A DEADLY FOE

UTSA scientists seek vaccine against a simple but virulent life-form
Welcome to the inaugural issue of UTSA Discovery magazine. This annual publication was created to share news about the exciting research and creative endeavors being conducted at The University of Texas at San Antonio.

As the fifth-largest public university in Texas, and the fastest-growing university in the state, UTSA is on a rocket ride to become the next premier public research university in Texas and to be among the top-100 in the nation.

At UTSA, we are undergoing a transformation. Over the past several years, we have embraced our research mission by increasing our doctoral programs to 20 and hiring world-class faculty to work alongside both undergraduate and graduate students to explore problems and create solutions. We have strengthened our collaborations with the University of Texas Health Science Center at San Antonio, the U.S. Air Force, Southwest Research Institute and other private and public entities. Last year alone, we increased research expenditures by 37 percent.

In the following pages, you’ll see just a few of the many outstanding achievements being accomplished campuswide. I hope you will take a few minutes to glance through the magazine, and return to it again as you have the opportunity.

Thanks for letting me share this good news about UTSA. I’d love to hear what you think. Please feel free to drop me a line at president@utsa.edu.

Ricardo Romo, President
UTSA is accelerating toward its vision of becoming a premier public research institution at an exciting and challenging time. Academic research is no longer limited to the creation and dissemination of knowledge and the training of the next generation of researchers. In the 21st century, “premier research” connotes a much more extensive concept.

Today’s complex research problems require collaborations of interdisciplinary teams involving universities, health science centers, industry, the military, research institutions, governments and others. This is clear from the research road maps of most funding agencies. Furthermore, research does not end with discovery. There are additional obligations to take those discoveries through the next steps of development into meaningful products and services for society. This often involves joint ventures with the additional metrics of intellectual property, workforce development and economic development.

UTSA has strategic advantages in meeting these new challenges. These include its vibrant multicultural population and exceptional opportunities for collaboration, which are of paramount importance in our ability to recruit and retain world-class faculty and outstanding students and staff.

The specific research projects profiled in this issue exemplify these multidisciplinary, collaborative approaches to complex problems. You will note the involvement of many of our external research partners. Further, you will observe that these programs carry discoveries forward into meaningful applications for society.

UTSA’s climb toward premier public research status will be fueled not only by its phenomenal growth of students, faculty and facilities, but also by these dramatic changes in the scope of our global collaborative research.

Robert Gracy, Vice President for Research
The Road to Excellence
UTSA sets its sights on premier public research status

By Lety Laurel

By 2016, university officials want research expenditures to exceed $100 million a year, propelling the university to premier public research status. It’s an ambitious goal, they admit, but not impossible. Every year, research expenditures surpass the previous year’s, and UTSA adds dozens of new faculty and additional doctoral programs.

“It’s going very fast and it’s a challenge for research infrastructure to keep pace with this growth,” said Robert Gracy, vice president for research. “It is probably one of the most exciting things that we will experience in our careers, this enormous change that is going to happen in our university and in our city.”

In 2006, the university’s total expenditures for research increased 37 percent from 2005. That placed UTSA ninth out of the 42 public and independent universities in the state, according to the Texas Higher Education Coordinating Board.*

Within the University of Texas System, UTSA ranks third in federally supported research and development expenditures, after Austin and El Paso. In the biological and life sciences, UTSA’s expenditures placed among the top universities in the state, exceeded only by UT Austin and Texas A&M University, according to the coordinating board.*

Yet, despite this progress, there’s much to do in the next decade, said Jeffrey Kantor, associate vice president for research. “I’m very impressed with the first steps we’re taking, but it’s a long road.”

To help guide the way to obtaining premier status, the university began work last year on a 10-year strategic plan. One proposed initiative is to increase research campuswide, from undergraduate students to faculty. Doing so is crucial for providing knowledge and molding a capable workforce, officials have said.

Exceeding $100 million in research expenditures would signal this elevated status, but there are many other factors involved in becoming a premier public research institution, Gracy emphasized. These include the number of publications produced by university faculty, research citations, patents, the development of technologies that can benefit society and other measures of creative endeavors. The number of research-oriented faculty, doctoral programs, Ph.D. students and postdoctoral trainees must also be considered.

“It all comes back to the accomplishments and the quality of our faculty,” Gracy said. “Premier means that we are recognized by the public, by our peer institutions. Thus, awards to faculty such as Nobel Prizes, National Academy memberships and editorial boards are other metrics of premier research status.”

Elevating UTSA’s reputation in the academic and research worlds could
attract more research-oriented faculty across all disciplines, helping to further the goal of national recognition, said Mahesh Senagala, associate professor and associate dean for academic affairs and research in the College of Architecture.

“Research is probably the most important thing,” he said. “Reputation goes a long way in establishing research credibility and fundability. … Also San Antonio is becoming a magnet for research companies, so it means economic progress. If we look at many successful research universities, you see they are either situated in very active economic zones or have been instrumental in forming those economic zones.”

With UTSA’s unique student population and its partnerships with community institutions such as Southwest Research Institute, the University of Texas Health Science Center at San Antonio and other academic organizations, Southwest Foundation for Biomedical Research, the military and commercial entities, UTSA won’t look like any other premier research institution in the nation, Gracy said. “These partnerships, in conjunction with our multicultural diversity, create unique synergies with which to build UTSA’s research focus,” he added.

Increasing student enrollment will also shape the university. Predictions have enrollment hovering around 35,000 in 10 years. “We are going to need a lot of additional buildings for research,” Gracy said. “I think [the university] is going to be recognized by our community as an even greater asset to the community than it is now … both in terms of job creation and the training of a first-class workforce for the community.”

When universities accomplish their mission of education and research, the benefits are far-reaching, Kantor said. New knowledge is created, which is then passed on to students. New technologies developed within the institution can be implemented commercially.

“There’s not a single person that would not be affected in a positive way by the kinds of research and development that we’re doing,” Gracy said. “The research that we are conducting is going to have a major impact on our quality of life in the 21st century.”

While promoting research is a key initiative, it’s not the only mission of the university. “If we only obtain the money and we don’t promote the education, particularly of Hispanic students, we won’t reach our goal,” said George Perry, dean of the College of Sciences, which brings in 75 percent of research funding to the university. “We’re a university. Our research occurs in the context of the education of students.”

* Excludes health science centers
Pilot program to address obesity in preschoolers

As obesity in school-aged children becomes a national crisis, researchers in San Antonio are finding that many children are already overweight or obese before they even enter kindergarten.

A 2002 American Heart Association study reported that one in 10 children between the ages of 2 and 5 is overweight. So UTSA researchers Zenong Yin, Suzanne Winter, Art Hernandez, Ashley Love and Susan Veitschegger with the College of Education and Human Development and the Child and Adolescent Policy Research Institute have launched “Healthy and Ready to Learn.” This program focuses on preventing excessive weight gain and promoting healthy development in high-risk Mexican American preschoolers. Funded with a $250,000 grant from the Baptist Health Care Center, the program will target children ages 3 through 5.

“We are entering an area of research that is virtually untapped,” said Winter, principal investigator and associate professor of early childhood education. “We know of no other program that comprehensively targets young children with a multifaceted program of evidence-based diabetes prevention. We are developing all the materials, exercises and packets from scratch. It’s a daunting task, but of course at the same time, it is extraordinarily exciting.”

Members of the Edgewood Family Network, Promotoras, will accompany researchers to child care centers, where teachers and parents will be provided with information and activities to encourage children to eat healthy, increase their physical activity and spend less time viewing TV or playing video games.

— ASHLEY HARRIS

Sex and the media

To determine the impact of the media on adolescents’ knowledge and attitudes about sex, researchers from the College of Liberal and Fine Arts and the College of Education and Human Development recently conducted studies involving local Hispanic teens.

“Little is known about Hispanic teens’ sexual knowledge, attitudes and behaviors, and their relationship to media influences,” said Viviana Rojas, study investigator and assistant professor of communication. “Information about this relationship could contribute to an understanding of the early onset of sexual behavior and early teen pregnancy.”

A 2005 report from the San Antonio Metropolitan Health District indicated that birth rates among Bexar County teens ages 15 to 17 were 80 percent higher than the national average in 2003. These rates vary among minority populations, but the report showed that Hispanic teens appear to be at highest risk.

Through focus groups conducted at San Antonio middle and high schools, UTSA researchers found that teens readily adopted styles of dress, expressions and attitudes seen and heard through media channels. Teens also admitted that the attitude toward sex portrayed in the media makes them feel less vulnerable to the risks and realities of sexual behavior, and that they rely on the media for information and a behavioral standard.

Additionally, male participants said what they saw on television affected their expectations about the way their partners act, dress and participate in sexual activities.

Rojas hopes the data gathered will be used to create more effective sex education programs. “The information collected will also contribute to future studies on how teenagers talk about sex, parents’ involvement in the sex education of their children and the role of the Hispanic family in sexual education,” she said.

— ASHLEY HARRIS
A “SMART BUILDING” KNOWS how many people are inside, how long they have been there and what rooms they occupy. Without human intervention, the building can adjust temperature, lighting, communications, security and other systems in real time as needed by its occupants.

Throughout the spring 2007 semester, senior architecture students worked to develop a prototype for such a building, said Mahesh Senagala, associate professor and associate dean for academic affairs and research in the College of Architecture. The project was a collaboration between the LEGO Corporation, the College of Architecture and the College of Engineering.

While modern automobiles have between 60 and 100 sensors that monitor numerous “human” variables, people spend more time in buildings that typically have only one: a thermostat. A smart building, rather than inefficiently maintaining a constant temperature in the entire structure, will determine whether anyone is using specific areas and then will turn on the appropriate air conditioning or heating systems. Similar concepts can be implemented for lighting and security schemes.

Using various sensors and devices like motion detectors and radio frequency identification, Senagala envisions a structure that can adapt to different situations on its own.

“Architecture has close to zero percent integration of these technologies,” Senagala said. “It’s a big market. Somebody has to show the way.”

Senagala, who is known for his work on tensile structures and human-computer interactions in architecture, was recently elected president of the Association for Computer-Aided Design in Architecture, and earned the UTSA President’s Distinguished Achievement Award for Performance/Creative Production and Other Scholarly Work for 2006–2007.

— JAMES BENAVIDES
Chlamydia vaccine tested

To say 30-year-old postdoctoral fellow Ashlesh Murthy enjoys being center stage at UTSA would not be much of a stretch. Murthy, a native of Bangalore, India, was the first recipient of a doctoral degree in UTSA’s cell and molecular biology program. As he crossed the stage to receive his diploma, Murthy’s parents and relatives gathered in India to watch him via the Internet as a part of UTSA’s first commencement Webcast.

This summer, Murthy, now a postdoctoral fellow at UTSA, will face an international audience as he travels to Japan as a presenter at a scientific conference on chlamydia.

Chlamydia, caused by the bacterium Chlamydia trachomatis, can damage a woman’s reproductive organs and is the most commonly reported sexually transmitted bacterial disease in the United States, according to the Centers for Disease Control and Prevention.

Under the guidance of his mentor, UTSA biology professor Bernard Arulanandam, Murthy has successfully administered a chlamydial prevention vaccine in mice. The next step will be to test the vaccine in larger animals, primarily guinea pigs.

“This is a very prevalent disease in women throughout the world, and the biggest problem is that most infected women never show any symptoms, so they never get treated,” said Murthy. “When chlamydia is left untreated, it can lead to severe complications including pelvic-inflammatory disease, ectopic pregnancies and infertility.”

According to the CDC’s most recent report, 930,000 cases of chlamydial infection were reported in the United States in 2004.

— KRIS RODRIGUEZ

Research tests thumbprint identification to improve firefighting efficiency, safety

The scenario that frightens and motivates UTSA alum Alexander McLeod goes like this:

A commercial flight is hit by lightning during its descent into San Antonio International Airport. The plane makes an emergency landing adjacent to Interstate 10. The plane survives, but there’s chaos as passengers scramble for safety. Emergency responders, residents, passersby and the media speed toward the scene.

McLeod, who earned a Ph.D. in information systems and technology management, is working with College of Business doctoral candidate Darrell Carpenter to investigate new biometric technology that uses thumbprints to identify personnel who respond to a call. They believe it will improve safety and security at emergency sites, and improve management of firefighting personnel.

The joint project with the San Antonio Fire Department is funded with a Building and Fire Research Laboratory grant.

The technology could be used for daily management chores such as scheduling to technical rescues and major emergencies, explained McLeod, a retired firefighter.

“The larger the scale of the incident, the more difficult it is to know who is there,” he said. The current tracking system uses a board with clips and tags from helmets.

Introducing the technology raises privacy concerns, Carpenter said. His research focuses on the behavioral side of bringing new technology to an employment setting.

“We want to explore people’s privacy concerns and see how much [they] will affect their use of the system,” Carpenter said.

If the biometric-based information system is successful, the researchers would like to see it used with other emergency response systems in the future.

— LYNN GOSNELL
Teaching the parents, protecting the kids

A 13-year employment history at the Texas Department of Family and Protective Services (DFPS) made Jolyn Mikow, an assistant professor of social work, the ideal person to receive a $100,000 research grant from the agency to evaluate parenting education programs in Texas and across the nation during spring and summer 2007.

The agency, which financed Mikow’s graduate education and inspired her to earn a doctorate in social work, contacted her to manage the Texas team in a project called “Validation of Measurements for Evidence-Based Interventions to Prevent Child Abuse and Neglect.” The project is designed to determine whether parenting education programs are accomplishing their goal of preventing abuse and neglect.

Mikow leads the study at UTSA with the support of Maureen Rubin, a visiting professor of social work, and researchers from the University of Kansas and national child advocacy organizations. They are developing an instrument to look at the objectives of parent education classes and measure how the classes change parents’ behaviors with their children.

The DFPS and its federally funded Community-Based Child Abuse Prevention Program require evidence-based practices for child abuse prevention—intervention methods with proven and replicable results.

“The lack of evidence has led to questions about what kind of parent education really works,” said Mikow, “and what child welfare agencies across the nation really need to do to reduce child abuse and neglect.”

Few methods exist to measure the success or failure of parent education classes, but the scant material Mikow has found suggests that two elements contribute to successful programs: reducing the risk factors and increasing the protective factors that build resiliency and help strengthen family bonds.

The results of Mikow’s study should provide the agency with a tool to determine which classes work in changing parenting practices and protecting children. She hopes it will lead to more efficient and more effective programs throughout the state and nation.

— JAMES BENAVIDES

Students create robots to help military

The latest Brookings Institution report indicates that since 2003, about 33 percent of the more than 3,300 soldiers killed in the war in Iraq have died because of improvised explosive devices (IEDs). The report defines IEDs as devices that are placed or fabricated in an improvised manner incorporating destructive, lethal, noxious, pyrotechnic or incendiary chemicals and designed to destroy, incapacitate, harass or distract.

In an effort to reduce the number of wartime fatalities, UTSA Department of Electrical Engineering students are designing and building rover robots that they hope eventually will be able to assist the military. The robots are equipped with biosensors and global positioning system (GPS) technology to enable them to go into dangerous areas and detect IEDs or biological and chemical weapons.

The project is led by internationally recognized robotics expert Mo Jamshidi, who came to UTSA from the University of New Mexico, where he directed the Autonomous Control Center.

As a native of Iran, Jamshidi said the war in Iraq is very personal.

“Every time I see a U.S. soldier or an innocent Iraqi civilian killed in the news, it just breaks my heart,” he said.

UTSA’s robots were featured in the 13-episode public television series State of Tomorrow. The 30-minute program ran on 13 PBS stations throughout Texas from April to June.

— KRIS RODRIGUEZ
MOTHER MARY

In San Antonio, colorful images of the olive-skinned Virgin of Guadalupe can be found in countless small businesses, home altars, yard shrines, public buildings, art galleries and, yes, churches.

But La Virgencita, as she is known, is just one of many versions of the Black Madonna, a blend of the Virgin Mary and ancient mother goddesses from Native American, Eurasian and African cultures, says Malgorzata Oleszkiewicz-Peralba, UTSA associate professor of modern languages and literature.

In The Black Madonna in Latin America and Europe: Tradition and Transformation (University of New Mexico Press, 2007), Oleszkiewicz-Peralba examines the worldwide phenomenon of the dark mother archetype. Her comparative approach to this potent cross-cultural icon has taken her around the world.

“There are so many connections among these different manifestations,” says Oleszkiewicz-Peralba, who grew up in Uruguay and Poland, where Our Lady of Czestochowa is much revered. Other specific Black Madonna manifestations examined by the author include Our Lady of Aparecida (in Portuguese, Nos-sa Senhora Aparecida, the patron saint of Brazil) and Iemanjá, a mother goddess in the Afro-Brazilian religion of Candomblé.

“These images are potent because they carry an ancient memory of the dark mother, who was the first mother of humanity,” Oleszkiewicz-Peralba says.

Though culturally specific, each Marian/goddess manifestation shares the same syncretic quality, that is, the hybridization of Christian and non-Christian sacred symbolism. Furthermore, these images are often associated with national identity and/or adopted as icons of social justice causes, she says.

STATE OF ENERGY

Dianne Rahm, professor of public administration, has edited a collection of articles about one of today's salient public policy topics—renewable energy sources. In Sustainable Energy and the States: Essays on Politics, Markets and Leadership (McFarland and Company, Inc., 2006), Rahm presents case studies from eight states and regions.

The book’s state-focused approach reflects a current political reality. “Federal leadership on sustainable energy has been lacking,” Rahm says. In the absence of consistent policies and funding at the federal level, the states have stepped in, tailoring policies to their own resource base. However, these efforts are often undercut by the on-again, off-again nature of federal energy law and funding.

Take Texas, for example. A federal wind production tax credit encouraged investment in wind turbines, but Congress let the tax credit expire before being reinstated. The result was a “boom or bust economy,” Rahm notes, which hindered the state’s ability to develop infrastructure to transmit wind energy from wind farms, usually in less-populated areas, to population centers.

Each area profiled possesses a unique set of environmental resources and challenges—and therefore a different menu of policies and regulations. “What works for a sunny state isn’t going to work for a rainy state,” Rahm says.

DO-OR-DIE TESTING

Sharon L. Nichols, assistant professor in the College of Education and Human Development, is a passionate critic of “high-stakes” standardized testing in American public schools. She and co-author David C. Berliner present their argument in Collateral Damage: How High-Stakes Testing Corrupts American Schools (Harvard Education Press, 2007).

“This book is trying to ring the alarm,” Nichols says. “When you use a test as the only way to make a decision on teacher effectiveness, it is extremely problematic and damaging.”

The authors trace the history and expansion of this trend, which was strongly affected by federal legislation, beginning with the 1965 Elementary and Secondary Education Act and 1983’s landmark report, A Nation at Risk. The 2002 No Child Left Behind Act required states to adopt a system of accountability for schools based on standardized testing.

Nichols and Berliner, a professor at Arizona State University, apply a social science principle called Campbell’s Law in their analysis. This principle holds that the more important an indicator becomes, the more likely it is to corrupt and distort the very process it is monitoring.
“We applied it to education and we found a range of examples that showed the more important we make these test scores, the more likely we’re creating this environment in which the process of education is completely corrupted,” Nichols says. Nichols and Berliner document the prevalence of cheating and other offenses committed by educators to help raise scores. They acknowledge that it’s a reasonable expectation that the public wants to know how well schools are functioning, and they offer several examples of alternative assessments in their final chapter.

**SELLING WORDS**

How does linguistic research help make a brand name successful? How important is a single sound in marketing communications? These questions, and many related topics, are examined in a new volume titled *Psycholinguistic Phenomena in Marketing Communications* (Lawrence Erlbaum Associates, 2007), edited by Tina M. Lowrey, professor of marketing.

Lowrey first became interested in psycholinguistics and marketing 20 years ago. “In the past five years, there’s been a resurgence of interest by newer marketing scholars in psycholinguistic theory,” she says. The volume aims to showcase the diversity of current research in the field of psycholinguistics and marketing communications. Three of the book’s four sections delve into research focused on units of language: words, sentences and bodies of text. The last section is a summary written by social psychologist Robert S. Wyer Jr. on the topics and ideas presented by the various contributors.

Lowrey’s chapter, co-authored with L.J. Shrum, UTSA professor of marketing, examines the many ways sound conveys meaning apart from semantic content. Drawing from classic linguistic theory by renowned linguists and their own research, they examine the phenomenon of phonetic symbolism, such as how the smallest unit of sound may carry symbolic meaning.

Studies have shown that vowels voiced with the tongue in the back of the mouth carry a connotation of large size and space. One example would be the u sound in *blunder*. The converse has been shown for vowels pronounced toward the front of the mouth, for example, i as in *million*.

The implications of phonetic symbolism in branding and product preference are the subject of emerging research. The researchers found that a brand name will be preferred if a product and the symbolism evoked by its sound was a match. “Not only will you prefer it, you’ll remember it as well,” Lowrey says. In the author’s experiments, subjects associated the made-up word *brimley* with a convertible; *bromley* with a sport utility vehicle.

“If you’re naming your new brand, it might be wise to take into account some of these ideas, and have your name be linked to the right associations,” Lowrey says.

**REGIONAL DISCOURSE**

Vincent B. Canizaro, associate professor of architecture, has brought together more than 40 articles or book excerpts from seminal figures in architectural regionalism, stretching from the early part of the 20th century to the present.


Regionalism in architecture eludes a simple definition, according to Canizaro, who writes, “Regionalism is never a singular theory or practice but is most often a means by which tensions—such as those between globalization and localism, modernity and tradition—are resolved.” Still, the term refers to buildings and communities that are connected to, and draw their context from, a particular locale.

Each chapter includes from two to 12 articles organized around a theme, such as regional planning, bioregionalism and regional modernism. Included are works by well-known writers on the interplay between place and architecture.

“It’s much more interesting for students to read a variety of viewpoints, rather than listening to one theorist,” Canizaro says. The influence of Lewis Mumford pervades the book, says Canizaro. In 1952, Mumford edited *Roots of Contemporary American Architecture*, which became a popular textbook. His writings are featured in two chapters in this collection.

“Mumford is certainly the best guide for 20th-century discussions of regionalism. He was thorough and pragmatic, and he understood that architecture is a subset of regional planning,” says Canizaro. “He was interested in trying to make people’s lives better, and in that sense, has always been considered a utopian.

“The promise of regionalism in architecture is to re-embed us in the reality and diversity of our local places—critically and comfortably. I guess the reason I like him so much is I’m an optimist, too.” — LYNN GOSNELL

For a more complete listing of faculty publications, go to www.utsa.edu/discover.
Five years after the attacks of Sept. 11, some experts believe it’s not a question of whether there will be another attack, but a question of when. As more soldiers are deployed in the global fight against terrorism, scientists at UTSA and other research facilities around the country are quietly focusing their microscopes on the “smallest” of threats—bacteria that can be used as biological weapons.

One-celled creatures may be the simplest forms of life, but they can become deadly when developed into an aerosol and used for bioterrorism, says Professor Karl Klose, director of UTSA’s South Texas Center for Emerging Infectious Diseases.

Funded by two awards from the National Institute for Allergy and Infectious Diseases (NIAID), part of the National Institutes of Health, UTSA researchers are working to help develop vaccines against *Francisella tularensis*, a bacteria that causes the disease tularemia. Klose, a professor of microbiology; Judy Teale, a professor of immunology; and Bernard Arulananandam, associate professor of immunology, are involved in the tularemia projects.

What makes their work especially important is that *Francisella tularensis* is one of the most lethal bacteria being studied in laboratories as a biological warfare agent. It is comparable to anthrax and the plague, Klose says.

By Rosanne Fohn | Illustration by Stephen Durke
FEATURES

1. UTSA Discovery
What is tularemia?

Tularemia is a rare disease found in nature in small mammals, including rabbits, hares and rodents. Most people who contract the disease are infected when they handle the skin or meat of a diseased animal and the bacteria enters their body through a cut on the hand. Other common ways to get tularemia include eating infected meat, drinking contaminated water or being bitten by blood-sucking insects such as ticks, deerflies or mosquitoes that have had contact with infected animals. Still, tularemia, also called rabbit fever or rabbit skinner’s disease, is not easily acquired.

“Tularemia is not very dangerous if acquired by the usual route,” Klose says. “People are very likely to survive, and the disease is treatable with antibiotics.”

Tularemia, however, is much more lethal when the bacteria are inhaled. In aerosol form, it would take only 10 to 15 organisms to cause disease, according to the NIAID. The disease progresses rapidly, is difficult to diagnose because it is so rare, and has a mortality rate of about 30 percent if not treated with antibiotics, Klose explains. This, coupled with the bacteria’s ability to survive in nature, makes it an even more suitable candidate for biological warfare.

The idea of using bacteria as a weapon is not new. According to the Centers for Disease Control and Prevention, historians estimate that more than 200,000 Chinese were killed in germ warfare experiments before World War II.

“The Japanese experimented on Chinese [prisoners of war] during World War II,” Klose says. “The U.S. and Soviet Union did lots of research on biological weapons during the Cold War. We stopped our research in 1973, when President [Richard] Nixon signed an agreement with the Soviets to stop all bioweapons work and the U.S. destroyed its stockpile at that time, but the Soviets continued with their work until the Soviet Union collapse in the late 1980s.”

Friend or foe?

What makes airborne tularemia so fascinating to researchers is its deceptiveness. “When Francisella bacteria first enter the body, they are not eliminated by the body’s natural defense system,” Klose says. Like an enemy hiding in a Trojan horse, they turn deadly once accepted into the fold.

Normally, when bacteria enter the body, macrophages, a type of white blood cell, are the first line of defense. “The macrophages engulf the invaders and destroy them, then scour the body looking for more,” he says. “Then, they teach the body that the invaders are bad and help the body develop immunity.”

But that doesn’t happen with tularemia. Instead, the macrophages engulf the bacteria, but don’t kill them. As the macrophages patrol throughout the body, the tularemia breeds inside of them. Then the macrophages burst, spreading the tularemia to distant areas, where they cause widespread infection.

“What we want to find out is how does tularemia prevent itself from being killed by macrophages when it enters the body,” Klose says. “We’ve identified certain genes that play a part in the process, but we don’t yet know what these genes do. Once we figure it out, we want to develop potential vaccine candidates.”

Because of the work’s deadly implications, access to organisms for research is under tight control, he adds.

Scientific teamwork

The two NIAID awards given for UTSA’s tularemia research have one goal: to identify potential vaccine candidates to work against the disease. One is a program project grant to conduct basic research on the organism, while the other is part of a large government contract involving three universities and two companies.

The first grant was awarded in July 2005. The $6.4 million, five-year project is made up of four interdependent projects conducted by Klose, Arulanandam and Teale, as well as Michael Berton, a microbiologist from the University of Texas Health Science Center at San Antonio (UTHSCSA).

Klose studies the organism to identify the genes responsible for its ability to cause the disease. Inactivating these genes in tularemia converts them from dangerous to benign organisms, which then become potential vaccine candidates. Klose then passes them along to Arulanandam. “I am studying which of the vaccine candidates gives us the best immune response and protection,” Arulanandam says. “We have already tested some of them, and some look very promising.”

Meanwhile, Teale’s research focuses on the mechanisms that the bacteria use to avoid being killed by the body’s natural defenses, while Berton focuses on the body’s natural
defense system to find out why the body does not recognize tularemia as a dangerous invader.

The second grant, awarded in August 2005, is part of a large, five-year government contract to produce tularemia vaccine candidates.* “This is a more focused approach involving a national consortium of scientists with the goal of producing a tularemia vaccine within five years,” Klose says.

He and Arulanandam are working on the $1.9 million project. “We have a list of targeted antigens that Dr. Klose will mutate, then I will take those and test them in the lab,” Arulanandam says.

Research infrastructure
One of the reasons UTSA is able to conduct this type of research is an assortment of new facilities that did not exist three years ago. The 227,000-square-foot Biotechnology, Sciences and Engineering (BSE) Building on the 1604 Campus, which opened February 2006, is UTSA’s biggest building and one of the largest research facilities in the UT System.

On the third floor of the BSE is Klose’s biosafety level 2 laboratory used for nonvirulent, but high-security, research. He and Arulanandam also share a 900-square-foot BSL-3 lab to study the highly infectious forms of tularemia, work that requires the researchers to use respirators and wear special head-to-toe suits made of an impervious material.

“In the BSL-3 lab,” Klose says, “all the work is performed in biosafety cabinets, and there are redundant measures in place so there is no possibility that anyone becomes infected.” Anyone working in the labs has to have FBI clearance and undergo safety training. The labs are under high-level surveillance by the FBI and the CDC, as well as by UTSA’s safety office and police department.

The $10.6 million, 22,000-square-foot Margaret Batts Tobin Laboratory Building, which opened in 2005 on the 1604 Campus, houses a second BSL-3 lab that Teale is using for her tularemia research. In addition to the joint project with Klose and Arulanandam, she is principal investigator on a separate National Institutes of Health research program to study the pathogenesis of tularemia in the elderly. It is well known among researchers and health care personnel that those aged 65 and older have higher death rates from severe respiratory infections. Teale’s research is designed to determine whether older people are more susceptible to tularemia. “This is critical so that treatments can be developed that also work for people with weaker immune systems, such as the elderly or persons whose immune systems have been compromised,” Teale explains.

Student research
In addition to the scientists, two Ph.D. graduate students are working on the tularemia projects. They receive the same safety training and must pass the security training, Klose says.

In fall 2005, when Stephen Rodriguez first entered the cell and molecular biology Ph.D. program, he conducted a small project in Klose’s lab working with novicida, a form of tularemia harmless to humans. Now, he is conducting his Ph.D. thesis research using the more virulent form of the bacteria.

Before selecting UTSA for his graduate work, Rodriguez looked into programs at several universities. “I wanted to see which programs had a sense of purpose,” he explains. “With some of them I didn’t see it, but with Dr. Klose, I got that feeling of purpose right up front.”

Another student involved in the research is Jeff Barker. He is working on a doctorate in microbiology at UTHSCSA, but followed Klose to work in the UTSA lab when the professor came to the university in 2004. Like Klose, Barker is studying which genes make tularemia so deadly. “We have the potential for creating a vaccine that could be approved by the [Food and Drug Administration] and used by the military,” Barker says. “It is incredible to actually see results and, as a graduate student, to actually see that a product may come from your work.”

Lab work, Barker says, is the reason he got into the field. “I get to discover something new each day that no one else knows. I get to come up with new ideas to discover what makes these things tick.”

Klose likes mentoring his graduate students almost as much as he enjoys the research. There’s the constant thrill of discovery, he says, and the idea that he’s training the scientists of tomorrow.

“There is a critical need for people trained in biodefense in order to protect the American public,” Klose says. “New infectious diseases are constantly popping up. For example, five years ago, many people had never heard of anthrax, West Nile virus or SARS. We’re training the next generation of scientists who can respond to new threats and create the treatments and cures for future generations.”

*This project has been funded in whole or in part with federal funds from the National Institute of Allergies and Infectious Diseases, National Institutes of Health and the Department of Health and Human Services under contract No. HHSN660200500040C.

RIGHT
Francisella tularensis is one of the most lethal bacteria being studied as a biological warfare agent. Photo courtesy of Karl Klose.
South Texas Center for Emerging Infectious Diseases helps attract researchers to UTSA

BY ROSANNE FOHN

UTSA’s tularemia projects have received more than $8 million in funding, making them the centerpiece of the university’s South Texas Center for Emerging Infectious Diseases.

The center brings together 19 well-respected researchers and scientists who collaborate on such infectious diseases as cholera, mosquito-borne viruses, anthrax, autoimmune diseases, parasites and chlamydia, the most reported sexually transmitted disease caused by bacteria in the United States. With an aggressive recruiting program, the university has been able to attract some of the best minds in the country.

“Our vision is to add additional faculty and facilities to help the university truly become a world-class research university,” says Neal Guentzel, associate dean of the College of Sciences.

Professor Karl Klose, microbiologist, is director of the center. Klose was an associate professor at the University of Texas Health Science Center at San Antonio before being recruited to UTSA by Guentzel in 2004. “I had the opportunity to come in here and help build this university into a research institution,” Klose says. “I liked the idea of being able to help build the reputation of UTSA. The possibilities are almost endless.”

UTSA’s destiny changed about a decade ago when leaders of the University of Texas System recognized that there was a need for more institutions dedicated to top-notch research in order to educate underserved minority students and to build a more highly educated workforce, Guentzel says. UTSA was one of four universities singled out to receive major financial backing to meet this new goal.

When Ricardo Romo was appointed president of UTSA in 1999, the university took a quantum leap forward, says George Perry, dean of the College of Sciences. “The last five or six years, the university has been revolutionized. The amount of funding each year has increased at least 20 percent,” he says.

Even better, in 2006 the university received a 37 percent increase in funding for research, due in part to grants and contracts awarded to the university through the Center for Emerging Infectious Diseases.

Private funding has also played a part, including a gift from the Tobin Foundation for the Margaret Batts Tobin Laboratory Building, which opened in 2005. That building and the new Biotechnology, Sciences and Engineering (BSE) Building each have a biosafety level 3 lab, which is necessary for center researchers to conduct their work.

“The center provides a focal point to bring all of these extraordinary researchers to UTSA for collaboration,” Guentzel says. The collaboration brings more research to the university and the additional funding enables the university to enhance and upgrade the facilities and bring in more highly qualified faculty to grow the program, he adds.
Scientists team up to study language acquisition in bilingual babies

By Lynn Gosnell
Illustration by Corri Bristow

Look Who's Talking—In Two Languages

To nine-month-old Warren*, a visit to the UTSA baby lab must have seemed like child’s play. As he wiggled and fussed on his mom’s lap, researcher Sophia Ortiz waved plastic toys in front of his face. A Barney video played silently in the background. A visiting professor placed a funny cap on his head. What looked from the outside like child’s play was actually serious science.
"Language is not only communication, it’s culture. ... If you truly want to understand people from another culture, you have to speak their language."

The stretchy knit “pilot cap” Warren wore featured 19 sewn-in sensors dotting the surface, each filled with conducting gel. The sensors began picking up and amplifying a record of Warren’s brain responses to sounds from a machine, and soon waves of squiggly lines began appearing on a nearby computer screen. After about 20 minutes, the electroencephalogram (EEG) recording was over, but the study of Warren and his brain was just beginning.

Warren was one of 30 children recruited by UTSA sociologists in fall 2005 to participate in an ambitious project studying language acquisition in children growing up in bilingual environments. The project brings together sociologists, neuroscientists and educators from UTSA and the University of Washington’s Institute for Learning and Brain Sciences in a multiyear collaboration. The aim of the research is to study the development of the bilingual brain using the methods of both the neuroscientist and the social scientist.

“We want to know how the baby’s bilingual brain develops and how infants, even before they learn to talk, are processing two languages,” says Harriett Romo, associate professor of sociology and head of the research team at UTSA.

Though the use of EEGs and standardized tests is an essential part of the research framework, what’s fascinating to Romo and her team are the complex social contexts that shape language acquisition in bilingual environments.

The research is part of a five-year, $90 million National Science Foundation (NSF) initiative examining “the science of learning.” Beginning in 2004, NSF grants established study centers at four major educational institutions. Each center focuses on a different aspect of learning and the brain, and by design, each center is highly collaborative.

UTSA is linked with the Center for Learning in Informal and Formal Environments (the LIFE Center), an interdisciplinary collaboration between the University of Washington (UW), Stanford University and the Stanford Research Institute. It was through a colleague at the Stanford Research Institute that Romo first heard about the LIFE Center and the proposed research on the bilingual brain. Because much of Romo’s research focuses on Spanish-speaking families and bilingual children, it was a natural fit.

“We want to know how the baby’s bilingual brain develops and how infants, even before they learn to talk, are processing two languages,” says Harriett Romo, associate professor of sociology and head of the research team at UTSA.

Though the use of EEGs and standardized tests is an essential part of the research framework, what’s fascinating to Romo and her team are the complex social contexts that shape language acquisition in bilingual environments.

The research is part of a five-year, $90 million National Science Foundation (NSF) initiative examining “the science of learning.” Beginning in 2004, NSF grants established study centers at four major educational institutions. Each center focuses on a different aspect of learning and the brain, and by design, each center is highly collaborative.

UTSA is linked with the Center for Learning in Informal and Formal Environments (the LIFE Center), an interdisciplinary collaboration between the University of Washington (UW), Stanford University and the Stanford Research Institute. It was through a colleague at the Stanford Research Institute that Romo first heard about the LIFE Center and the proposed research on the bilingual brain. Because much of Romo’s research focuses on Spanish-speaking families and bilingual children, it was a natural fit.

“Language is not only communication, it’s culture. ... If you truly want to understand people from another culture, you have to speak their language,” says Patricia Kuhl, co-director of the UW Institute for Learning and Brain Sciences.

Kuhl is renowned for her work on language acquisition and the brain.

RECRUITMENT AND RELATIONSHIPS

The research project’s first challenge: finding families of bilingual babies from 6 to 12 months of age who could commit to a long-term study involving lab tests and repeated home visits to gather data about the bilingual environment.

Since most of the families in the study are classified as low socioeconomic status, the provision of transportation to and from the testing site was essential to the recruitment effort. As further incentive, each participating family is paid a small stipend to compensate them for their time.

Though Romo’s biggest fear was that they would not be able to find enough subjects, 70 families volunteered. Because of the specific age range needed, however, only 30 babies started the project. A few have since dropped out, although the next phase of testing will bring in new participants.

UTSA researchers Ortiz (who earned her master’s in sociology at UTSA in May 2006) and graduate student Maria Rodriguez have been highly involved in the project since day one. “We’ve established a really good relationship with the families, so they’ve come to trust us a lot,” Rodriguez says.

Since the initial EEG testing, there have been follow-up visits every three months to assess ongoing language development. Rodriguez and Ortiz are often greeted with offers of home-cooked food and news of the latest developmental milestones.

“They’re trusting us with their kids, and then they’re trusting us going into their homes, so that’s been very rewarding to us,” Rodriguez adds.

This ability to establish relationships is important for the project, the researchers say. The information elicited during home visits is personal. How does the family define themselves ethnically? Who speaks Spanish? Who speaks English? Who speaks or reads both? What are the attitudes toward both languages? What foods do they eat? What level of education have they attained? The in-depth questionnaire contains more than 200 questions and takes hours to complete.

The UTSA researchers are also trained to observe elements of the home environment that affect language development, such as what is on the television or radio, what music is being played, what books or magazines are on the shelves and what videos are being watched.

“The parents are very, very humble,” Ortiz says. “They're
very open to you and try to assist you as much as they can.” She was especially moved by one parent who showed her carefully preserved copies of songs written by her father, who was from Mexico. Ortiz has a recording of one of the older siblings singing these songs.

On many occasions, Ortiz and her colleagues have gone beyond their job description. There was the time Ortiz arrived for a home visit to find the mother in labor. Off they went to the hospital. Another family was being evicted from their residence; the UTSA researchers helped them find a new place. It’s not unusual to be asked to pick up children from child care or give someone a lift to buy groceries, they say. “We get attached to these families,” Ortiz adds.

Romo believes the project presents her student researchers with a wonderful opportunity. “What my students can do and the sensitivities they have about the bilingual families and the bilingual community, and the opportunity that this kind of research gives them, are extremely important,” she says.

IN THE BABY LAB AND IN THE HOME
Maritza Rivera-Gaxiola, a research professor and neurobiologist from UW’s Institute for Learning and Brain Sciences, temporarily relocated to San Antonio to conduct the neurological tests. She spent six weeks measuring the ability of the babies to discriminate among three basic phonemes found in English or Spanish and testing their mental, motor, behavioral and linguistic development. To most ears, the syllables tested sound like “ta” or “da,” but in fact there are telling nuances in the use of each syllable in English or in Spanish that will register on the EEG.

By analyzing the EEG data, Rivera-Gaxiola is able to tell whether the babies differentiate between Spanish and English sounds at a very young age.

This technique builds on seminal research done by Kuhl on language acquisition in monolingual babies. Up until 6 to 8 months of age, researchers found, infants can hear and respond to speech sounds from all languages. But by 10 to 12 months of age, they react only to the sounds used in their environment, Rivera-Gaxiola explains.

“These kids responded to both languages equally,” says Rivera-Gaxiola. This finding is consistent with the research on monolingual babies, because these children are hearing speech in two languages on a regular basis.

Meanwhile, UTSA researchers are expanding the very definition of bilingualism. “There is not just one prototype of a bilingual home,” Romo says.

Some children in the research pool have parents who speak only Spanish, but they pick up English from their older siblings. Other children have Spanish-dominant grandparents, with parents who are mostly English-speaking but understand Spanish. Not all the families have roots in Mexico; some bring Spanish from other parts of the world. Another family switches back and forth between English and Spanish, in what many people think of as “Tex-Mex.”

PUTTING IT ALL TOGETHER
The interdisciplinary approach is building an extensive database about the developing bilingual brain, Rivera-Gaxiola says. Putting the data together will yield research that challenges the way both academic disciplines think about their subjects.

One example: Rivera-Gaxiola will add variables having to do with socioeconomic status to her research. “I didn't have the ethnographic approach, and it changes and enriches the way I look at my data,” she says.

Romo finds the study of language acquisition from the phonetic level to be new and enriching information for her own sociological research.

Ultimately, Romo hopes the study will show “how rich a bilingual experience is and how much it would contribute to the cognitive development and ability of someone to expand their horizons both educationally and economically,” she says.

In these babies’ future, that will be a valuable skill indeed.

*Name has been changed to provide confidentiality.

:: PROFILE ::

HARRIETT ROMO
Associate professor of sociology
Director of the UTSA Mexico Center

Harriett Romo is the lead investigator at UTSA for the Learning in Informal and Formal Environments (LIFE) Project, supported by the National Science Foundation. The purpose of the LIFE Project at UTSA is to allow researchers to study how learning occurs from infancy to adulthood in formal and informal bilingual settings.

Romo also heads the UTSA Mexico Center, which highlights ties between UTSA and Mexico. With interdisciplinary collaboration, the center promotes research, projects and service activities.

Romo has a bachelor’s degree in education, master’s degrees in education and sociology and a Ph.D. in sociology. She was a postdoctoral scholar in sociology at Stanford University. She has been with UTSA since 1999.

:: PROFILE ::
With Texas expected to become home to another 9 million people in the next quarter-century, state planners already are seeking ways to unsnarl future traffic jams. The solution almost certainly involves adding or expanding roads; the question now is where exactly new roads will be needed.

State Demographer Steve H. Murdock does not presume to have all of the answers. But Murdock, who holds the Lutcher Brown Distinguished Chair in Demography and Organization Studies at UTSA, believes that knowing more about Texans—who they are, where they live, what they do and when they do it—can only lead to better decisions.

His work may influence the future of transportation in Texas. Murdock and his Institute for Demographic and Socioeconomic Research are working with the University of Texas at Austin’s Center for Transportation Research on a two-year, $200,000 project with the Texas Department of Transportation (TxDOT). The project, which began in September 2005, is scheduled for completion this August.

TxDOT officials say the research will provide an overview of the demographic data that is available for transportation planning. It will also provide a summary of current uses of that data within the department and other transportation agencies in the state.

“As Texas’ population continues to grow and as the complexities of that growth change the fundamental demographic structure of the state, transportation planners will need a better understanding of demographic data,” says Greg Lancaster of TxDOT.
Steve Murdock was appointed state demographer by Gov. Rick Perry in 2001. After moving from Texas A&M University to UTSA in 2004, he was named the Lutcher Brown Distinguished Chair in Demography and Organization Studies and director of the Institute for Demographic and Socioeconomic Research at UTSA. He is also director of the Texas State Data Center.

Murdock’s areas of interest include demography, human ecology, applied sociology and rural sociology.

He received his bachelor’s degree in sociology from North Dakota State University, and earned master’s and doctoral degrees in sociology from the University of Kentucky.
During the first year of the project, researchers fed demographic information into a database they created specifically for TxDOT. The institute trained TxDOT workers on the database and on using demographics in general. Because the database is tailored to TxDOT’s needs, Murdock says, it should be much easier to use than any source of demographic information the agency has worked with in the past.

“As far as I know, they’ve not had a Texas-specific overview of these demographics,” he says.

This year, Murdock and his colleagues will analyze the data they provided to TxDOT to see what trends emerge and consider what they might mean to the state’s transportation system. The researchers are not simply looking at changes in the total population; they are also taking into account age, race, ethnicity and income.

Mike Cline, a UTSA doctoral student and research scientist involved in the TxDOT project, believes demography has not been used to the extent possible in transportation decisions. While an engineer might incorporate total population figures into plans for a new road, a demographer might delve a little deeper, breaking those totals into subgroups and considering how they might change the big picture, he says.

A surprising array of factors can affect traffic patterns.

Take age: The elderly tend to drive fewer miles than other motorists, Murdock says, but they have a greater need for transportation from home to health care. And accident rates peak for teens and young adults, and then again for those who are 80 years old or older. So as Texas’ population ages, accident rates could be affected.

Income also plays a role. People with lower incomes are more likely to carpool or use public transportation than wealthier people, and they are more likely to drive older cars. So a shift in income levels could affect the number of vehicles on the road and the number of breakdowns.

The institute is getting its data for the TxDOT project from several sources. TxDOT itself provides detailed information on its highways and their use. The U.S. Census has total population figures broken down by age, gender, race, ethnicity, income levels and more, as well as information on commuting patterns. And the institute has its own population estimates and future projections for Texas.

The Institute for Demographic and Socioeconomic Research—which houses the Texas State Data Center and state demographer’s office—has never before worked with TxDOT, but it has done projects with a dozen or more state agencies, the federal government and nonprofit groups.

At any given time, the institute juggles between six and eight research projects, in addition to academic research and its ongoing work for the State of Texas, Murdock says. The institute undertakes more than $1 million in research a year.

Among its recent projects:

- The institute is wrapping up the first year of a project with Methodist Healthcare Ministries, one that estimates the number of uninsured Texans for specific counties to help in planning what services to provide. The second year will involve predicting the likely change in the number of obese people in specific areas of South Texas, as well as the number of people with diabetes.

- Murdock and his staff are finishing a project for the federal Economic Development Agency on how the growth and decline of various manufacturing jobs has impacted communities in Texas and Arkansas. The United States has seen a net loss of millions of such jobs, Murdock says. “What we’re trying to do is determine who was impacted how,” he adds.

- As part of the Texas State Data Center, the institute routinely does a series of current population estimates and future projections. The data produced is used by a range of people and organizations. Little League teams refer to the data when drawing their boundary lines, Murdock says, and retail businesses consider it when choosing sites for new stores.

Murdock, who has spent 30 years doing demographic analyses in Texas and who has been the state demographer since 2001, says to be an effective policy researcher he must remember two things: He must never try to force the numbers to support a particular point of view, and he must truly believe that the data he supplies can lead to better decision making.

Murdock’s work has positively affected policymaking, says Sen. Rodney Ellis of Houston. He directly cited The Texas Challenge, a book authored by Murdock and his colleagues, in proposing the TEXAS Grant Program. The program helps academically successful high school students with financial need pay for college. Since 1999, it has provided free tuition at Texas’ public colleges and universities to more than 137,000 students.

“He puts a human face on a statistical analysis, and that’s very powerful in the public policy arena,” Ellis says.
KEITH CLUTTER LOVES TO BLOW THINGS UP.

So far he’s unleashed 17 truck bombs in various locations around San Antonio and set off dozens of explosive devices close to U.S. troops.

An associate professor in the UTSA Department of Mechanical Engineering, Clutter has a Ph.D. in aerospace engineering and is an expert in blast dynamics, the modeling of combustion and explosive shock waves. He’s also a major in the Air Force Reserve and an Iraq veteran. He’s seen the effects of terrorism firsthand. That’s why he’s trying to simulate it.

BY RANDY LANKFORD
Fortunately, Clutter’s explosions happen only on a computer. By attacking buildings in a virtual world, Clutter hopes to identify San Antonio’s most at-risk locations so they can be reinforced in the real world. And by studying the often unseen physical effects of up-close explosions on soldiers, he plans to give military medical personnel a better way to prioritize and treat injuries resulting from blasts.

THE CITY
Terrorists choose their targets based on vulnerability and consequence. They select locations that are easy to reach and whose destruction will produce the greatest overall consequence, whether financial, tactical or in loss of life. Clutter chooses his targets the same way, and uses bombs that are a little more than twice the size of the one used on the Alfred P. Murrah Federal Building in Oklahoma City in 1995.

“Sometimes when I tell people about what I’m doing, they say we shouldn’t even be talking about it, that we’ll give terrorists ideas,” Clutter says. “I tell them, ‘The bad guys are certainly talking about it.’ We need to beat them to the punch to determine our softest spots and defend them.”

Clutter identifies targets based on the assessed value of the buildings themselves. He recognizes that some high-value targets, such as a city’s Emergency Operations Center or a unique medical facility, may be located in low-value buildings. But since the assessed value of most buildings is readily available on the Internet, it’s a likely way for terrorists to choose their targets. The overall concept of determining the targets’ value versus vulnerability is still sound, even if the definition of “value” varies.

Using a cross-section of downtown San Antonio containing 280 infrastructures of varying height, size and orientation and collectively valued at $1 billion, Clutter has simulated the damage a 10,000-pound truck bomb would do at 17 different locations. This geometric representation of the city is used along with computational fluid dynamic technology to pinpoint locations where the combination of property value and blast profiles maximize the damage such a bomb would produce.

Every scenario is unique, since various building materials, such as concrete and glass, respond to explosive pressures differently. Surrounding buildings’ proximity to one another, changing terrain and the size and number of vehicles in the vicinity can also reflect blasts in different directions, causing varying results.

Clutter’s simulations have resulted in a range of damages, from shattered windows to leveled buildings. The projected financial impact has ranged from $2.7 million in one scenario to $126 million in another.

“There are experts who’ll tell you they can predict exactly where terrorists are going to strike,” Clutter says. “If that were true, we’d all be waiting there for them with our guns drawn. My opinion is you focus on understanding your consequences and trying to minimize them.”

Clutter explains that every large city interacts with the Department of Homeland Security (DHS) to get funding. “If the City of San Antonio can go to the DHS with this kind of rock-solid data—pinpointing exactly where it needs to maybe create a pedestrian-only thruway or put up security cameras to monitor a parking garage—it has a much better chance of receiving the kind of support it needs.”

Emergency response planning is another application for Clutter’s research. By modeling the effects of blasts in various parts of the city, he’s able to predict the probable locations and types of injuries as well.
Explosions create upside-down triages, with the more serious injuries being found later in the rescue process as responders work their way toward the center of the blast zone. Clutter says the data he’s collecting will help emergency personnel find the most seriously injured more quickly by predicting where blast forces will be the highest.

“There’s a lot of data going all the way back to World War II that correlates building damage to occupant injuries,” says Clutter. “We can determine the building occupancy and compare that to the level of damage to estimate how many and what kind of injuries there are going to be.”

THE SOLDIERS
During his tour of duty in Iraq, Clutter served on an Explosive Ordnance Disposal team. These teams, dealing with roadside explosive devices, can be exposed to blasts that may do unseen damage.

While some wounds are easy to see, others, like head injuries and especially concussions, can be less obvious. Clutter wants to make those unseen injuries as recognizable as any other.

An explosion is recorded as a pressure time history—a time-based schematic of the position and force of a pressure wave as it expands outward after an explosion. As the blast sweeps over a soldier, the difference in the pressure load will cause the head to move. Since the brain moves independently of the skull, this can result in it slamming against the front of the skull, much like whiplash.

Again using computational fluid dynamic technology and explosion modeling, Clutter can measure the forces a soldier is exposed to. Working with fellow UTSA engineer Tom Connolly, Clutter is developing a sensor that can be built into soldiers’ helmets capable of recording blast data in real time. That data is then correlated to Clutter’s models to project the type of injuries it’s likely to cause.

While Clutter is involved in computational fluid dynamics, which model the bomb explosions, Connolly is involved with dynamic systems modeling, which measures impact on the brain.

“I build a model of the brain and skull to measure what that pressure wave does to a human head,” Connolly says.

That’s important because medics often don’t know that a person has received a brain injury until symptoms begin.

“If you ask the soldier, he’s going to tell you he’s fine and ready to go,” Clutter says. “He may have an injury where the brain begins to swell. If the doctors know that, they’ll actually cut out a piece of his skull, give the brain a chance to swell and then go down again and then repair the skull. The problem is they don’t know if your brain is going to swell or not, and there’s no outward indication that it’s going to happen.”

The sensor they are developing will serve as that outward indication. By recording the intensity of the pressure wave, the sensor can provide a history of the force to which the soldier has been exposed.

“The troop doesn’t even have to be conscious,” Clutter explains. “The medic can plug the sensor in the soldier’s helmet right into a handheld computer and get an instant readout of what it’s been exposed to. He can then make an informed decision about whether that soldier’s brain is likely to have been injured. Then there are lots of ways that [it] can be treated.”

Clutter’s devastated model of San Antonio has been presented to city officials. He has a working prototype of his helmet sensor and is seeking additional funding to develop more sophisticated models of the device.

Until that happens, Clutter will continue working in his virtual world, gradually making the real world safer by doing what he loves—blowing things up.

KEITH CLUTTER
Assistant professor of mechanical engineering
Interim director of UTSA’s Center for Response and Security Engineering and Technology
Keith Clutter’s teaching and research concern thermal fluid sciences, numerical modeling and combustion and explosives.

He has developed a computational fluid dynamics code that simulates explosions from gas and other explosives. With the code, he analyzes potential explosion scenarios and conducts vulnerability assessments for various companies and organizations.

Clutter received his Ph.D. in aerospace engineering in 1997 from the University of Florida. He was a United States Air Force Fellow in 2001.
In the 15 years since UTSA offered its first doctoral program, the number of students, faculty and doctoral programs have soared. The university now serves 424 doctoral students through 20 programs.

In January, the Texas Higher Education Coordinating Board approved a proposal to add a marketing concentration to the existing doctorate in business administration. Yet another doctoral program, this one in psychology, also is being reviewed.

Although doctoral programs are relatively new for the university, graduates are putting their Ph.D.’s to use in classrooms, laboratories and the business world. Here are the stories of three of them.

FROM INSURANCE SALESMAN TO PROFESSOR

When Jim Hackard decided to return to school for his Ph.D., he did not quite realize what he was undertaking. He had completed his M.B.A. while working, and he didn’t anticipate the full-time commitment that is required when pursuing a Ph.D.

After a 30-year career as a life insurance actuary, most of which was spent at the San Antonio–based insurance, banking and investment company USAA, he retired and began his doctoral studies with the goal of becoming a professor. And it turned out that although he had underestimated the amount of work his degree would demand, he had been right about how much he would enjoy being a professor.

A member of the first cohort of the doctoral program in finance, Hackard was among the first to graduate. In August 2006, just three months after graduating, he became a professor at Southern Illinois University–Edwardsville (SIUE), where he teaches a course on corporate finance and another on financial markets and institutions.

Hackard’s research interests include market microstructures, corporate finance and investments. He became interested in finance during his last 10 years at USAA, while doing financial forecasting and cash-flow testing.

He feels fortunate to have been part of UTSA’s doctoral finance program. “For a brand-new program, it’s been extremely successful in placing its students,” he says. “We’ve all ended up at good schools, and that speaks well of how much the faculty supported us in our job searches.”

Hackard is developing a life insurance course for next spring, and he says he’s still using what he learned in the business. “One of the things that led me to be a teacher was how much I enjoyed mentoring young actuaries when I was in that field. Now I really enjoy being in the classroom and helping students learn, and I continue to learn.”
ART APPRECIATION LEADS TO MULTILINGUAL EDUCATION

Holly Hansen-Thomas earned her Ph.D. in culture, literacy and language in 2004. A member of her program’s first cohort, she was the first graduate to secure an academic job. She is now in her second year of teaching at Binghamton University, a graduate-level campus of 14,000 students that is part of the State University of New York. She currently teaches a literacy class and a class on English as a Second Language (ESL) instruction for mainstream teachers. She is also seeking a grant to provide Spanish teachers with professional development.

“There’s a lot that I like about my job,” she says. “It’s an exciting time and a lot of things are happening. This summer the education department split off, so now we’re our own school of 15 full-time faculty. Because we’re so small, we all have a voice.”

Hansen-Thomas is the chapter counselor of Kappa Delta Pi, an education honors society. The group underwrote her dissertation on how middle school ESL students who are native Spanish speakers learn math discourse. She studied three classes in Texas where math was taught in a group-oriented manner with hands-on activities. Her results generally supported previous findings that these teaching methods have been shown to help second-language learners. She is continuing her research by comparing her data with results from New York classrooms.

Hansen-Thomas’ interest in ESL began after she completed her bachelor’s in art history and moved from Austin to Barcelona, Spain, simply hoping to see the art she had studied. After a brief stint as an au pair, she began teaching English and eventually became certified in ESL, English and Spanish at the secondary level.

After returning to the United States, she earned her master’s degree in bilingual and bicultural studies in 1999 at UTSA. Her passion for language and culture soon led her and her husband to Dresden, Germany, and then to Hungary, where she taught under the Fulbright Teacher Exchange Program.

After that experience, where she was recognized as a visiting professor, Hansen-Thomas decided to return to UTSA to pursue her doctorate. “I felt really supported at UTSA. I had developed good relationships with the faculty, and I felt like I would still be able to learn more from them as a doctoral student. And I was right.”

TAKING RESEARCH TO THE NEXT LEVEL

Before she graduated from UTSA’s neurobiology Ph.D. program in December 2005, Julissa Villarreal set a program record by authoring three research papers while enrolled.

Explaining what drew her to UTSA from Columbia University, where she earned her undergraduate degree, she says, “The program was new and growing, and with a newer program, you have newer facilities. I really liked that it was in Texas, and I especially liked the fact that they had minority faculty.”

Since earning her doctorate, Villarreal has gone on to become a postdoctoral fellow at the National Institutes on Aging (NIA) in Baltimore; she also conducts research at Howard University in Washington, D.C. She recently wrote a successful National Institutes of Health (NIH) grant proposal that will be funded until 2008—an achievement she’s proud of because only about 19 percent of NIH grant proposals receive funding.

Villarreal is continuing her preclinical study of the effects of normal aging on learning and memory. She first became interested in this area when working with Edwin Barea-Rodriguez, associate professor of biology and assistant department chair at UTSA. Working in the NIA’s experimental gerontology lab, she studies different compounds that can delay age-related deficits, including deficits in motor skills.

The postdoctoral fellowship is a transition period between school and career, she says. “The best part [about this time] is being able to focus on your research. You can get publications out and acquire more skills in a setting that’s different from graduate school. And the resources available through NIA are great.”

In the future, Villarreal would like to run a behavioral core facility, assessing the behavior of various rodent models.
The building, which opened last year, received the Education Design Showcase 2006 award.