answer," Stump says. "Better characterization of the location and sizes of these small events may provide insight into the possible sources. We're interested in how such earthquake sequences form and vanish, why they occur in a particular location and how stress in the North Texas area builds and is released."

Above right: Junior Ashley Howe and geophysics research projects director Chris Hayward check the portable seismograph's power controller.

Below right: Professor Brian Stump adjusts a seismometer, the heart of the battery-powered station. The sensor measures ground velocity as slight as .00000001 meter/second.

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