The Integrated Ocean Drilling Program (IODP) gives insight into our planet’s history and future. IODP is both the largest geoscience research program that the National Science Foundation (NSF) supports and Texas A&M University’s largest single research program.

The centerpiece is the scientific ocean drill ship R/V JOIDES Resolution, which after a $115 million renovation is once again on its mission in the world’s oceans.

IODP manages the JOIDES Resolution on behalf of the U.S. Implementing Organization, a partnership with Texas A&M, Lamont-Doherty Earth Observatory of Columbia University and the Consortium for Ocean Leadership in Washington, D.C. Texas A&M is allocated approximately 85 percent of the $620 million, 10-year contract, which NSF awarded in 2003.

IODP provides administrative, fiscal and science support and manages the Gulf Coast Repository—one of three permanent archive locations that house all cores collected since 1968 by IODP and its two NSF-supported predecessors.
Welcome to the exciting world of research and discovery that flourishes at Texas A&M University and its branch campuses in Galveston and Qatar. Our 10th edition of Advance will take you on a stimulating journey, as its pages unfold exciting stories that will capture your imagination and arouse your curiosity.

With almost all of the 450 faculty reinvestment positions filled, the research environment is evolving rapidly into an even more vibrant landscape. Furthermore, a new university-wide academic master planning process was launched in fall 2008, and as part of this process, a major research roadmap exercise inspired more than 1,100 faculty to participate in identifying landmark areas for advancing Texas A&M to higher levels. These research landmark areas will be announced in summer 2009.

In addition to our faculty growth and academic master planning, our research infrastructure is expanding in remarkable ways. The $100M Interdisciplinary Life Sciences Building is near completion, and faculty are preparing to move in by January 2010. Also close to completion are two buildings that will house the Texas A&M Institute for Genomic Medicine and the Texas A&M Institute for Preclinical Studies. And there is more! The George P. and Cynthia W. Mitchell Institute for Fundamental Physics and the George P. Mitchell Physics Building edifices add to a beautiful panorama along University Drive with its proximity to the new Jack E. Brown Engineering Building. Construction on the $100M Emerging Technology and Economic Development Building began this spring, and it too will add to this magnificent expanse in support of science and engineering research and education.

Texas A&M continues to grow in national rankings and international reputation. As a result, the research expenditures as reported to the National Science Foundation (NSF) for Texas A&M in 2008 exceeded $605M for science and non-science fields. This reflects a 28 percent growth in research over the last five years and a growth of 38.67 percent in federal research alone. Texas A&M is ranked third nationally by the National Science Foundation for universities without a medical school. Additionally, since 2003, the number of graduate students has increased by 19 percent.

Research at Texas A&M is global—spanning every continent of the world. To showcase some of our international collaborations, we are sponsoring the biennial China-U.S. Relations Conference in Beijing on 21-23 October 2009, which will be the fourth such event with the first one held in 2003. The Research Roundtables are a popular feature of the conference, and productive collaborations have been formed from these meetings. Also, a joint meeting with CONACYT will be held in June 2009 to highlight collaborative projects between researchers at Texas A&M and those at various universities in Mexico. And, of course, our faculty in Qatar are ramping up their research programs with many of the projects being done in collaboration with local industry and other researchers from around the world.

I must emphasize that Texas A&M attracts some of the brightest students from all over the world, and they are an integral part of all our research projects.

I have been privileged to serve this past year as interim vice president for research and oversee these extraordinary dynamic activities and changes. We can capture only a snapshot of the many and varied research programs in this 10th issue of Advance. The articles are amazing, and the photography is fabulous. I hope you enjoy the experience of our 2009 edition of Advance.
Furby Lives! *By Kelli Levey*

The elusive pygmy tarsier was labeled extinct in 1921, but reports of its demise are greatly exaggerated.

Addressing Addresses *By Keith Randall*

Geography researcher studies how street names and addresses reflect cultural and societal identities.

A Prescription for Happier Nurses *By Chrystal Houston*

Study links improvements in workplace to more satisfied nurses.

Green Invader *By John Holder*

An invasive plant species is a growing headache.

Dune and Dirty *By Kathleen Phillips*

Hurricane Ike teaches lessons through ecosystem research.

A Bird Tale *By Roma Subramanian with photographs by Nancy Newberry*

Inside the parrot disease conundrum.

Bombs Away! *By Mike Downey*

Detecting nuclear weapons at the border.

Getting from Point A to Point B *By Michael Long*

Texas A&M researchers in Qatar are making tomorrow’s transportation cheaper, smarter and greener.

The Fight for Clean Water *By Kara Bounds Socol*

Scientists work to ensure the availability of clean drinking water is an entitlement—not a luxury.

Look Here! *By Richard Nira*

Gaze manipulation technique could transform gaming, education and advertising practices.

Considering the Alternatives *By Kara Bounds Socol*

From biomass to bacteria, Texas A&M researchers design the future of energy production.

Window of Opportunity *By Kara Sutton-Jones*

Early reading intervention helps young children at risk for reading difficulties.

Book Reviews
Anthropologist Sharon Gursky-Doyen is eager to return to the cold, slimy environs of Indonesia, where she and a team discovered in late 2008 a trio of tiny primates not seen alive in more than 75 years. The elusive pygmy tarsiers were found in Central Sulawesi, Indonesia.

Gursky-Doyen, who teaches at Texas A&M University, says she is eager to return to the thick of Lore Lindu National Park for the summer of 2009 with graduate student Nanda Grow.

Though the chances are slim for finding more pygmy tarsiers—furry, Furby-looking creatures about the size of a small mouse and weighing less than two ounces—Gursky-Doyen says she can’t resist trying again.

(A Furby was an electronic toy robot popular in the late 1990s that had large eyes and ears. The robot spoke its own language but could be programmed to speak some English words.)

Last time out, on the second day of a two-month excursion, she discovered a female, nicknamed “Priscilla.”

The creatures were labeled extinct in 1921. In August 2008, Gursky-Doyen, Grow and six local field assistants from Indonesia captured two male and one female specimens and saw evidence of a fourth.

“We were hoping to find some sign of them, but when we went through the specimens we had caught in our mist nets, amid the bats and birds, there they were,” Gursky-Doyen recalls. “My hands were shaking and I was just about breathless. It was so surreal, such an unlikely event, I could hardly hold my hands steady to measure them and record my data.”

Over two months, the team used 267 mist nets to try to capture the creatures. They then attached radio collars to their necks to track their movements.

The moist, mountainous terrain at heights of 7,000 to 8,000 feet above sea level proved tricky to navigate, and the nocturnal nature of the animals added another element of danger. Rain fell every day, even though it was the dry season.

“It was always foggy and wet, so you had to be careful not to get hypothermia,” Gursky-Doyen says. “And the moss was so slippery, we were always struggling to stay upright. It was a lot of work and few results, but it was exciting.”

Gursky-Doyen, a physical anthropologist, specializes in the behavioral ecology and conservation of nonhuman primates. In addition to research on the spectral tarsier, Gursky-Doyen’s earlier research focused on this primate’s unusual infant caretaking behaviors, as well as the relationship between behavior and lunar cycles. Her most recent research project involves the relationship between group living and ecological pressures such as predation and the temporal distribution of resources.

Gursky-Doyen is currently documenting the first behavioral and ecological data on a living population of pygmy tarsiers. The Indonesian Institute of Sciences in Java is holding hair and fecal samples from the specimens, awaiting an export permit.

Pygmy tarsier characteristics include their small size, and long, thin fingers with claws, which Gursky-Doyen says could indicate that they are of a lower order than other primates, which have fingernails, or that they have adapted to the mossy environment.

Gursky-Doyen, who began work on her dissertation in 1993 in central Indonesia, says she is eager to return to gain more firsthand knowledge about the creatures and work toward their preservation.

The National Geographic Foundation provided $25,000 for several months of field research in 2008, and in 2007 she received $5,000 from the Conservation International Primate Action Fund.

Whatever else happens, she says she hopes the tarsiers won’t slip back into oblivion.

“There are still primates waiting to be discovered in Indonesia,” she says. “Not all have been seen, heard and described.”

The elusive pygmy tarsier was labeled extinct in 1921, but reports of its demise are greatly exaggerated. By KELLI LEVEY

The pygmy tarsier (Tarsius pumilus), also known as the Mountain Tarsier or the Lesser Spectral Tarsier, is a nocturnal primate found on central Sulawesi, Indonesia, in an area with lower vegetative species diversity than the lowland tropical forests.
Number 10 Downing St., 1600 Pennsylvania Ave., Hollywood and Vine. Street names and addresses have long fascinated people and no one yet has confirmed exactly how to live on Easy Street.

But only recently have scholars begun to take a serious look at the history and politics of street addressing. Today, we generally take for granted that houses have numbers and streets have official names, but when, where and why did these practices first emerge and what do they say about us as a people? Texas A&M University geography professor Reuben Rose-Redwood has been delving into such questions for several years, seeking to explore the little-known history of the modern street address.

“One of the basic questions in geography is ‘Where are things located?’ and ‘Why are they located where they are?’” he explains.

“Historically, the naming and numbering of streets has been one of the primary strategies for organizing geographical space into identifiable locations.”

The first recorded case of house numbering occurred in 15th-century Paris, Rose-Redwood says. Yet, it was not until the second half of the 18th century that the numbering of houses became common both in Europe and elsewhere. Most people generally associate addresses with the postal service, but sometimes the introduction of house numbering served more pressing needs.

For instance, when King Louis XV decreed that all cities and towns in France were required to have numbers affixed to their residences in 1768, he did so mainly for military reasons: Many soldiers were housed with individual families, and numbering the houses seemed the best way to keep track of soldiers’ locations.

London also began numbering houses and local business establishments during the 1760s and started installing street signs at intersections as well. Soon, marketers got involved in the form of city directories.

City directories, which consisted of alphabetized listings of the names of heads of households and business owners along with their street locations, soon came into vogue. Rose-Redwood’s research has documented the leading role that city directory publishers played in promoting house numbering in American cities during the late 18th and 19th centuries.

In the United States, Philadelphia led the way and had a house numbering system in place by the 1790s, which separated odd and even numbers on opposite sides of each street, as is common today in most American cities. In the 1850s, Philadelphia developed a new system that provided 100 numbers per block, known as the decimal system of house numbering, which soon spread to other cities across the country, says Rose-Redwood.

In addition to studying the historical geography of house numbering, Rose-Redwood has also drawn attention to the cultural politics of commemorative street naming.

“The assigning of street names involves a symbolic struggle over who will have the power to reshape the collective memory of a community,” Rose-Redwood maintains. “There are often multiple interests at stake in the naming process, and underlying social tensions commonly come to the surface during street naming controversies, so assigning a particular name to a street is not a matter to be taken lightly.”

Rose-Redwood has focused particularly on the politics of street naming in New York City, including the renaming of the numbered avenues on the Upper West Side in the 1880s and 1890s and in Harlem a century later.

“On the West Side, property owners petitioned the city to rename the numbered avenues because this was thought to enhance the prestige of the neighborhood and therefore boost property values,” he suggests. “In contrast, the renaming of streets after African-American civil rights leaders in Harlem was chiefly a means of claiming cultural recognition in the city’s streetscape.”

Commemorative street names in Harlem dating from the 1970s and 1980s were all named after black men, and it was not until 1993 that the first street was named after a black woman, notes Rose-Redwood.

Street addressing is generally an urban phenomenon, but in recent years, rural communities across the United States have been adopting city-style street addresses to facilitate emergency response management.

“Since the 1980s, rural areas have been replacing their rural route and box numbers with city-type addresses, because this is increasingly seen as a matter of public safety,” Rose-Redwood explains. “It just goes to show that street addressing is far more than a mere footnote in postal history, since various state and nonstate actors have played an important role in readdressing the landscape.”
When administrators consider building new hospitals or remodeling older ones, they might direct most attention to the patient experience: Many studies indicate a link between the physical environment and patient outcomes. But hospital design decisions often overlook another important audience: the nursing staff. A recent study from two researchers at Mays Business School shows that the design of a hospital affects nurses’ job satisfaction and stress levels.

Although a shortage of nurses persists in the U.S., understanding what keeps a nurse happy and on the job is an important element in patient well-being. Beyond that, this study shows that the “servicescape”—the physical environment where a service takes place—affects nurse retention, productivity and effectiveness.

To examine their theory, researchers Leonard Berry and Janet Parish surveyed hospital nurses six months before some of them were set to move into a new wing of an older hospital facility. They surveyed this same group six months after the move and compared the attitudes of the nurses who had moved into the new wing with those of nurses who stayed in the older part of the building, paying special attention to how each group rated job stress, job satisfaction and perceived service quality.

The new wing of the hospital had single-occupancy patient rooms that were larger and had more natural light, more hand-washing stations and more staff break rooms. The results of the survey suggest that these improvements to the servicescape had an effect on the nursing staff: Those who moved to the new wing reported more positive perceptions of work stress, job satisfaction and service quality. They also rated design features, such as safety, pleasantness and quality of workspace, higher than did nurses in the older part of the facility.

The findings of this study are significant—an American Nurses Association study showed that 88 percent of nurses indicated health and safety concerns affected their decision to leave nursing. Improved hospital facilities may be a key factor in addressing the U.S. nursing shortage and improving health care.

“Few service roles are more intense than that of hospital nurses, who typically work long shifts performing emotionally and physically demanding tasks,” say the researchers.

“This study shows that the quality of the facility where hospital nurses work matters to them; it makes a difference in the quality of their work life.”

The study made several recommendations for hospital administrators planning construction: Include nurses’ input in designing the spaces where they work; don’t sacrifice functionality for beauty; and whenever possible, improve older parts of the facility as well, to avoid negatively affecting the morale of nurses who don’t move into the upgraded area.

This study garnered the researchers the 2008 Journal of Service Research Best Article Award. Berry is a Texas A&M University Distinguished Professor and holds the M.B. Zale Chair in Retailing and Marketing Leadership. He also teaches in the Texas A&M Health Science Center College of Medicine. Parish is a clinical associate professor and assistant head of the department of marketing at the Mays Business School.
Giant reed (Arundo donax) is a robust perennial grass nine to thirty feet tall, growing in many stemmed, cane-like clumps, spreading from horizontal rootstocks below the soil, and often forming large colonies many meters across. Individual stems or culms are tough and hollow, divided by partitions at nodes like bamboo.

It’s a giant reed. It grows 10 meters tall, like a huge grass, and it grows...everywhere.

Well, not quite everywhere. But it’s appearing in more and more of North America, and that’s a problem. It’s an invader—like kudzu or fire ants.

It’s called Arundo donax, and it’s spreading through Texas, California and other areas in the United States. In fact, you can find Arundo all over the Texas A&M campus, and there is a large infestation in the Navasota River bottomlands around Highway 6, just outside Navasota.

Associate Professor James Manhart, Associate Professor Alan Pepper, and graduate student Daniel Tarin, in Texas A&M’s Department of Biology, are interested in determining where the Arundo found in the Rio Grande basin originated.

Like any invasive species, Arundo is not a problem in the places where it originated. In its original habitat, there are natural checks and balances, called biocontrols, that keep it from growing out of its ecological niche. According to Manhart, samples of Arundo taken from multiple locations in North America show that the plant was introduced from the same geographic location, very possibly southeastern Spain.

In its adopted homes, Arundo crowds out native species. The plant’s dense monocultural stands clog waterways and irrigation ditches, use more water than native species, increase the risk of fires, and ultimately lead to lost native habitats and biodiversity.

Working with genetic markers called microsatellites, Manhart and his colleagues are trying to narrow down the original habitat of Arundo and its natural adversaries. The team’s task is easier because Arundo donax is sterile, not reproducing sexually. That means the species is evolving more slowly than organisms that do reproduce sexually, which in turn leaves Arundo more vulnerable to the same biocontrol agents over time.

The biologists are looking closely at several candidate biocontrol organisms. One is a wasp called Tetramesa, which also reproduces asexually. So far, the scientists have developed four genetic markers specific to the wasp. The wasp controls Arundo by damaging new shoots and effectively “topping” the plant.

Another likely biocontrol agent candidate is one species of a tiny insect called scale. Like the wasp, the scale feeds on portions of the Arundo plant. The scale’s natural distribution suggests that it, like Tetramesa, originated in the same area as Arundo.

Manhart hopes the information that he and his colleagues are gathering with microsatellite markers will lead to collecting the right biocontrol insects.

To determine whether the insects can control Arundo, and to protect other plant species from potential insect attack, caretakers are raising the insects in a controlled environment.

“Insects that pass these rigorous tests will eventually be grown in large quantities, released and monitored for their effectiveness,” Manhart says. “We are also using genetic markers to investigate variability in the insect biocontrol agents, and they will be used to determine which, if any, of the insect genotypes are most effective in controlling Arundo.”

The Manhart–Pepper–Tarin team is not the only Texas A&M research group interested in Arundo donax. Georgianne Moore, assistant professor in the Department of Ecosystem Science and Management, is looking at Arundo’s effect on water relations and management. Edward Rister, professor and associate head of the Department of Agricultural Economics, is focusing on Arundo’s economic influence.

John Goolsby, a research entomologist in the U.S. Department of Agriculture’s Agricultural Research Service, serves as “the major driving force,” as Manhart puts it, behind Texas A&M’s projects involving Arundo.

Together, these scientists are working to make sure that Texas—and the rest of the nation—gains some effective natural defenses against this “green invader.”
Hurricane Ike was the third most destructive hurricane ever to make landfall in the United States. Damages from Ike in U.S. coastal and inland areas are estimated at $24 billion, with additional damage of up to $4 billion in Cuba, $200 million in the Bahamas, and $500 million in the Turks and Caicos, amounting to a total of $28.7 billion in damages.

Rusty Feagin was managing several ecosystem research projects on Galveston Island when the 2008 hurricane season began.

Then he got an unexpected visit from a research assistant named Ike.

“Ike reconfirmed the basic idea I’ve had for several years,” says Feagin, ecosystem scientist with Texas AgriLife Research, a member of the Texas A&M System. “The plants on sand dunes and in marshes build an island’s elevation, so we shouldn’t compromise that.”

Hurricane Ike, which struck Galveston, Texas, on Sept. 13, 2008, destroyed or severely damaged most of the dunes and marshes that he and his graduate students had studied. Feagin has noted the changes that the 2008 hurricane season brought and will begin his research again.

And this time, his research will include the collective knowledge of more than 20 coastal barrier island researchers from across the United States. The team gathered with Feagin on Galveston Island and the Bolivar Peninsula in early January to see firsthand the ecological damage that Hurricane Ike wrought.

The team, with funding from the National Science Foundation, aims to develop a “research–management–outreach framework to sustain barrier island ecosystems,” according to Feagin. The Coastal Barrier Island Network project is a five-year joint effort of AgriLife Research with Wake Forest University and the New Jersey Institute of Technology.

“Barrier islands do so many things and are of tremendous value,” says William Smith, Wake Forest botanist and project leader. “And scientists today realize that the issues facing barrier islands are complex problems that have to be addressed by a multidisciplinary team. There is no answer yet, but for the first time we are addressing it in this manner.”

Hurricane Ike teaches lessons through ecosystem research.

By KATHLEEN PHILLIPS
Graduate Ph.D. student Starr Lozada-Bernard (right) surveys the erosion on Galveston’s beach and sand dunes. Hurricane Ike washed out the beach, the dunes, and finally the Blue Water Highway. (opposite page)

After discussing data and touring the Hurricane Ike damage, the scientists agreed to the following findings:

• Critical differences exist between natural and human-dominated barrier island land forms and ecosystems.

• Controlling processes that influence vulnerability and resilience of barrier island ecosystems occur over many spatial and temporal scales. Feagin explains that because barrier island sediments can move great distances during large events such as a hurricane, sometimes researchers need to look at one barrier island in isolation to understand how its ecosystem works, whereas other times there is a need to look at multiple islands to see how the sediment and ecosystems change among the islands (some lose land, whereas others gain).

• Economic valuation tools such as cost–benefit analysis, as well as rapid assessment methods that use remote sensing, GIS and field validation techniques, can bridge the divide between those who advocate development and those who advocate ecological sustainability.

• New mechanisms are needed for communicating with stakeholders (e.g., politicians, government agencies, teachers, local public, and developers) about emerging science and implementing management strategies.

“Barrier islands do so many things and are of tremendous value.”

• Managing for stability versus natural dynamism needs to be addressed, along with better restoration alternatives that include native vegetation.

• There is potential for development of a unified conceptual framework for soft-sediment coasts.

“We are close to understanding how all sedimentary coasts work in a general way; the sediment moves and the ecosystems must move with it over time, while human occupation within these ecosystems generally interrupts this movement because of the structures that we have built,” Feagin explains.

The coastal barrier island scientists hope to research and find possible solutions to these issues.

Disappearing Beaches

Galveston researchers study erosion and Texas shoreline.

By KEITH RANDALL

Run by professors William Merrell and William Seitz, the Center for Texas Beaches and Shores at Texas A&M University at Galveston offers valuable information about many aspects of the Texas coastline—including erosion.

Erosion is eating about 64 percent of Texas’ beaches, Merrell says, and some areas lose as much as 10 feet of shoreline each year. Homes that were once hundreds of yards from the beach now have the beach as their front yard.

“Hurricane Ike did considerable damage—in some areas, you can see where 50–100 feet of the shoreline has just vanished,” Seitz says. “Large tracts of beach in the West End area of the island have been washed away.

“Roads have collapsed in many areas. And some of the projections for future beach erosion are pretty scary,” Seitz adds. “At the current rate, many Texas homes will be washed away within 20 years,” and the problem is likely to get worse.
Congo African Grey Parrot, Psittacus erithacus
Itamar Villanueva is really interested in “the band.” However, this band is not a bunch of guitarists belting out rock songs but rather a horizontal strip of dark blue on a membrane.

The band represents the results of a test that Villanueva, a Ph.D. student who works in the Schubot Exotic Bird Health Center of the Texas A&M University College of Veterinary Medicine and Biomedical Sciences, has developed. The test has the potential to help diagnose proventricular dilation disease (PDD)—a fatal neurological disorder affecting captive parrots worldwide.

The test, which is the first of its kind, screens the serum of PDD-affected birds for antibodies produced in response to a specific antigen of avian Borna virus (ABV), the proposed causative agent of PDD.

PDD is named for one of its symptoms: dilation of the proventriculus, an organ in the upper digestive tract of birds. The proventriculus secretes digestive enzymes and transfers food from the crop to the gizzard, where it is digested further. PDD damages the nerve supply to the proventriculus, ventriculus (gizzard) and portions of the small intestine. Food accumulates in the proventriculus, resulting in swelling of the organ. Common clinical signs include depression, weight loss, regurgitation and passage of undigested seeds.

As is often true in scientific discovery, a mixture of curiosity and serendipity led to the development of the test.

“I was working on a vaccine for influenza in chickens and had a little downtime and asked if I could observe the necropsy of a macaw that had died of PDD,” Villanueva says. He was curious to see whether the tissues of PDD-affected birds contained an antigen recognized by their own serum.

By using a technique called Western blotting (which uses a membrane to separate and identify proteins according to their size), Villanueva reacted the serum of PDD-affected birds against their own tissue proteins. He found that the serum almost always reacted against a 38-kilodalton (a Dalton is a unit of atomic mass) protein (the reaction appeared as a blue band on the membrane), indicating that the birds were producing antibodies specifically targeted against this protein. Serum from healthy birds did not react against this protein, indicating that only PDD-affected birds produced the protein.

Richard M. Schubot Professor of Exotic Bird Health and professor of immunology, Ian Tizard, leads the PDD research group in the Schubot Exotic Bird Health Center. Tizard says that the test shows in one step that PDD-positive birds have a PDD-specific antigen and are producing antibodies against that antigen.

Villanueva hopes that the test, which is currently about 90 percent accurate in detecting anti-ABV antibodies, will help prevent PDD misdiagnosis, which may result in the needless euthanasia of rare, expensive birds. The test is also an improvement over crop biopsy, another method to detect PDD. Crop biopsy is invasive, can give rise to complications and is only 60 percent accurate in diagnosing PDD.

The test is being offered as a free service to veterinarians to confirm its accuracy. It has also been submitted to the Office of Technology Commercialization at the Texas A&M University System to investigate its marketing potential. The Schubot lab is collaborating with Thomas Briese, associate director of the Center for Infection and Immunity at the Mailman School of Public Health, Columbia University, New York, to determine whether the PDD-specific antigen that Villanueva has isolated is the ABV nucleoprotein.

Although the test represents a step forward in understanding this complex disease, a maze of unanswered questions remains. For example, not all birds infected with ABV will develop PDD. Tizard says that “ABV is necessary but not sufficient for causing sickness.” Whereas some ABV-infected birds remain healthy for as long as 10 years, others become ill and die within two to three weeks. The trigger that leads to the development of PDD is not known. Also, although PDD is believed to be an infectious disease, its mode of transmission is not understood. Tizard illustrates the perplexing nature of PDD transmission by describing a case in which PDD developed in only one bird of a bird pair, even though the birds shared a cage and food for five years and even fed each other.

To better understand the behavior of ABV, the PDD research group at the Schubot Center grew the virus in tissue culture. The group will collaborate with a research group at Columbia University to sequence the genome of the virus to determine its relatedness to other viruses. Tizard says that the goal is to develop “effective, practical treatments for PDD and, if possible, a vaccine.”

Parrots are some of the most recognizable birds in the world. These exotic tropical birds have fascinated people for centuries because of their bright coloring, their abilities to imitate human speech and their long life spans (some live up to 80 years in captivity). These traits have made them popular pets but a fatal neurological disorder called PDD has begun affecting captive parrots worldwide. Texas A&M researcher Itamar Villanueva has developed a new test that helps to prevent the misdiagnosis of PDD which leads to the needless euthanasia of these rare and beautiful birds.
Golden Conure, Guaruba guarouba

White Crested Cockatoo, Cacatua alba

Hawk Headed Parrot, Deroptyus accipitrinus

Congo African Grey Parrot, Psittacus erithacus
Blue and Yellow Macaw, *Ara ararauna*

Congo African Grey Parrot, *Psittacus erithacus*

Quaker Parakeet, *Myiopsitta monachus*

Cockatiel, *Nymphicus hollandicus*
Blue and Yellow Macaw, Ara ararauna
Camelot Macaw, Ara chloroptera x macao
Detecting nuclear weapons at the border. By MIKE DOWNEY

The task is gargantuan but vital: protect U.S. borders from terrorists smuggling in nuclear weapons.

Multidisciplinary teams of Texas A&M University researchers from nuclear and industrial engineering, mathematics, physics and other departments, along with the Bush School of Government and Public Service are developing a new sensor detection system with more than $7 million in federal funding over the next five years.

The detectors, and the system to use them, aim to find highly enriched uranium (HEU) or plutonium hidden in cargoes of ships and vehicles. More than 18 million shipping containers enter U.S. ports each year.

The multidisciplinary project is called SHIELD (Smuggled HEU Interdiction through Enhanced anaLysis and Detectors), according to project director David Boyle of the Nuclear Security Science and Policy Institute (NSSPI) at Texas A&M.

“Ultimately, we are setting up a framework to allow the DNDO [Domestic Nuclear Detection Office, Department of Homeland Security] to take our proposed new detectors, or any future devices and systems, and evaluate how they will function in the real world,” Boyle says. “It’s a systems approach to get a tool to evaluate ideas.”

The $7.5 million project is a joint effort of the National Science Foundation and the DNDO.

The detection project is so massive that it actually extends beyond U.S. borders, according to NSSPI director William Charlton. The layered defense system will include detectors at foreign ports and borders as well.

DETECTOR TEAM

The SHIELD project is divided into four teams. Nuclear engineer Charlton heads detector technology; mathematician Wolfgang Bangerth leads the radiative transfer and inverse group. Industrial engineer Gary Gaukler directs the systems team, while public policy professor Arnold Vedlitz of the Institute for Science, Technology and Public Policy in the Bush School examines the policy and social implications.

Charlton says the project’s multidisciplinary composition is a break from past large-scale research efforts. The teams are working together to understand the issues, in addition to developing systems and detectors, he says.

A staggering 18 million shipping containers enter through ports in the United States every year. A team of Texas A&M University researchers are working on a massive joint effort to detect highly enriched uranium or plutonium that terrorists could potentially hide in the cargoes of ships and trucks with the intent to build nuclear weapons.
“There’s more to the problem than just the detector itself. Engineers and scientists don’t always do a good job with the social side,” Charlton says. “As we add the social policy side, we will develop the framework DND0 wants.”

Charlton says that young, vibrant faculty researchers lead the team “to energize the troops,” about 20 student researchers as well as 14 co–principal investigators.

The team has developed four detector concepts ready for validation, Charlton says. The detectors must be robust because inspectors must use them in the field, he says. “These detectors need to be able to survive getting hit by a car.”

MATHEMATICS TEAM

Among other approaches, the radiative transfer and inversion group is working on using methods from medical imaging (as in the familiar medical computed tomography [formerly CAT] scan), says mathematician Peter Kuchment, one of the team’s eight members.

“All these detectors need to be able to survive getting hit by a car.”

However, unlike medical imaging, “there is no hope to image a device smuggled in cargo,” he says, because “the perpetrators are not going to ship something that’s easily detectable.”

He points out that the nuclear material will probably be shielded and produce a very low radioactive signal—much lower than that found in medical imaging, further complicating detection. We will try to get just a “yes” or “no” that something is suspicious, Kuchment says.

Another complication: There is a lot of radioactivity in the background and only a few particles that hit a detector are from smuggled material.

“Can we detect a very low signal against such a high background?” Kuchment asks. “We are not sure yet, although the first trials have been encouraging. It's possible the emission will be so low and well shielded that we will have to go beyond mathematics for detection. That is why the project involves so many different fields of research.”

In addition to Kuchment’s efforts, Bangerth and researchers from the computer science and mathematics departments are developing computer models to simulate the radiation from radioactive sources hidden inside cars or cargo containers.

“Comparing the predicted radiation with predictions for cars or containers without sources allows us to determine criteria to detect the presence of illicit materials,” Bangerth says.

By using computer models, one can develop synthetic data, detection and imaging methods without doing costly and time-intensive real-life experiments, he says. When these methods work well with synthetic data, one can apply these algorithms to real-world data, Bangerth says.

SYSTEMS TEAM

Gaukler points out that SHIELD is looking at a complete protection system, not just one detector. Of course, radiation detectors are needed, but “you need to use these detectors in a smart way,” Gaukler says. This is the global, or strategic, policy view of stopping nuclear smuggling, he says.

“It’s how smart you are in using what you have,” Gaukler says. “Where do you put these detectors? Foreign ports? Domestic ports? Given that there may not be enough funds to establish the same array of detectors at each U.S./foreign port, how do you prioritize?”

Around 50,000 shipping containers enter U.S. ports daily. Gaukler says the tradeoff for safety is time—current passive radiation detectors are fast, but they are not always reliable. Active detectors are costly and largely experimental. Manual detection—by human inspectors and handheld devices—is reliable but takes hours, “and commerce would come to a standstill if every shipping container were manually inspected,” he says.

The systems team already has figured out an inspection policy that it believes is better than the current system—even before new detectors are invented.

The team proposes using radiography—X-rays—to get a picture of a container.

“It is really the way you use your detectors— that is, the inspection policy—that decides how good your system is going to be,” Gaukler says.

POLICY AND SOCIAL TEAM

Vedlitz describes his role in the research project as putting forward questions as well as answering them.

“What are the domestic and international policy implications of developing and deploying this sensor detection technology? If we put them in foreign countries, what are the treaty concerns? How will the American public and national, state and local governments respond?” Vedlitz asks.

These are huge issues, Vedlitz says. The problems are not confined to one discipline, which is why many disciplines are working together on this, he adds.

His team is doing risk assessments and surveys to gauge how much taxpayers are willing to spend on these protections. By studying public opinion, the media and legislative hearings, the team can find out how politicians and the public think about the issue…and how they might vote on funding, he says.

Vedlitz asks what good is the best technology in the world “if no one is willing to use it.” The detectors must be reasonably priced to develop and deploy, must be easily used, and must not hold up the traffic of trade, Vedlitz says. “Otherwise, there is no point in designing them.”

Advance
Texas A&M University’s Laboratory for Biological Mass Spectrometry (LBMS) is using ion mobility–mass spectrometry (IM-MS) to better analyze protein structure and folding.

LBMS has a five-year, $1.4 million National Science Foundation grant “…specifically to develop an instrument not yet commercially available” that incorporates the latest IM-MS advances, explains director David Russell, also co-director of the Center for Structural Biology and head of the Department of Chemistry.

IM-MS, Russell says, is faster and requires less human effort than conventional approaches. In joint development with Houston’s IonWorks, the device will rapidly characterize protein structure, a crucial first step in cellular processes and drug discovery—and central to diseases such as Alzheimer’s, Parkinson’s and type 2 diabetes. He expects to finish the apparatus by summer’s end, followed by testing and refinement.

Russell credits funding from the Department of Energy and the National Institutes of Health, and members of Texas A&M’s structural biology research group, for enabling the preliminary research.

The group’s results will benefit at least 25 research programs across the university and will influence the international search for solutions, Russell predicts.

Instrumental Collaborations

Structural biology strength positions Texas A&M as world leader in characterizing new proteins. By SHANA HUTCHINS

Texas A&M’s state-of-the-art instrument will incorporate the very latest IM-MS hardware and computer software for acquisition and processing of data and give Texas A&M researchers a major advantage—access to technology not generally available at other institutions.
Getting from Point A to Point B

Texas A&M researchers at Qatar are making tomorrow’s transportation cheaper, smarter and greener. By MICHAEL LONG

In many ways, the Internet has made the world easier to navigate, but at some point in the week or the day, we still have to get from one place to another—and age-old problems remain. Roads break down. Airplane fuel is a finite commodity, and the world has a growing need for more and different sources of it. Scientists at Texas A&M University at Qatar are addressing these challenges at the most basic level: the chemistry and technology at the heart of transportation.

“You may think you can’t run an airplane on coal and natural gas and biomass—but we’re figuring out how to do it and how to do so cleanly and efficiently,” said Nimir Elbashir, visiting assistant professor, whose research focuses on fresh approaches to alternative energy.

“What if your car ran on diesel, but you wanted to use less crude oil, or none at all? As a scientist, I would tell you that we should try to create something in the lab with the characteristics of diesel but made from plentiful materials. And while we’re at it, we should try to make this new kind of diesel more efficient and friendlier to the environment than real diesel.”
“In fact, this is exactly what we’re doing right now.”

Elbashir, a chemical engineer, is working on a way to convert relatively abundant natural gas to ultraclean transportation fuels. The key to doing this is the technology for the conversion of gas to liquid (GTL). He is studying GTL technology known as Fischer–Tropsch synthesis, which was developed in Germany 85 years ago and which led to an industrial boom in fuel production there at the time—an interesting parallel for natural gas–rich Qatar, which endeavors to be the world capital of GTL technology.

In the century since, hundreds of Fischer–Tropsch–based plants have been built around the world, but only three practical designs for their technical “heart” have appeared: Elbashir is working on optimizing those designs and creating potential new ones.

“Different systems and more efficient design for those already in existence can help transform this technology from a small part of the world’s energy matrix to a significant source,” he says. “That could lead to new fuels, more abundant energy, lower costs and significantly reduced environmental impact from transportation.”

An unusual challenge of the work is that it incorporates both basic and applied science. Elbashir’s investigation into the technical aspects of transforming gas into liquid includes identifying the nature of reaction media that cause the transformation—an effort that is basic science. Yet to do this work, scientists must also address the technical challenge of controlling the characteristics of these media, as well as figure out reactor configurations that facilitate the process—an exercise in applied science.

Solutions in both realms may become the foundation for industrial processes at the center of nothing less than a new front in an energy revolution.

Elbashir’s promising work has attracted both commercial and academic interest from several institutions around the world. The result has been critical support for the bench science that can make practical and efficient GTL possible for the world of transportation. Development of such technology could also support the efforts of small companies that are seeking profitable small-scale GTL plants with fewer technical complications.

Eyad Masad is looking to the future of transportation, too, but he has his feet on the ground.

“Roads look simple, but they’re not. They deteriorate in lots of ways and for lots of reasons. As drivers, we think about the delay and the frustration of a big pothole that damages the car on the way to work, but the problem is far more than that. Millions of dollars can be wasted due to road failures caused by poor material selection and design,” says Masad, an associate professor in the Department of Civil Engineering who is teaching and conducting research in Qatar.

Along with fellow researcher Dallas Little, a professor of civil engineering at Texas A&M in College Station, Masad is looking for innovative solutions to improve the design and performance of materials used in constructing infrastructure, especially roads.

“We can improve the performance of road systems by finding and designing materials that sustain the traffic load and accommodate the prevailing environmental conditions,” says Masad. “A road that runs through the desert has to withstand not only extreme heat but also rapid and regular changes in temperature.” Such a road, he says, will require different materials and structure from those of a road going through College Station.

Little and Masad are investigating the use of sulfur in asphalt roads. Research indicates that adding sulfur pellets to road material makes the road stiffer. Under certain traffic loading and environmental conditions, sulfur-modified roads experience less damage—from traffic, weather, temperature or something else.

Fewer potholes means fewer road repairs. And fewer repairs means longer road life and lower maintenance cost.

Little and Masad don’t have to tear up their sulfur-infused roads to find out what is happening below the surface: They use X-rays. Through Texas A&M’s Advanced Characterization of Infrastructure Materials Lab and other on-campus materials labs, researchers use computed tomography (think of the “slices” visible in a physician’s MRI [magnetic resonance imaging] results), mechanical loading systems and computational software to “see inside” the asphalt and find cracks, stresses, shifts and other changes.

Like Elbashir’s work on making alternative fuels from traditional resources, this work too has far-reaching effects beyond the lab: Sulfur is a by-product of the processing of natural gas and is generally considered a waste material. Through finding practical applications for sulfur, not only is there less waste to dispose of, but another industrial process gains benefits that, in this case, accrue to the public.

Sulfur disposal is of special interest in Qatar. With the world’s third-largest reserves of natural gas, the nation directly benefits from finding practical uses for waste sulfur from the processing of natural gas. This endeavor brings together the work of Elbashir, Little and Masad: Elbashir is finding new ways to convert natural gas into alternative sources of energy, whereas Little and Masad are helping to put the by-products to other productive uses.

It’s entirely likely that someday a car running on GTL-processed natural gas will drive on a road strengthened by the sulfur that came from that car’s fuel. The science of transportation is full of these kinds of connections—researchers and projects meeting at crossroads of practicality, yielding efficient, environmentally friendly ways of getting from point A to point B.
“Water, water everywhere,
Nor any drop to drink.”
from *The Rime of the Ancient Mariner*
by Samuel Taylor Coleridge

Bryan Boulanger is a man on a mission.

The Texas A&M University assistant professor of civil engineering may never have to think about his own drinking water, but he’s well aware that even in Texas, others don’t share his peace of mind.

“Globally, we lose 5,000 children every day from contaminated water,” he explains. “In 2009, that’s an unacceptable number for me. I want that to stop.”

Boulanger is not the only one who’s simply fed up. Many within the Texas A&M University System have taken it upon themselves to use their own particular skills and expertise to fight the battle for clean water.

Scientists at Texas A&M and in A&M System agencies such as Texas AgriLife Research work on a pure science level, detecting waterborne pathogens and developing new and better ways to combat them. Other researchers and faculty members take the fight to the home front, making every effort to ensure that the availability of clean drinking water is an entitlement—not a luxury.

**WATERBORNE CHALLENGES**

In 1993, one of the two water treatment plants serving Milwaukee became contaminated with the parasite *Cryptosporidium*. By the end of what turned into a two-week ordeal, more than 100 human deaths and roughly 400,000 cases of stomach cramps, fever, diarrhea and dehydration were attributed to the contamination.

Milwaukee acquired the unenviable designation of host to the largest known outbreak of waterborne disease in U.S. history.

George D. Di Giovanni was intimately familiar with *Cryptosporidium* long before it became a household name. At the time of the outbreak, Di Giovanni was a Ph.D. student in microbiology and immunology at the University of Arizona. While his graduate studies focused on bioremediation, the Milwaukee outbreak and its aftermath helped steer him toward a specialization in water contaminants.

“There was a lot of research being done at the time on other waterborne pathogens, but as far as an organism that posed a significant challenge to the drinking water industry, it was clear that more research was needed,” he says. “I soon learned that waterborne pathogen research was pretty challenging.”

After serving as a researcher with both the Environmental Protection Agency (EPA) and American Water Works Service Co., Di Giovanni entered the world of academia. For the past seven years, he has been a professor of environmental microbiology at the Texas AgriLife Research Center.

Scientists work to ensure the availability of clean drinking water is an entitlement—not a luxury. By KARA BOUNDS SOCOL
at El Paso, specializing in the detection, infectivity determination and molecular analysis of waterborne pathogens.

FROM RESEARCH TO POLICY

It’s clear from Di Giovanni’s vast array of research projects that investigating waterborne pathogens involves much more than running slides of drinking water under a microscope. And ridding water of these pathogens—particularly *Cryptosporidium*—can’t be accomplished by merely adding a chemical or two to drinking water sources.

Several years ago, Di Giovanni and his team developed a method that not only detected *Cryptosporidium* in drinking water but also revealed the presence of infectious *Cryptosporidium*, which until that point was much more difficult to detect. Over two years, the team studied 82 water treatment plants in 14 states. The resulting numbers showed that rather than the EPA risk goal of no more than one *Cryptosporidium* infection per 10,000 people each year, the overall risk for conventionally treated drinking water was 52 infections per 10,000 people.

*Cryptosporidium* poses one of the greatest challenges to drinking water quality because of its resistance to chlorination,” Di Giovanni explains. Study results indicated that an additional treatment barrier, such as ultraviolet light disinfection, may be needed to meet the EPA risk goal.

Because of his team’s findings, Di Giovanni said team members are conducting a follow-up project that entails a more widespread and vigorous study of drinking water systems across the nation.

Another one of Di Giovanni’s most recent research focuses garnered him and his team the 2007 Texas Environmental Excellence Award—the state’s highest environmental honor. High levels of fecal pollution discovered in many of the state’s lakes and other surface water bodies prompted the research.

Using bacterial source tracking, Di Giovanni and his colleagues developed bacterial genetic and biochemical libraries of *E. coli* bacteria in two major Texas watersheds. The results helped identify sources of fecal pollution and helped shape statewide water quality protection strategies.

Di Giovanni continues to use source-tracking techniques to reveal the genetic makeup of waterborne organisms. This approach determines not only which species are present in specific watersheds but also whether these species are a health threat.

“We’re basically trying to find out where the fecal contamination source is and if it causes diseases in humans,” he explains. “This then helps in the development of watershed protection plans.”

Although drinking water is typically the first thing that comes to mind when one considers water contamination, Di Giovanni’s research extends to other water sources as well. One study, for instance, looked at the risks involved with consuming sheep that grazed on oat forage irrigated with contaminated water. It also investigated the effects of direct human contact with this same reclaimed wastewater—sewage that is treated and then reused for such purposes as irrigation.

The water analyzed in this study was in the Juarez Valley, where almost 90 percent of agriculture and livestock activities rely on reclaimed wastewater. Here the reclaimed water is a blend of raw and marginally treated wastewater rife with *Giardia* and *Cryptosporidium*. The sheep examined in the project, however, were not harboring the pathogens found in the irrigation water. Di Giovanni and a colleague have also refined a method for recognizing potentially infectious viruses that could lead to a disease outbreak. By doing so, they are helping to develop a standard method for routine monitoring of water for infectious viruses by providing a technological foundation for the water industry and the EPA.

THE FIGHT ON THE HOME FRONT

It’s the end of a long workweek, and to B. Stephen Carpenter, that can mean only one thing: It’s Filter Friday. "Our goal is to produce about 10,000 filters a year," Boulanger says. “We have about 100,000 households in the Colonias that could potentially benefit from them."
For close to two years, Carpenter has met colleagues and students in his garage most Friday afternoons to make ceramic water filters for impoverished residents of the Texas–Mexico border.

Carpenter, an associate professor in Texas A&M’s Department of Teaching, Learning and Culture, learned about the impact of water filters a few years ago from his undergraduate art professor and mentor, Richard Wukich, of Slippery Rock University in Pennsylvania. Wukich is a champion of the technology and has helped deliver filters and establish filter production facilities in such countries as Iraq. Colleague and fellow art professor Manny Hernandez of Northern Illinois University has advanced the design of the filters, kilns and other production equipment and has worked with people in such countries as the Dominican Republic, Guatemala and Cambodia to develop filter production facilities.

It was a chance conversation with Oscar Muñoz, deputy director of the Colonias Program in the Texas A&M College of Architecture’s Center for Housing and Urban Development, that once again sparked Carpenter’s interest in the ceramic filters. Muñoz told Carpenter of the vital need for uncontaminated water in residential areas along the Texas side of the Rio Grande, where roughly half a million people—most of whom are legal U.S. residents—live in Third World conditions. The typical colonia resident has no running water or sewage system.

Carpenter and Muñoz decided that by working together, they could provide a way for colonia residents to have clean water. Muñoz shares his vast knowledge of colonia life, while Carpenter contributes an artistic perspective, skills in firing and making pottery and curriculum design. Boulanger lends his environmental engineering expertise to the project, while Wukich and Hernandez serve as consultants and technical advisers.

“Our mission is to connect colonia residents—people who feel very isolated—to as many services as possible,” Muñoz says.

A SIMPLE SOLUTION

In 1981, Fernando Mazariegos of the Central American Industrial Research Institute in Guatemala developed the ceramic water filter that Carpenter and his colleagues used. It has since been replicated thousands of times by members of the U.S.-based nonprofit group Potters for Peace, who teach the fabrication of the filters as part of their overall mission.

After the devastation of Hurricane Mitch in 1998, Potters for Peace established a ceramic water filter production workshop in Nicaragua to address the urgent need for safe water. More than 5,000 filters were distributed in the first six months alone.

The cone-shaped ceramic filters look much like 10-inch-deep terra-cotta flowerpots and are designed to fit inside five-gallon plastic containers. They are made from sawdust and clay and coated with colloidal silver, which when combined with the fine pore size eliminates most bacteria and other microbes. A family of four, Carpenter says, needs to refill the container twice to provide enough water for daily cooking and cleaning.

To avoid consuming contaminated water, a colonia resident in Eagle Pass told Carpenter that she spends at least $30 a month on bottled water—a large sum for those with annual family incomes of $8,000 to $16,000. The ceramic filters, on the other hand, cost between $15 and $20 and can last indefinitely with proper maintenance. Those distributed a decade ago in Nicaragua, for instance, are still effective.

To help alleviate the financial burden even further, Carpenter says he’s hoping that nonprofit groups and individuals will cover some of the cost of the filters as service projects.

From December 2008 to February 2009, Boulanger, Muñoz and Carpenter experienced an unprecedented progress toward fulfilling their water filter quest. The Webb County Commissioners Court granted space in Laredo for the group to build its first point-of-use ceramic water filter production and education center. Also, Texas A&M announced that it is providing a site at its Riverside Campus for a filter research and development facility.

“Our goal is to produce about 10,000 filters a year,” Boulanger says. “We have about 100,000 households in the colonias that could potentially benefit from them.”

The group says that volunteers are eagerly waiting to help with the filter project. With research and development facilities finally becoming realities, the biggest hurdle to creating and distributing the filters has been overcome.

Visit www.itunes.tamu.edu and search for “Clean Water for Texas” to see a video about the water filter project.
Look here!

PHOTOGRAPH BY JEAN WULFSON
A new procedure called subtle gaze direction (SGD) can dramatically alter which parts of an image people look at on a computer screen. Ann McNamara, an assistant professor in the Department of Visualization at Texas A&M University, and a team of research associates developed the concept.

The research has possible applications in areas as diverse as computer gaming, online education, training simulations and advertising.

“When people are viewing images, there’s certain things that catch your gaze,” McNamara says— “human faces, things that appear nearer rather than farther or areas with high contrast.”

To document where people’s eyes are drawn to in an image, McNamara and her associates use small infrared cameras calibrated to record the movements of a subject’s pupil; the cameras track a subject’s eye movements when looking at a series of images on the screen.

As an assistant professor of computer science at Saint Louis University in 2006, McNamara began the project with fellow researchers Cindy Grimm, associate professor of computer science at neighboring Washington University in St. Louis, and Reynold Bailey and Nisha Sudersanam, then graduate students at Washington University in St. Louis.

With their eyes tracked by cameras, the research subjects first looked in the expected areas in image after image.

Then McNamara and her fellow researchers had a question.

“We wanted to see if people’s gazes would actually follow a path we chose for them through the scene,” she says. “For instance, if we wanted people to look at one area, we wondered if we could actually force them to look there.”

Putting a flashing red light in the corner of the screen would work, of course, but McNamara and her colleagues had something else in mind.

She wondered: If you wanted to do it subtly, so that users would not know that something was directing their eyes, how would you go about it?

“We came up with the idea of applying image space modulation,” says McNamara.

The technique involves choosing a small region of pixels in the image and basically alternating the pixels between black and white: a tiny flicker in the image’s luminance channel.

“Humans are highly responsive to changes in luminance,” she says.

The flickers, called modulations, are visible to the naked eye—if one knows where they are and when they’re occurring.

“The modulations catch your attention, but only for a brief ‘enough period that your eyes actually move toward it,’” she says. “Once you start looking toward it, the modulation stops.”

Using the eye-tracking technology, researchers found a dramatic difference in what part of an image subjects looked at with versus without modulations.

Ignoring typical gazing sites such as human faces, the subjects looked at modulated areas in empty sky, the ground or clothing.

“The effect of modulation is based on the characteristics of human vision.

“The reason we see a clear view of the world is because our eyes are always moving,” says McNamara. “If you could actually stop your eyes from moving, then you would see one very clear area in the center of your viewing area and the rest, your peripheral vision, would be blurred.”

McNamara says that despite this limitation, humans are aware of motion in their peripheral vision.

SGD has several possible applications, says McNamara.

“Let’s say you were passing geometry over a network into a game,” she says. “You could use SGD to try to force the game player to look at an area that’s well rendered and away from an area that’s not so well rendered.”

This technique could save game developers the expense of graphically articulating details on the entire screen, thus improving the game’s performance without noticeably detracting from the gaming experience.

SGD also has possible education applications.

“If you have a painting on a Web site that art students are learning from,” says McNamara, “you can have audio that guides them through the painting, but you could also use SGD to have them look at specific regions as you’re talking about them.”

Using SGD in training simulations could also enhance learning.

A flight simulator, for instance, could use SGD to focus the user’s gaze on important controls. If a control were to become critical, you could draw the user’s attention to it by modulating it, she said.

The technique could also be useful for driving simulators—for instance, modulating the rear-view mirror and the side mirror areas, to develop a young driver’s habits in a way that could potentially transfer to the real world.

And, of course, businesses have products to sell.

“Advertisers would love to be able to direct where you gaze,” she said.

McNamara, who joined the Texas A&M faculty in 2008, holds a Ph.D. in computer graphics from the University of Bristol, UK; an M.A. in education from the University of Dublin, Ireland; and a B.S. in computer science from the University of Bristol.

Her research focuses on advancing computer graphics and scientific visualization through new approaches for optimizing an individual’s experience when creating, viewing and interacting with virtual spaces.
Automobiles fueled from garbage. MP3 players activated by footsteps instead of batteries. Computers powered by sugar.

To many, such scenarios might seem absurd. But to alternative energy researchers at Texas A&M University, they simply mean another day at work. Many of the energy-related developments credited to Texas A&M researchers are already here, even if they haven’t yet appeared in the marketplace. Other such developments are coming soon.

As Texas A&M chemical engineering professor Mark Holtzapple puts it, “We’re really involved in some incredible technology that will have a big impact on the world.”

FROM GARBAGE TO GASOLINE

At the end of the 1985 film Back to the Future, Dr. Emmett Brown crash-lands his DeLorean time machine on Marty McFly’s front lawn, insisting that Marty return with him to his latest destination: the future. But rather than powering the DeLorean with its customary plutonium, the scientist digs around in Marty’s trash can, pulling out banana peels and a beer. He crams the items into the “Mr. Fusion” attached to the sports car’s engine and the time machine instantly blasts off.

As he hears his energy research compared to the film yet again, Holtzapple chuckles. “I never could get the flux capacitor to work,” he says, referring to the time machine’s critical component, “so we went down this road instead.”

By “this road,” Holtzapple is referring to his lifework: a technology that converts everyday garbage into high-octane gasoline. Unlike the movie’s version, however, this alternative fuel technology is a present-day reality. In fact, a biofuel demonstration plant was completed in November in Bryan, Texas, and the first commercial plant is slated for construction by 2011.

Holtzapple started working in biomass conversion in 1978—the year after the United States faced its first energy crisis. Research funding for alternative fuels was readily available—that is, until gasoline prices dropped three years later. With the fall in gasoline prices came a virtual cessation of research funding for alternative fuels.

“There’s only a handful of biomass professionals who were involved during that time and continued their research through the bad times,” Holtzapple says. “I’m one of them.”

The advent of biofuels goes back to the early 1900s, Holtzapple says. The first diesel engine, for instance, ran on peanut oil. And Henry Ford originally designed the Model T to run on ethanol.

“We’ve been talking about using biofuels for a long, long time,” Holtzapple explains. “The problem was that oil was so cheap.”

The most inexpensive way to manufacture something, Holtzapple explains, is to use it once and then throw it away. This “once-through” approach has historically been the thinking about fossil fuels, he says: Take them from the ground, burn them, and then dump the carbon dioxide into the atmosphere.

“As we get more and more people on the planet, instead of thinking in terms of a once-through process, people have to start thinking in cycles,” he says. “If we want to address global warming, biomass is a way to do so through such a cycle.”

In 1991, Holtzapple and Cesar B. Granda, Texas A&M chemical engineering research engineer, developed a method to convert biomass into mixed alcohols that could be blended into gasoline. They termed the process “MixAlco.”

The MixAlco process begins with biomass—which includes garbage; biosolids from wastewater treatment plants; and green waste such as lawn clippings, food waste and any type of livestock manure—that is treated with lime and then fermented using microorganisms in soil to form organic salts. Water is removed, ketones are formed and hydrogen is added to create mixed alcohols, which are then combined with existing gasoline.

The result is gasoline that is nearly identical to that developed from crude oil, Holtzapple says. And at its current state, it would cost consumers roughly the same amount that they are currently paying at the fuel pump while providing a plethora of environmental benefits, he says.
Terrabon LLC has licensed the MixAlco technology. Another technology company, Byogy Renewables Inc., has licensed a similar system that converts biomass directly to gasoline. Holtzapple and his Texas A&M colleagues Sergio Capareda and Kenneth Hall developed that process.

Holtzapple says he’s excited about the possibilities that Texas A&M presents for biomass conversion. From growing sorghum for biomass feedstock to storing it over long periods to converting it to gasoline, each and every step could be undertaken at the university, he says.

“With this thermoelectric technology, even the most commonplace motion—like walking—could power a cell phone,” Grunlan says.

Tahir Cagin, a Texas A&M chemical engineering professor, looks at power harvesting from another perspective. Cagin’s focus is on piezoelectrics—materials, such as crystals or ceramics, that generate voltage when a form of mechanical stress is applied and that change their physical properties when an electric field is applied. Engine vibrations or even sound waves can stimulate piezoelectrics.

Cagin and his research partners have found that a certain type of piezoelectric material can convert energy at a 100 percent increase when manufactured at a minuscule size. These findings could have profound effects for such low-powered electronic devices as cell phones and laptops.

AN IRRESISTIBLE MAGNETISM

Another promising technology that relies on power harvesting comes from the laboratory of Ibrahim Karaman, Texas A&M assistant professor of mechanical engineering. Here the power source is ferromagnetic shape memory alloys (FSMAs).

“My main interest is to develop new active materials for higher efficiency and better reliability,” he says. With FSMAs, Karaman believes he has potentially found the ideal material.

Alloys are materials made up of a combination of metallic elements. And shape memory alloys are metals that “remember” their shapes or configurations—much like rubber. A shape memory alloy can be deformed, but when heat is applied, it will return to its original shape. An external load or stress will likewise deform shape memory alloys, but its shape will return when that load is removed.

FSMAs take the movement of traditional shape memory alloys one step further. Not only do FSMAs react to heat and stress like traditional alloys, but they also respond to magnetic fields, which have the same deformation effect as external stress. This means that FSMAs can change shape much more quickly than traditional shape memory alloys because they don’t have to wait for a slow temperature change.

Load application makes the FSMAs magnetic, and repeatedly switching between nonmagnetic and magnetic behaviors generates power.

In the past, power harvesting could take place only with high-frequency load applications, such as wind or vehicle vibration, Karaman says. FSMAs, however, overcome that low-frequency barrier.

“We have shown that you can generate enough power from merely walking to power up a cell phone,” Karaman says.

But potential uses of FSMAs go far beyond powering cell phones and other small devices. Magnetic refrigerators already on the market operate at a much higher efficiency rate than standard refrigerators but don’t require refrigerant
gases, which are known to harm the environment. However, these magnetic refrigerators are made out of rare-earth metals—substances that are not only expensive but also require large magnetic fields to operate.

The concept of substituting FSMAs for the rare-earth metals is much more practical in terms of magnetic refrigeration, Karaman says, because FSMAs have demonstrated the same capabilities as the expensive metals but require much smaller magnetic fields.

“Our finding is that you can reduce the magnetic field requirement by applying spring load,” Karaman says.

Although Karaman’s research is still in the basic-science stage, he feels certain that applications of his findings are imminent.

“Our finding is that you can reduce the magnetic field requirement by applying spring load,” Karaman says.

Although Karaman’s research is still in the basic-science stage, he feels certain that applications of his findings are imminent.

“As engineers, we tricked it into making as much hydrogen as possible by forcing it to do so,” he says.

Despite its public persona, most strains of E. coli are harmless. And according to Wood, it is the easiest bacterium to work with. And although scientists use the organism in multiple ways, Wood and his colleagues are, to their knowledge, unique in considering its use as an energy source.

Like most alternative energy technologies, the first step for turning bacteria into hydrogen actually begins at the glucose stage. Well aware of the backlash in Texas concerning the use of corn for ethanol, Wood has instead turned to the biomass option of switchgrass as the glucose source. Through fermentation, E. coli converts the sugar into hydrogen. The hydrogen bubbles out of the solution and then is captured for a fuel cell, which produces electricity.

“There’s nothing between the reactor and the fuel cell,” Wood explains. “It’s very, very simple. Plus, as the hydrogen burns, the only thing produced is water, so we’re not polluting anything. There’s no cleanup involved at all.”

And the bacteria-to-hydrogen technology is environmentally friendly in another way as well. Because the conversion process involved is so simple, it can easily be done on site. Instead of spending hundreds of billions of dollars building dangerous hydrogen pipelines, those pipelines could instead carry glucose.

“If a truck hit a pipeline transporting glucose, you’d have a sticky mess—but not an explosive one,” Wood says.

Right now, it would take a reactor the size of a filing cabinet to power an average home using this technology, Wood says, and it would require adding about 200 pounds of glucose over the course of a day. Powering a home for a year would cost roughly $6,700. Wood and his colleagues are striving not only to reduce the size of the reactor needed but also to decrease the annual energy cost to $1,000 to $1,500.

Wood estimates that it will be five to 10 years before his technology is put into commercial use. But he feels certain that some day, he will walk into a coffee house where laptop users are putting a spoonful of sugar in their coffee—and another in their computer.

As many scientists before him have discovered, Thomas Wood knows that failure can definitely be a good thing.

It was about two years ago when Wood, a Texas A&M chemical engineering professor, and his research colleagues attempted to add genes to a strain of E. coli bacteria to produce energy in the form of hydrogen. Their experiment didn’t work. But as they attempted to determine what went wrong, something else went very right: They found that E. coli already had everything it needed to produce hydrogen on its own.

Instead of adding genes, the researchers found, they could remove genes to manipulate hydrogen production.

“Was it better to clone in 20 new genes to make hydrogen, or just work with the 5,000 genes that were already there?” Wood asks.

The latter, he determined, was not only simpler but also yielded tremendous results.

To explain his research results, Wood likens E. coli to a four-way stop. By removing six specific genes, he says, the researchers eliminated the bacterium’s ability to turn right or left. Instead, they forced it to go straight—or forced it to create hydrogen. The result is a strain that produces 140 times more hydrogen than is created naturally.

“As engineers, we tricked it into making as much hydrogen as possible by forcing it to do so,” he says.

Despite its public persona, most strains of E. coli are harmless. And according to Wood, it is the easiest bacterium to work with. And although scientists use the organism in multiple ways, Wood and his colleagues are, to their knowledge, unique in considering its use as an energy source.
Early reading intervention helps young children at risk for reading difficulties. By KARA SUTTON-JONES

“Teaching reading IS rocket science.”
—Louisa C. Moats, reading education expert

Learning to read doesn’t just happen. Children must be taught the symbols, sounds and meanings of words that open a window to the wonder of print. Teachers serve as the mentors that invest in the reading success of these children, encouraging their growth along the way with the words “Now you try it.”

For many students, the reading instruction they receive in the general classroom is sufficient, but roughly one-fourth of children need something more. Project Early Reading Intervention (ERI) investigates this “something more.” This four-year study, now in its third year, examines the effects of different early reading intervention programs for kindergarteners who are at risk for developing reading difficulties.

“We have a finite amount of time where we can make significant jump starts in children’s reading development,” Deborah Simmons, principal investigator and professor of special education at Texas A&M University, says. “From the study, we’re learning that if schools provide that extra support in kindergarten, we can get the majority of children out of risk for reading difficulties.”

Simmons and her team of researchers, Shanna Hagan-Burke and Oi-Man Kwok, from the Texas A&M Center on Disability and Development, partnered with Michael Coyne of the University of Connecticut and Mary Little of the University of Central Florida. They collaborated with school districts in their respective states to study how children respond to different reading interventions.

The team found that many students identified as at-risk for early reading problems benefited from the supplemental programs typically taught in schools. However, children who were most at risk at the beginning of kindergarten responded best to a reading method that was systematic and clear.

Simmons says that the ERI curriculum is a specialized, organized approach to reading instruction. It emphasizes phonemic awareness—the ability to hear, identify and manipulate sounds in words—and the alphabetic principle—the recognition that letters represent sounds that can be combined to form words.

“The ERI curriculum is based on what we know from educational research and includes the elements that are necessary for children to learn how to read words and sentences,” she adds.

The reading interventions consist of daily 30-minute supplemental sessions of small-group instruction. Paraprofessionals or teachers who have received additional training, such as kindergarten teacher Melissa Neumann from John C. Webb Elementary School in Navasota, Texas, teach the sessions.

“The ERI curriculum has provided balanced, organized activities and assessments to individually meet these students’ needs for becoming successful readers,” Neumann says.

“Each student came into the program with strengths and weaknesses. These students have been able to make individual gains throughout each lesson, whether it be in naming a letter; making a letter sound; writing a letter; or, most importantly, becoming confident with themselves,” she adds. “Of course, the most exciting gains are those students who entered with no knowledge of letter and sound recognition and can now read words and are well on their way to reading text in books.”

To help students make reading gains, timing is everything, Simmons notes. The study reinforces how critical it is for at-risk children to receive reading intervention early and consistently.

“There are optimal windows for children to learn to read. The evidence is clear that if children are not solid readers by the end of first grade, the odds are not in their favor to become successful readers,” she says.

“Children can get out of sync or start to fall behind early,” she adds, “and the curriculum in schools doesn’t slow down.”

This is why Simmons and her team feel that early reading intervention is so important.

And Project ERI is opening up the window of opportunity for at-risk students for whom that window may otherwise have opened a little too late.
A Look at the Evolving and Surprising New Face of Worldwide Terrorism.

Women as Terrorists
By R. KIM CRAGIN and SARA A. DALY

The look of worldwide terrorism is changing, and now it often has a female face. *Women as Terrorists: Mothers, Recruiters, and Martyrs* looks at the various roles women have played in a wide variety of terrorist groups over the last 30 years. Sara Daly and R. Kim Cragin provide a penetrating look into the increasing involvement of women in terrorist activities. They attempt to discover and explain why women became involved in terrorist groups, how terrorist leaders deliberated and eventually used women to achieve their objectives, and how women’s presence in turn affected the recruitment of new fighters and supporters into the terrorist movement.

*Sara Daly is a lecturer, George Bush School of Government and Public Service, Texas A&M, and an adjunct international policy analyst at RAND Corporation, Arlington, Virginia.*
Local Consequences of the Global Cold War

Edited by JEFFREY A. ENGEL

The effects of the Cold War were local as well as international. Local Consequences of the Global Cold War looks at how actions in international relations during the Cold War affected individuals and local or regional governments. Each chapter lays out a major international issue and then unfolds the consequences of that issue for a region or city. By focusing on the effect of broad topics such as postwar occupation, militarization or decolonization on localized concerns such as movies in Japan, race relations in the American South or forests in East Germany, Engel and his colleagues show how the Cold War affected every facet of life—East and West, urban and rural, developed and developing nations—as well as the superpowers directly engaged in the struggle.

Jeffrey A. Engel, editor, is an assistant professor and interim director, Scowcroft Institute for International Affairs, Bush School of Government and Public Service, Texas A&M.

Stealing from Each Other

By EDGAR K. BROWNING

According to economics expert Edgar K. Browning, almost all Americans would be better off if none of the federal welfare-state policies of the last century—including Social Security—had ever been enacted. In 1900, government played a very small role in the day-to-day activities of American citizens. There was no income tax. No Social Security. No federal welfare programs. No minimum wage laws. No federal involvement in education. Government was small, spending well under 10 percent of our incomes. But now, federal, state and local governments spend more than 33 percent of our incomes. This book examines all facets of the welfare state and its egalitarian underpinnings in the United States. Egalitarians claim, for instance, that markets are unfair and that we must have redistributive policies to produce “social justice.” This reasoning supposedly justifies the two-thirds of federal spending that simply robs Peter to pay Paul. We are stealing from each other, the book argues.

Edgar K. Browning is a professor in the Department of Economics, College of Liberal Arts, Texas A&M.
Management Lessons from Mayo Clinic

By LEONARD L. BERRY and KENT D. SELTMAN

Management Lessons from Mayo Clinic reveals for the first time how this complex service organization fosters a culture that exceeds customer expectations and earns deep loyalty from both customers and employees. Service business authority Leonard Berry and Mayo Clinic marketing administrator Kent Seltman explain how the clinic implements and maintains its strategy, adheres to its management system, executes its care model and embraces new knowledge—invaluable lessons for managers and service providers of all industries.

Leonard L. Berry is a Presidential Professor for Teaching Excellence, Distinguished Professor of Marketing, holder of the M.B. Zale Chair in Retailing and Marketing Leadership in the Mays Business School at Texas A&M. He is also a professor of Humanities in Medicine, College of Medicine, Texas A&M Health Science Center.

Land-Change Science in the Tropics

Edited by ANDREW MILLINGTON and WENDY JEPSON

Land-use and land-cover change research over the past decade has focused mainly on contemporary primary land-cover conversions in the tropics and subtropics, with considerable resources dedicated to explaining and predicting tropical deforestation and often ignoring the dynamism in the world’s agropastoral landscapes.

This collection integrates cutting-edge research in the social, biogeophysical and geographical information sciences to understand the human and environmental dynamics that change the type, magnitude and location of land uses and land covers in the changing countryside. The research reported examines land-use and land-cover changes in Bolivia, Brazil, China, Colombia, Côte d’Ivoire, India, Malawi, Mexico, Pakistan, Peru, Senegal and Thailand.

Each chapter advances one of three themes: adaptations and change in settled agricultural zones, agricultural intensification, and markets and institutions. This book describes the monitoring of land-cover changes, explains the processes through which land is altered and describes the development of spatially explicit models to predict land change. It also illustrates how practitioners have integrated knowledge from the three scientific realms—social, biophysical and GIScience—that underpin land-change science.

Wendy E. Jepson, co-editor, is an assistant professor in the Department of Geography, College of Geosciences, Texas A&M.
The Integrated Ocean Drilling Program (IODP) gives insight into our planet’s history and future. IODP is both the largest geoscience research program that the National Science Foundation (NSF) supports and Texas A&M University’s largest single research program. The centerpiece is the scientific ocean drill ship R/V JOIDES Resolution, which after a $115 million renovation is once again on its mission in the world’s oceans.

IODP manages the JOIDES Resolution on behalf of the U.S. Implementing Organization, a partnership with Texas A&M, Lamont-Doherty Earth Observatory of Columbia University and the Consortium for Ocean Leadership in Washington, D.C. Texas A&M is allocated approximately 85 percent of the $620 million, 10-year contract, which NSF awarded in 2003.

IODP provides administrative, fiscal and science support and manages the Gulf Coast Repository—one of three permanent archive locations that house all cores collected since 1968 by IODP and its two NSF-supported predecessors.