Focus on science

The College of Natural Sciences at The University of Texas at Austin
Winter 2002

Observing Atoms in Action

Studying Species' Survival

Focus
on science

For people who value current, relevant and comprehensive science news, *Focus On Science* provides a channel for greater awareness of and involvement in the adventure of science at The Universityof Texas at Austin and in daily life.

WINTER 2002

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Dean's Letter

Dear Friends,

One of the College of Natural Sciences' main goals is to expand the scientific understanding of the world around us through basic and applied research. A myriad of research activities occur with this in mind in our 12 academic units and 33 affiliated research units.

Some of these investigations are global in scale, such as Dr. Marcy Litvak and Dr. Camille Parmesan's work described in part of the second article of this *Focus on Science*. Others probe much smaller domains, including the nano-structure of solid substances, the interaction of AIDS drugs with DNA machinery inside cells, and the universe of the human brain.

The college continually seeks ways to enhance its support of research, as is true of neuroscience. A Section of Neurobiology was formed in 1999 when the School of Biological Sciences (SBS) was created. And last year, the Institute of Neuroscience and its graduate program came under the auspices of the college.

The institute and its more than 55 faculty members previously received guidance from six deans. It now has enhanced funding support from the college for its endeavors and its faculty, who are drawn from six different colleges.

Among the pivotal research being done by institute members is that of Dr. Adriana Alcantara in the Department of Psychology of the College of Liberal Arts, who is determining which neurotransmitters and other components of the nervous system interact to produce drug addiction.

Her studies complement those of another institute member, Dr. Adron Harris, from the Section of Neurobiology at the College of Natural Sciences, who directs the Waggoner Center for Alcohol and Addiction Research. Harris recently discovered that pain-relieving drugs interact with the same protein targeted by alcohol in the brain. The finding could lead to better pain relievers and a better understanding of alcohol's effects on the brain.

A broad range of other neuroscience-related studies occurs throughout the college. In the Department of Physics, Dr. Mark Raizen, whose quantum research is featured in the first article of this issue, also uses light to guide nerve cell growth. And Dr. Risto Miikkulainen in the Department of Computer Sciences uses the brain as a model for evolving computer programs' behavior.

The potential impact of research developments like these is why we support initiatives such as the Institute of Neuroscience as much as possible. For example, we are actively recruiting an accomplished scientist to direct the institute. That requires us to choose from a select group of highly qualified individuals from which other institutions are also actively recruiting.

The benefits of having a truly outstanding director are evident in Dr. Alan Lambowitz' guidance of the Institute for Cellular and Molecular Biology. Since Alan took over its leadership in 1997, research dollars for that group have increased ten-fold, and the graduate program has expanded from 40 to 166 students, while the university's stature in this field has improved tremendously.

With your support, I'm sure we will find an equally exceptional leader for neuroscience, as we also continue to enhance research in other areas.

There will be many other achievements — research and otherwise — that will come from our talented faculty and staff in the upcoming year. I look forward to sharing their accomplishments with you as we address additional challenges and opportunities in the future.

With all best wishes,
I am cordially yours,

Mary Ann Rankin, Dean
College of Natural Sciences

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On the Cover: *Dr. Mark Raizen has used optical equipment to demonstrate that atoms can undergo an extraordinary quantum transport process. Photo by: Marsha Miller*

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Tour the College of Natural Sciences on the Web at:
www.utexas.edu/cons/
College information and links. Offers full text of *Focus on Science*

Check out these Sites of Interest:

To learn about the Institute of Neuroscience, which recently became part of the college, go to:
www.utexas.edu/neuroscience

To read about CT image reconstruction of the egg of an extinct elephant bird, which is a project similar to the one described on page 11, go to:
www.digimorph.org/specimens/Aepyornis_maximus

New sites in the College:

www.utexas.edu/cons/news
News releases about CNS-related research and activities

www.utexas.edu/cons/outreach/newslettersredirect.html
The Marine Science Institute and Human Ecology's newsletters are now available on-line

www.utexas.edu/cons/wins
A Women in Natural Sciences program has been established to recruit and retain female students and faculty

www.utexas.edu/cons/urp
This site highlights undergraduate research activities

Female Edith's checkerspot laying eggs. Photo by: Dr. Camille Parmesan

A Chilly Step into the Quantum World

Physicists capture unusual microscopic behavior in action

Dr. Raizen and an optical table used for cooling and trapping atoms. Photo by: Marsha Miller

In the familiar, everyday physical world that people are used to considering, water runs downhill, people who jump for joy come back down, and a book resting on a coffee table stays put unless someone moves it.

In the world of quantum mechanics, though, microscopic matter can spontaneously appear in new places. The ability of electrons to undergo this process, called tunneling, has helped spur the miniaturization of electronic devices, and has resulted in specialized microscopes that manipulate individual atoms. This type of tunneling also is thought to underlie plant photosynthesis and other biological processes.

Now, thanks to Dr. Mark Raizen and two graduate students in his laboratory, scientists have experimental evidence that another amazing type of tunneling occurs. In traditional tunneling, electrons or other matter overcome an energy barrier between two sites, or potential energy states, to change locations. Raizen's group studied dynamical tunneling, which has a different twist to it.

In dynamical tunneling, an atom moving in one direction suddenly changes course midstream to head the opposite direction. Raizen notes that the spontaneity of the behavior is part of what makes it fascinating. "It's such a surprising result. Here they are moving along, and then — wham! — they're going in the other direction," says Raizen, the Sid W. Richardson Foundation Regents Chair in Physics.

The apparatus Raizen's group assembled for chilling Cesium atoms Photo by: Dr. Windell Oskay

To visualize dynamical tunneling, the physicists studied ultra-cold Cesium atoms placed under tightly controlled conditions. Graduate students Daniel Steck and Windell Oskay first carefully aligned hundreds of mirrors and a handful of lasers, all crammed into a 4-foot by 12-foot area. The investigators used the completed apparatus to chill millions of Cesium atoms to near Absolute zero, or roughly -500 Fahrenheit.

The lasers then were used to generate wavelengths of light on which the sluggish atoms could hitch a ride like surfers on a wave. The atoms could do so because they can behave like waves as well as particles. "A wave is something that actually is not a point," Raizen says, "so it can exist in different places."

The investigators set the lasers to produce periodic pulses of light that created an intermittent potential energy state within the atoms as they traveled in one direction on a wavelength of light. The conditions caused some atoms to switch states and appear on another wavelength of light nearby that traveled in the opposite direction, only to switch directions again microseconds later. Raizen and the students studied the behavior repeatedly for four months, with the students working in 24-hour shifts.

Repeated measurements were taken partly to verify that the atoms tunneled a thousand times faster than had been predicted. The physicists designed the apparatus so that the wavelengths of light were too far apart for dynamical tunneling to occur without assistance. The help came in the form of chaos, a quality that is normally associated with phenomena in the larger, classical world of people and buildings and cars. Chaos is the exquisite sensitivity of a system to small changes in the system's initial conditions.

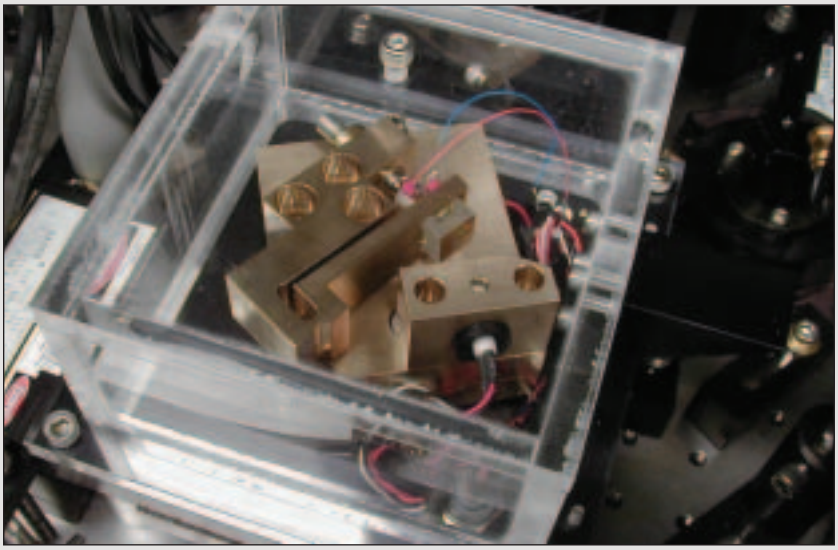
In the 4-foot by 12-foot world of the atoms, the lasers' light introduced chaos into the system that permitted tunneling to occur, and to occur quickly. Chaos affected the system by creating potential energy states near those of the Cesium atoms that made it easier for them to change quantum states and switch the wavelength of light they traveled on. When the laser settings were adjusted to eliminate chaos, dynamical tunneling stopped.

"This was the first-ever example of dynamical tunneling. That had never been seen before in any system, not with electrons, not with anything," Raizen says. "And the chaos-assisted tunneling had never been seen before."

In essence, the physicists had demonstrated that chaos, a phenomenon that is traditionally associated with the classical world, matters in the quantum one. Understanding the interface of the two worlds will become increasingly important as the miniaturization of electronic and other devices continues, Raizen says.

The four months of observation also permitted the investigators to verify that dynamical tunneling occurred as anticipated. For example, the Cesium atoms only tunneled if the velocity of the second wavelength of light matched that of the first. This symmetry was needed to create the right initial potential in the atoms for them to change states.

The findings were published in the journal *Science* in July 2001. At the same time, a larger team at the National Institute of Standards and Technology (NIST) in Gaithersburg, Maryland, published general results on dynamical tunneling. Raizen notes that his group's more far-reaching results involving chaos prove that "it takes the dedication of only a few graduate students to do something really significant."



A close-up of the diode laser in a plexiglass box that is used to trap and cool Cesium atoms. Photo by: Dr. Windell Oskay

Steck is now a postdoctoral student at Los Alamos National Laboratories; Oskay recently began a postdoc at NIST's complex in Boulder, Colorado. Meanwhile, Raizen is revamping the experimental apparatus to study atoms that are moving even slower so that they interact more.

The pioneer of quantum chaos experiments says he hopes the results will nudge quantum knowledge along. "We're moving into an even more exciting stage where we're going to be doing experiments that theorists don't understand yet," Raizen says, "and they're going to have to play catch-up with us."

Dr. Raizen's Web page is at: www.ph.utexas.edu/dept/research/raizen

A recent summary of his research on guiding neurons' growth is at:
www.utexas.edu/admin/opa/news/02newsreleases/nr_200211/nr_raizen021125.html

An announcement about his receipt of the Max Planck Research Prize is at:
www.utexas.edu/admin/opa/news/02newsreleases/nr_200212/nr_physics021205.html

Dr. Steck received a University of Texas outstanding dissertation award for 2001, and the Council of Graduate Schools 2002 Distinguished Dissertation Award in Mathematics, Physical Sciences and Engineering, for his part in the dynamical tunneling research.

Studying Species' Survival

Biologists analyze flora and fauna in changing environments

Dr. Litvak, and Dr. Scott Miller, who is from the University of California, Irvine, inspect a tower used to position equipment for measuring gas exchange.

Dr. Marcy Litvak
Photo by: Bob Nagy

SCIENTISTS HAVE LONG KNOWN THAT NATURE CONSISTS OF A COMPLEX BIOLOGICAL TAPESTRY. TO PAVE THE WAY TO A BETTER UNDERSTANDING OF THE CHALLENGES WILDLIFE FACE DUE TO GLOBAL WARMING AND OTHER FACTORS, THREE ASSISTANT PROFESSORS WHO ARE MEMBERS OF THE ENVIRONMENTAL SCIENCE INSTITUTE HAVE BEEN ANALYZING INDIVIDUAL STRANDS OF THIS TAPESTRY:

In the isolated reaches of central Canada, forests of aspen, spruce and jack pine receive a four-month reprieve from the cold each June through September. They go into hyperdrive, turning sunlight, water — and carbon dioxide pulled from the air — into energy to fuel new growth.

In recent years, this photosynthetic activity has been the focus of Dr. Marcy Litvak, who studies carbon storage in stands of these trees in Manitoba as a barometer for the role boreal forests play in the global carbon cycle. Based on atmospheric models of patterns of global warming, forests in central Canada are more likely than their lower-latitude counterparts to become warmer and to face more frequent wildfires as a result of global warming.

Boreal forests also are of interest because they store large reserves of carbon in vegetation and in the soil. Whether these forests dampen or hasten global warming depends on how these carbon reserves respond to and recover from climate change and disturbances like forest fires. These fires occur every 50 to 150 years in central Canada, destroying the vegetation, but leaving much of the biomass to decay over time, while the forest canopy regenerates and brings in new carbon.

Litvak and collaborators at the University of California, Irvine, are measuring how the these processes contribute to whether boreal forests act as an overall source or sink of atmospheric carbon dioxide after fires. Early results suggest that their role changes dramatically as boreal forests recover from fire.

"While recently burned stands act as sources of atmospheric carbon dioxide, 20- to 50-year-old forests act as carbon sinks, and 70- to 150-year-old stands are in relative balance with atmospheric carbon levels," she says. As a result, Litvak notes, any factor that alters the age distribution of boreal forests could have a crucial impact on the global carbon cycle and climate change.

To analyze the respiratory behavior of forests, the researchers brought in seven aluminum towers by helicopter and placed them in different-aged stands within a 50 kilometer area. The adjustable towers were used to place instruments above the tree tops in each stand, where a sample of the entire stands' carbon dioxide exchange could be measured using a technique called eddy covariance, and the data fed to Litvak by satellite.

The stands were chosen because they represent various stages of recovery following local wildfires. "We have seven stands that range in age from four years to 150 years, post-burn."

Beginning this past summer, Litvak and a student also performed hands-on analyses of the stands by using portable devices that momentarily seal a leaf or other tree part into a chamber to measure rates of carbon dioxide exchange.

A similar device tested how much carbon esc-

apes from the forest floor when leaves and other organic matter decompose, or roots respire. "In this way, we figured out what each different component of the ecosystem was contributing to the total carbon stored and released in each stand," Litvak says.

Litvak is not alone in her quest for detailed information about the biological impact of global warming. Dr. Camille Parmesan has analyzed the general effects of climate change on wildlife for a decade.

Parmesan's interest stemmed from graduate research at the university on a West Coast butterfly called Edith's checkerspot. The colorful creatures are extremely sensitive to shifts in temperature and rainfall that affect the plant that is their sole food source.

In a landmark 1996 *Nature* paper, Parmesan demonstrated that climate change has caused populations of the butterfly to disappear along the U.S./Mexican border while doing very well in Canada and cooler, mountainous regions. This study was the first to address the entire range of a species, and required four years of fieldwork. Parmesan extended this work with a similar study in 1999 about the creep of ranges of 57 species of European butterflies.

The year before, she began participating in a United Nations' panel examining the effect of climate change on wildlife. The results of this study came out in 2001 as an Intergovernmental Panel on Climate Change (IPCC) publication, but not without difficulty.

Economists on the panel had trouble accepting the biologists' conclusion that regional climate change was affecting many physical and biological systems. They believed that many of the studies upon which the conclusion was based were too short-term, focused on too few species, or focused too much on global warming as the culprit.

To address their concerns, Parmesan teamed up with Dr. Gary Yohe, an economist at Wesleyan University in Connecticut, to analyze the largest and most stringent set of studies to date. Even when other possible causes for the life history changes they saw were explicitly considered, global warming remained the likeliest explanation for changes in hundreds of species analyzed, such as earlier flowering of plants, earlier migration of birds and butterflies, and northerly shift of species' ranges.

Top: An antenna extends from a transmitter worn on the back of a white-crowned sparrow. Bottom: The transmitter is positioned like a backpack using elastic loops around the bird's legs. Photos by: Dr. Tom Hahn, University of California, Davis

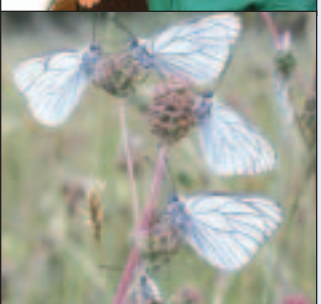
Moreover, Parmesan was able to show that, during cooler periods that occurred in North America and Europe during the 20th century, species shifted their ranges to more southerly, or lower altitude, regions. Thus, temperature change could drive species' movement in either direction.

Since the results were published in *Nature* in January, Parmesan has begun shifting focus to her first love, fieldwork on insects. The projects include traveling to Europe again, where she'll

Top: Male Edith's Checkerspot basking at 10,500 feet in the Sierra Nevada in California. Photo by: Dr. Camille Parmesan

Middle: Dr. Camille Parmesan Photo by: Marsha Miller

Bottom: Black-veined white butterflies in southern France. Photo by: Dr. Camille Parmesan



The eastern edge of Yosemite National Park in early May, the time when Bruener studies sparrows establishing nests.
Photo by:
Dr. Creagh Breuner

Dr. Creagh Breuner
Photo by: Dr. Larry Gilbert

study why closely related species of butterflies "drop out" at different elevations as one travels higher in elevation in the French and Swiss Alps. Not surprisingly, the work is relevant to global warming. "The more we understand the causes of range limits, the better we can predict how these responses to climate change are going to occur," Parmesan says.

Even without global warming, survival can be a struggle for species whose food sources, habitat or other factors change. This reality is very much on the mind of Dr. Creagh Breuner, who spends each spring studying white-crowned sparrows as they establish territories near Yosemite National Park.

The sparrows migrate to meadows at the eastern edge of the park that are 10,000 feet above sea level. Breuner and a colleague at the University of California, Davis, are adding to decades of scientific information gathered on these populations by studying how stress hormones affect male white-crowned sparrows competing to build nests during harsh spring conditions. "The male sparrows will be working full force on setting up a territory, and then a storm will come through and cause the snow cover to go from 70 percent to 100 percent in a couple of hours, decimating their food resources," Breuner says.

As a result, the male sparrows must decide whether to stick it out or temporarily retreat to lower elevations where conditions are better, only to start the territorial struggle again later.

To track the birds' movements, Breuner has fitted them with radio transmitters. She also has measured the birds' levels of avian stress hormone, called corticosterone, after capturing them in traps baited with food.

The male sparrows regularly visit the traps, and take several minutes to respond to the stress of capture. That means Breuner can rapidly take a blood sample to check their initial hormone level, and minutes later take another sample that indicates how a stressor, in this case being captured, has affected that level.

Early results suggest that male birds with a high corticosterone level stay away from their breeding meadow longer. This fits with evidence Breuner has gathered that male sparrows given implants to boost their corticosteroid level stay at lower elevations longer. "I think that means they're perceiving they're in worse body condition, and that they're needing more time to become fit and compete again," Breuner says. The impact of this is that they reproduce later, or have only poor quality territories to choose from, both of which can reduce their chance of having offspring.

She will soon begin laboratory studies of white-throated sparrows, which winter in Austin, hoping to learn more about how environmental disturbance affects stress hormone levels and the effect of these hormonal changes on survival. "Corticosteroids help animals survive in unpredictable environments," Breuner says. "It's important to understand how animals cope with change as global events radically alter environmental conditions."

Studying Black Holes

Top:
Globular cluster M15, part of the Milky Way galaxy.
Image by: NASA and The Hubble Heritage Team

Bottom:
The larger globular cluster, G1, in the Andromeda galaxy.
Image by: NASA and Michael Rich at UCLA

Recent results from the Hubble Space Telescope provide intriguing evidence that black holes are even more common than previously thought. In addition, the results suggest how black holes may form, information that is key to understanding how galaxies form.

Dr. Karl Gebhardt, an assistant professor of astronomy, and his colleagues have shown that globular clusters likely contain central black holes, similar to those found in galaxies. Globular clusters are tightly bound, spherical collections of stars that reside in all galaxies, and are about a million times smaller than their host galaxies.

Scientists have known for years that black holes with masses from a million to over a billion times that of our Sun exist inside nearly all galaxies. How these supermassive black holes form remains a fascinating question.

The scientists studied small star systems of globular clusters that represent one extreme of the formation process to address this question. They did so by taking into account the fact that a more massive central black hole causes stars to move faster. Thus, by analyzing the speed of stars near clusters' centers, they could learn about their black holes.

Using the Hubble Space Telescope, Gebhardt and collaborators revealed that the black holes in two globular clusters, M15 in our galaxy, and G1 in the Andromeda galaxy, are the proper mass to act as the seeds for producing the much larger supermassive black holes.

The two main theories on how galactic black holes evolve are that they develop all at once, when a galaxy is forming, or from a seed black hole that subsequently grows over time. "The observational evidence now points to the idea that you start out with a small seed black hole," Gebhardt says.

For Dr. Gebhardt's Web page, go to:
hoku.as.utexas.edu/~gebhardt/

For more information, including animations, on this research, go to:
oposite.stsci.edu/pubinfo/PR/2002/18

Nature's Decorative Touches

Beautiful, wavy patterns often form the edges of leaves and flowers, and of sea slugs and other organisms. Though these patterns are common, how they develop has been a mystery. Post-doctoral fellow Eran Sharon and former postdoc Benoit Roman in the Center for Nonlinear Dynamics have studied torn plastic sheets to suggest that these waves are part of a fractal pattern that may be much simpler to produce than previously envisioned.

Botanists, for example, have proposed that wavy leaf borders develop because of different growth rates on the opposing surfaces of a leaf. Sharon and Roman studied polyethylene sheets that were uniformly stretched and torn by a machine to suggest otherwise. A grid of dots printed on each sheet revealed how much it was deformed while tearing. From this, the researchers determined that waves formed because the material increased in length toward its edge. In the natural world, the equivalent ruffling would be expected if extra material existed at the edge of a leaf or other structure.

The theory is supported by computer modeling provided by Dr. Michael Marder, professor of physics, and optical studies of torn sheets. If added work on living plants bears the theory out, Sharon notes that the results mean that genetic instructions needed to determine the rate of growth on the edges of organisms do not have to be complex. "An organism that generates an increasingly steeper amount of length near its edge must take this wavy shape, no matter what."

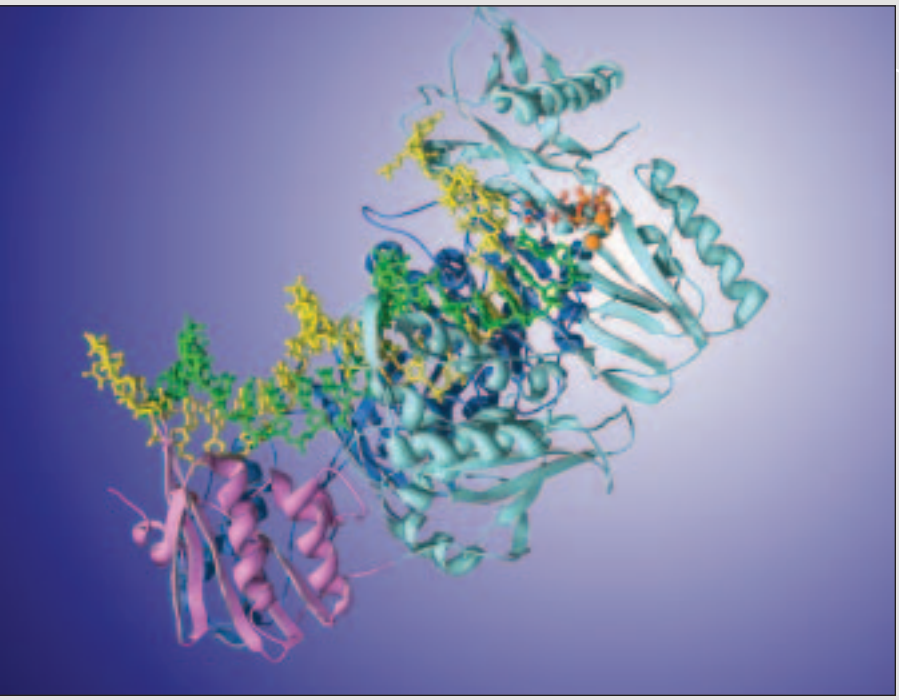
For the Center for Nonlinear Dynamics Web page, go to: www.chaos.ph.utexas.edu

The undulating edge of a leaf on a beet plant.
Photo by: Dr. Eran Sharon

Fine-Tuning anti-HIV Therapies

In 1992, the Food and Drug Administration unveiled its first drug approved under an accelerated review process to treat the virus that causes AIDS. The drug, ddC, had passed muster in early clinical trials, and the public was desperately seeking HIV treatment options.

But human volunteers developed severe side effects, which meant the drug was quickly relegated for use in advanced stages of the disease. Even more devastating results had come out of a National Institutes of Health study the prior year, in which five of 15 patients died after receiving a similar drug for treatment of another retrovirus, hepatitis B. Less toxic examples of these drugs, called nucleoside analogs, have since been developed, but none is symptom-free.



A 3-D model of HIV reverse transcriptase, the viral enzyme targeted by nucleoside analog drugs. Image by: Dr. Kenneth Johnson

As a result of the work of Dr. Kenneth Johnson in the Department of Chemistry and Biochemistry, patients in the future are more likely to have access to better versions of these analogs. Johnson, the Roger Williams Centennial Professor of Biochemistry, developed a quick, precise way to assess the toxicity of nucleoside analogs. In addition, he has determined that the drugs' interaction with a single enzyme underlies the confusing range of symptoms described with these mainstays of HIV treatment.

Nucleoside analogs cripple a virus' ability to make copies of its genetic material. The drugs focus on a quirk of the enzyme that does this copying. The enzyme, a reverse transcriptase, can't recognize and remove defective copies of the genetic subunits that it strings together to form replicas of viral genetic material. Drug companies capitalized on this quirk by developing analogs whose chemical structures were modified to prevent additional subunits from being attached to them once they became part of a virus' growing genetic strand. The drugs thus stopped replication in its tracks.

Other research suggested that the analogs' toxicity might result from damage they inadvertently wrought on a human enzyme: a DNA polymerase that resides in mitochondria, the fuel-generating structures inside cells. The theory was that the AIDS drugs short-circuited mitochondria's ability to replicate DNA, killing normal cells as a result.

Johnson notes that a common method for studying drug toxicity that involves feeding laboratory animals the drugs would not prove whether this theory was correct. "We can't be relying completely on such complex tests for toxicity," Johnson says, "especially with the knowledge we now have, which has pinpointed the cause of toxicity."

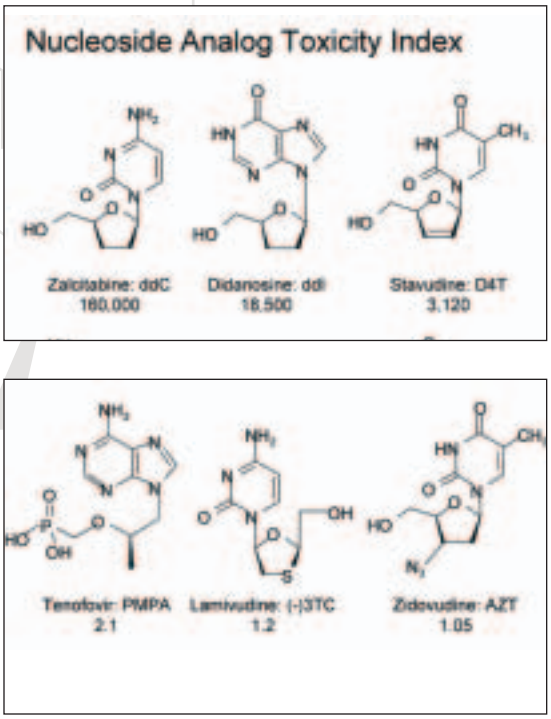
To test the mitochondrial toxicity theory, Johnson needed to isolate the human mitochondrial enzyme and study its interactions with the drugs. Using the equivalent enzyme that had been isolated in yeast, he tracked down the human version. His research group was one of two nationally who finally cloned the human mitochondrial DNA polymerase in 1998. They also identified an auxiliary protein needed for the mitochondrial DNA polymerase to operate at full speed.

With the protein pair in hand, Johnson has tested a dozen different nucleoside analogs' interactions with the mitochondrial DNA machinery. And he has shown that those drugs that attach to the mitochondrial DNA polymerase faster and

for a longer time period turn out to be most toxic in humans. The most toxic drugs, such as ddC, also mimic the structure of normal DNA subunits the most closely, information that can guide development of future nucleoside analogs.

Johnson has provided the instruments and enzyme test he has developed to drug companies so they can better analyze prospective treatment analogs. He is also working with Dr. Jon Robertus, a crystallographer and the Benjamin Clayton Centennial Professor in Biochemistry, to more closely analyze the structure of the mitochondrial DNA polymerase. "We're continuing to do basic research to provide the kind of information that drug companies really need," Johnson says, noting that he is beginning similar studies searching for nucleoside analogs to treat hepatitis C.

Dr. Johnson's Web page is at:
www.cm.utexas.edu/faculty/Johnson.html



Ranking of several nucleoside analogs from worst (ddC) to one of the best (AZT) based on effectiveness and minimal toxicity. Image by: Dr. Kenneth Johnson

Historic Evolutionary Fossil Imaged

Not long after Charles Darwin's "Origin of Species" predicted the existence of such creatures, an intriguing fossil that is believed to provide an evolutionary link between birds and dinosaurs was found. More than a century later, Dr. Timothy Rowe, co-director of the university's High-Resolution X-ray Computed Tomography (UTCT) facility, is helping solve a final remaining mystery about the winged *Archaeopteryx*: Did it have a primitive, dino-style brain or something more sophisticated?

London's Natural History Museum, which owns the fossil, had tried four previous times to obtain good X-ray images of a fragment of the 147-million-year-old specimen's tiny skull. Rowe and UTCT staff and scientists at the Digital Morphology group just recently completed taking 1,300 computed tomography (CT) images, from which they will develop a 3-D model of the animal's brain during the next six months. With this model, or endocast, Rowe says, "We'll be able to see how big its brain was relative to living birds and extinct dinosaurs and figure out how big different parts of the brain were relative to each other."

This will help answer questions such as whether *Archaeopteryx* relied mostly on sight or smell to navigate in the world. "Nobody's been able to get inside its head to see how it worked until now," Rowe says.

The *Archaeopteryx* imagery will soon be available at Digital Morphology, a National Science Foundation-sponsored digital library, which is a collaborative project of the UTCT, the Jackson School of Geosciences, the Center for Instructional Technologies and the Texas Memorial Museum.

For UTCT's Web page, go to:
www.ctlab.geo.utexas.edu
For the Digital Morphology group's Web page, go to: www.digimorph.org

The skull fragment of Archeopteryx, an intermediate between dinosaurs and birds. Photo by: Marsha Miller

Angela Milner, paleontologist from London's Natural History Museum, places the skull fragment into the CT scanner in Dr. Timothy Rowe's lab. Photo by: Marsha Miller

Mimicking the Brain—Computer-Style

No one would mistake a computer for a human brain. Yet as Dr. Risto Miikkulainen, professor of computer sciences, has found, the brain provides a good model for creating computer programs that learn to tackle complex problems.

Dr. Risto Miikkulainen
Photo by: Bob Nagy

Since 1992, Miikkulainen has developed algorithms that permit computer programs to evolve their behavior. The programs simulate the behavior of different artificial neural networks, and he analyzes the networks for their ability to find good strategies for completing complex tasks.

For example, a network is told to keep a simulated upright pole from falling while on a moving cart. The network receives input from sensors about the pole's and the cart's positions, and controls the cart's movement.

"Once you find the neural networks that perform well, then you combine them and get new networks. Thus a population of networks gradually evolves and gets better," Miikkulainen says.

In fact, the evolutionary approach has permitted him to develop networks that can solve this task in a few seconds, whereas it previously took them several hours to complete it. The networks now are learning to control two poles on a cart or to perform trickier tasks, including a game in which two devices try to destroy each other after gobbling energy cookies.

Miikkulainen and his colleagues have compared how well their networks perform that task with findings from other investigators. "The comparison shows that the techniques we've developed are really powerful," he says.

His work could lead to snazzier computer games and better robot-controlled devices, such as finless rockets, which would travel faster than their traditional counterparts.

Neural networks also could guide stock market decisions, the movement of banks of elevators and countless other tasks. "Building computer systems that would be able to learn behavioral strategies would be tremendously useful," Miikkulainen says.

For Dr. Miikkulainen's Web page, go to:
www.cs.utexas.edu/users/nn
To view an animation of the pole-balancing experiment, go to:
www.cs.utexas.edu/users/nn/pages/research/espdemo/index.html
To view a robot duel animation, go to:
www.cs.utexas.edu/users/nn/pages/research/neatdemo.html

Probing the Structure of Complex Solids

"What you see is what you get" doesn't necessarily apply to many solid substances. Whether you consider a plastic cup, the rubber soles of shoes or window glass, many items that appear to the naked eye to be simple solids have disorderly structures.

Using a specialized imaging method and supercooled liquids, Dr. David Vanden Bout has now explained how solids with disorderly features, called glassy solids, develop at the molecular level. The imaging technique developed by the assistant professor of chemistry and biochemistry could be used to study the architecture of cell membranes and similar structures, and to guide research efforts to develop nano-scale materials for use in the semiconductor industry and other fields.

Vanden Bout, a member of the Center for Nano- and Molecular Science and Technology (CNM), learned how solids with a disorderly structure develop by studying two chemicals that, at room temperature, already are a goopy mess of slow-moving molecules. That characteristic means the liquids' molecules are even slower and easier to observe in action when cooled down to the point just before they turn into a glass.

Vanden Bout studied the substances at a temperature just above the glass transition with single molecule fluorescence, in which light energy

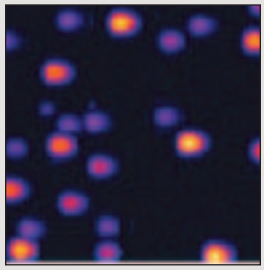
emitted by individual molecules in a substance is tracked to reveal the molecules' locations and movements. He visualized hundreds of molecules, each of which took tens to hundreds of seconds to rotate under the chilled conditions.

The approach revealed that the glass wannabes consisted of clusters of molecules rather than a random, uniform distribution of them. Moreover, the clumped molecules were switching between the nanoscale clusters, or domains, rather than staying put.

"We captured these microscopic domains slowly interconverting between one another," Vanden Bout says. The same was true whether he studied a complex polymer called polymethyl acrylate or a liquid with a simple molecular structure called ortho terphenyl.

He notes that the nanoscale domains, which are roughly a billionth of a meter in size, also exist for shorter times in the warmer, liquid state of disorderly solids. It just took the slowed-down conditions of his experiments and the right advance in imaging to bring their behavior to light.

For Dr. Vanden Bout's Web page, go to:
www.cm.utexas.edu/faculty/VandenBout.html
For the CNM's Web page, go to:
www.cm.utexas.edu/cnm



Enhanced image of single molecules rotating in a thin sheet of polymethyl acrylate. Image by: Dr. David Vanden Bout

I just descended to the seabed eight miles off the north Alaskan coast to study an isolated community of kelp, soft corals and other sea life. The boulders that started Boulder Patch likely hitched a ride on an iceberg 10,000 years ago from western Canada. I'm positioning two light meters to collect data on the amount of light reaching kelp. The construction of islands for oil development can cloud waters and reduce light reaching the kelp, which may affect their long-term survival. The yellow air bag helps keep me from plummeting to the seafloor as I deploy the 60-pound light meter. Graduate student Craig Aumack is nearby to update me on the passage of really big icebergs overhead so I can avoid bumping my head or going on an unexpected ride.

Wish you were here,
Kenneth Dunton

Dr. Kenneth H. Dunton is a professor at the Marine Science Institute.
His Web site is at: www.utmsi.utexas.edu/staff/dunton.htm

Meet Siobhan Doss

This Austin native planned on becoming a veterinarian. Luckily for future generations of veterinarians, though, Doss immediately signed up for the UTeach program at the College of Natural Sciences. The program gives undergraduates the opportunity to see what teaching is like while pursuing traditional science degrees. Doss taught a science lesson at a local elementary school her first semester, and says she was immediately hooked.

A mathematics major, she became a UTeach intern at the Texas Memorial Museum in the fall of 2001. She helped develop curriculum guidelines based on museum exhibits that grade school and high school teachers could use before and after a museum visit to enhance student learning.

One guide focused on a dinosaur fossil exhibit; another, on quilts. For the quilt guideline, Doss demonstrated how different-shaped panels could be sewn together to form a quilt. "It was nice because I could incorporate some of my math knowledge, my knowledge of geometry, into the activities," she says.

Doss' favorite teaching-related experience came as a camp counselor last year for the museum's summer camp. She taught up to five hours a day during Texplorers!, using some activities she had developed earlier. Plus there were field trips to a city park to look for fossils and other fun activities, such as a lesson in which the children dropped marbles on a pile of colored powder to learn how a meteor might burst. "The hands-on approach is a much better experience than telling students what happens out of a book," says Doss, who intends to teach sixth- or seventh-grade math.

In addition to continuing a UTeach internship at the museum, she worked this past fall as a Saturday counselor for Girlstart, a local non-profit that serves lower-income girls who are in middle school. "Those kids might not have had that opportunity to get to see that math and science are something that they can do without the program," Doss notes, adding that she hopes she serves as a role model for them and for the children she has met through UTeach.

For the UTeach Web site, go to:
www.uteach.utexas.edu

Siobhan Doss, a junior in mathematics, discovered her love of teaching through UTeach. Photo by: David Steadman

Meet Nan Hampton

Accessible. Dedicated. Innovative. Unassuming.

Ask people about Dr. Nan Hampton, the recently retired teacher of genetics lab classes at the School of Biological Sciences, and you hear compliments like these.

Andy Bowling, Hampton's teaching assistant for three years, says Hampton rarely left the lab or her adjoining office while on campus, and always made herself available for others. "I routinely saw her drop whatever she was doing to talk to students," says the botany graduate student.

Teaching wasn't on Hampton's mind when she visited The University of Texas at Austin in spring 1992. Despite undergraduate degrees in Plan II and zoology, and a graduate degree from here in zoology, she had recently completed a master's in library and information sciences and was managing databases at a local engineering firm.

Dr. Eldon Sutton, now a professor emeritus of molecular genetics and microbiology, saw her on campus, and asked if she'd teach a genetics lab beginning in three weeks. Hampton agreed to do so, although she says, "I was absolutely petrified by the prospect of teaching."

She dove in and learned the ins and outs of fruit fly genetics and other interactive lesson plans. As her comfort level grew, she read articles about other lab activities to try, some of which were outside her expertise. For example, Hampton developed a lesson involving PCR, a technically demanding approach to studying differences in genes. "I just launched into it," Hampton says. The same approach worked for a lesson about bacterial genes and one on determining the genetic basis for coat colors in cats, a topic she thought might interest students more than flies.

Her organizational skills also came to the fore in teaching. She made wall charts so students could easily identify fruit flies of different genetic backgrounds that she provided in color-coded glass vials. Hampton bred flies weeks before a lab occurred and came in on Sundays to prepare flies for the upcoming week's labs. Dr. Jeanne M.

Top: Dr. Nan Hampton helps a high school student isolate chromosomes from fruit fly larvae during a School of Biological Sciences outreach program. Bottom: Dr. Nan Hampton supervises the preparation of isolated fruit fly chromosomes for viewing. Photos by: Boby Nagy

Lagowski, director of the Health Professions Office in the College of Natural Sciences, notes that Hampton's willingness to do all this work reflected her passion for genetics. "I think she communicated her deep love of the subject to her students and made it come alive for them."

Though Hampton doesn't miss the work of keeping the labs running, she says the students are another matter. "I really enjoyed when they came and talked to me about their lab reports, and a light bulb would suddenly go on over their head after solving a genetics puzzle I had given them."

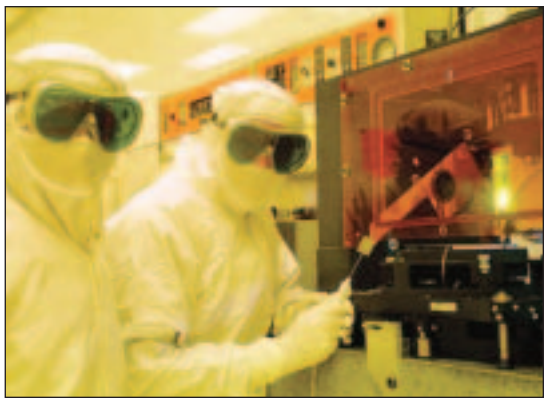
Hampton received a Texas Excellence Teaching Award in 1996, and a Teaching Excellence Award from the college's Advisory Council in 2000.

Thinking Big about Manufacturing Small Things

The Center for Nano- and Molecular Science and Technology led by chemistry professor Paul Barbara has launched a new initiative to foster education, research and industrial outreach in the development of nano-scale manufacturing processes. The Integrated Nanomanufacturing Technology Program brings together 18 university faculty from the college's chemistry and biochemistry and physics departments, from the College of Pharmacy and from various departments in the College of Engineering.

Program members are producing exciting innovations in the creation, evaluation and large-scale production of nano-scale materials that are built from structures that are about one billionth of a meter in size. The center eventually will be located in the renovated west wing of the Experimental Science Building.

The IC^2 Institute in the McCombs School of Business will assist with product commercialization. Additional support for the center's efforts has come in the form of an educational partnership with the Naval Undersea Warfare Center, from recent congressional approval of funds to study nanotechnology at UT Austin, UT Dallas and Rice University, and from extensive interactions, including research collaborations, with many leading U.S. high-technology companies.



Dr. C. Grant Willson and Dr. S.V. Sreenivasan, with a wafer that will receive nano-scale features in the university's Step and Flash Imprint Lithography apparatus. Photo by: Marsha Miller

Dr. Paul Barbara, director of the Center for Nano- and Molecular Science and Technology. Photo by: Peter Staats

A Fresh Focus for the Texas Memorial Museum

Fossilized sea urchins are among the speciments on display in the museum's new "Natural Wonders" exhibit. Photo by: Ann Molineux

The Texas Memorial Museum has started 2003 with a new focus. Beginning this month, it is concentrating entirely on natural science specimens, which comprise almost all of its collection. This shift will enable the museum to display many scientific treasures for public viewing for the first time.

Some of these previously unseen items are in the new "Natural Wonders: Treasures of the TMM" exhibit, which opened in January. The exhibit includes part of the jaw of a *Tyrannosaurus*, a dire wolf of the Pleistocene Epoch, and Paleozoic sea urchins—including some urchins that are newly identified species.

In late January 2004, existing exhibits that have been reconfigured will open to help cement the museum's position as the largest natural science museum in central Texas. Included among the offerings will be a 3-D visualization lab that showcases research on dinosaur fossils and a hall of geology that covers several geologic eras.

Cultural artifacts from the museum are being moved to the university's Center for American History and other Texas institutions, where they will play an important role in the institutions' research programs.

For more information on the museum, go to:
www.tmm.utexas.edu

New Geological Sciences Space Opens

John A. Jackson

Geological sciences students, faculty and staff now have access to 35,000-square-feet of additional useable space thanks to a generous gift from John A. Jackson and the late Katherine G. Jackson.

The $15 million addition contains classroom space on the first two floors, including three laboratory classrooms. The Joseph C. Walter Jr. and Elizabeth C. Walter Geology Library, which is being enlarged and upgraded, shares third-floor space with offices for research personnel.

Additional research clusters, which consist of connected rooms, occupy floor four, as does administrative and conference room space for the Environmental Science Institute. The building addition is topped off by administrative offices on the fifth floor for the Jackson School of Geosciences and the Geology Foundation. That floor also houses conference rooms and a placement center for geological sciences students.

The addition (in dark tan) to the west end of the Geological Sciences Building. Photo by: Joseph Jaworski

The building funding from the Jacksons is in addition to their contribution of $40 million, which created the John A. and Katherine G. Jackson School of Geosciences. They also pledged the remainder of their estate of more than $150 million to the school and to an endowment in the Geology Foundation in the couple's name.

In regards to the latter commitment, Jackson has written, "The continued study and understanding of geology and the resources and environment of the Earth will be important to The University and the citizens of Texas in the future."

Seay Building Dedication Held

In spring 2002, the Division of Human Development and Family Sciences in the Department of Human Ecology moved into 30,000-square-feet of space in the new Sarah M. and Charles E. Seay Building, located at the corner of Dean Keaton and Speedway. This much-anticipated event was celebrated with an October dedication ceremony. Division members had occupied three buildings on campus before moving into the Seay Building, which provides the most advanced family development research facility in the region.

Sarah M. and Charles E. Seay have been generous contributors to The University of Texas at Austin for over 50 years. Their latest contribution of $5 million provided the impetus for building the 180,000-square-foot Seay Building, which also houses the Department of Psychology.

Research facilities within the wing include a survey research lab where large-scale studies can be conducted using computers to gather data, a large room for videotaping and analyzing whole-family interactions, smaller rooms for studying parents interacting with their young children, interview rooms for gathering survey data, a large, well-equipped research library and a conference room.

Also located at the site is the Priscilla Pond Flawn Child and Family Laboratory, with soundproofed observation facilities, one-way mirrors for unobtrusively observing children's interactions, built-in microphones, computers and the Dell Family Funscape — a safe and lively playground children enjoy where their behavior can be observed.

For information on the Department of Human Ecology, go to: www.utexas.edu/depts/he/

From left: Dr. Cathy Surra, Sally Seay Stout, Dean Mary Ann Rankin, Provost Sheldon Ekland-Olsen

Celebrating Dana Center Anniversary

The Charles A. Dana Center hosted a reception and symposium Dec. 2-3 to celebrate its 10-year anniversary. Larry R. Faulkner, president of The University of Texas at Austin, spoke at the evening reception at the Etter-Harbin Alumni Center. Dr. Felipe Alanis, Texas' education commissioner, spoke during the symposium luncheon at the Alumni Center the next day. He was introduced by UT System Chancellor Mark Yudof.

The symposium, titled "Strengthening Texas Education," included panels of state and national experts discussing ways to improve student performance, funding of Texas schools and other topics.

The Dana Center led by Dr. Uri Treisman is a research unit of the College of Natural Sciences. The center focuses on establishing advances in educational research related to mathematics and science education. It does so by assisting educational leaders in Texas with new knowledge about teaching and learning, and by serving as a resource on important educational issues. The center also provides K-12 teachers and educational leaders with professional development opportunities and resources to assist in maintaining high academic standards.

Dr. Uri Treisman
Photo by: Bob Nagy

Honoring an Inspiring Mathematician

A mathematics conference was held in fall 2002 to celebrate the 60th birthday of Dr. Karen Uhlenbeck, the Sid W. Richardson Regents Chair. A fellow of the National Academy of Sciences and recipient of the 2000 National Medal of Science, Uhlenbeck was honored for her achievements as a mathematician, her enthusiastic commitment to mathematics and science education and mentoring skills. Faculty from Harvard, Stanford and premiere mathematical institutions in England, France and elsewhere lectured at the Texas Geometry and Topology Conference held Oct. 11 - 13. Former students of Uhlenbeck attended, including faculty and graduate students at institutions such as Rice University and the University of Houston.

Dr. Karen Uhlenbeck
Photo by: Marsha Miller

Background image:
A Texas star decorates the terrazzo flooring by the elevators in the Geological Sciences Building addition.
Photo by: Joseph Jaworski

Spring Commencement Address

Jean Kaspar
Photo by: Flash Photography

The following are excerpts from the spring 2002 commencement speech by Jean Welhausen Kaspar, CEO of 4K Ranch Properties, and a member of numerous business, cultural, and historical boards. Kaspar graduated with honors from The University of Texas at Austin in 1952 with a bachelor's in mathematics. Her entire speech is available on-line at:
www.utexas.edu/cons/admin/publications/focus/speech/kaspar.html

First, I want to congratulate each of you this morning. You have had the opportunity to attend one of the most prestigious universities in America. You have now persevered and are obtaining a very meaningful degree that will enable you, among other things, to make a difference in your lifetime. You are truly the faces and hearts of tomorrow. You hold within yourselves the power to shape the world and I challenge you to make it a better place. It means that you have a responsibility to develop your talents to the maximum, and to put them to use for noble purposes.

My guess is that the road to your accomplishment has not been all strawberries and cream — it never is! Something as worthwhile as a college education does not come easy. You have stood on the shoulders of many, who have blazed trails for you, and who have given you a helping hand. You have been mentored, financed, advised, guided, and befriended by many persons. Today is the day for you to say thank you to parents, grandparents, faculty, alumni, administrative personnel and valued friends. As they congratulate you — please thank them from the bottom of your heart....

… During my college days on campus, I often was the only female student in many of my math classes. I wasn't trying to be different, math was just my love and my aptitude. For example, I was the only young woman in a certain advanced calculus class. When my professor handed out our first quiz, I was handed a blank sheet of paper. I timidly raised my hand and said, "Sir, you gave me a blank sheet of paper," and he replied, "I know that, a blank sheet of paper is all you know about my

class." Dead silence — even though I wanted to cry, I report to you that I did not. In a few seconds a young man sitting close to me said, "If she can't take this test, I won't take it either," and turned his paper over. In a few seconds, all the young men in class turned their papers over. That day I stood on the shoulders of those young men and hopefully I inadvertently blazed a few trails for others. Maybe there is some young lady among you today that has been the only female in her class and was treated more fairly than I was that day. I hope so. Step by step, generation by generation, we open doors....

...Please do remember that The University of Texas is your home, the place where you made friends and came of age, a place that will be a part of you forever and of which you will be forever a part. Remember to come home often, both in fact and in spirit. This is where your future began.

It would be inappropriate at the first spring commencement since 9/11, not to mention its impact on our lives. I know each of you realize the gravity of the incident. You have been an eyewitness to a terrible American tragedy, but also you have been an eyewitness to an incredible rekindling of the American spirit. We can be proud, we can be grateful, for it has made us realize what is truly important in our life. We must cherish our families, we must know people are more important than things. We must learn the difference between faith and hate. We must be thankful for our freedom and be awed by the greatness of the American people. We rightfully have new heroes and new goals. You truly have inherited the greatest country in the world, not only the most powerful, but the most democratic and the most free. Abraham Lincoln said, "Freedom is the best hope of the Earth," and, "A nation which makes the final sacrifice for life and freedom does not get beaten."

Dear graduates, you have a vigilant watch to keep. So my honored friends — I have said to you — make a difference with your life.

1. Never forget to say thank you to a nurturing community.
2. Blaze a few trails for others.
3. Living with "adversity" can only make you stronger in your convictions.
4. Remember your college days with love and joy.
5. Guard your American freedom with alertness and courage.
6. And lastly, face your future with confidence. Make your life an adventure, reach for the stars, light up the world, dazzle us, astonish us, be extraordinary.

Be discriminate about what is right and what is wrong, for not everything that is popular is right — and not everything that is right is popular.

The time has come for us up here to pass the torch to you out there — the educated, promising leaders of tomorrow. The future will be better because of each of you. And as for the torch — I know you won't drop it! Your hands are sure and your hearts are strong.

God bless each of you — God bless Texas — God bless America. Again, congratulations — it is time to celebrate! Hook'em Horns!!

Background photo by: Alma Arce

Focus on Faculty

Dr. Allen J. Bard

Dr. Douglas Burger

Dr. Robert M. Krug

Dr. Alan Lambowitz

Dr. Ilya Prigogine

Dr. Allen J. Bard (Chemistry and Biochemistry) received the 2002 Priestley Medal from the American Chemical Society. The society's highest award was given to Bard for deepening the understanding of electron-transfer reactions, fostering the development of electroanalytical methods and instruments and opening up new areas of inquiry.

Dr. Douglas C. Burger (Computer Sciences) was awarded a 2002 IBM University Partnership Award, and a 2002 Sloan Fellowship for his work in advanced computer architectures.

Dr. Nell B. Dale (Computer Sciences) received the Karl V. Karlstrom Outstanding Educator Award from the Association for Computing Machinery in late 2001 for changing the focus of computer programming away from language syntax and toward problem solving and software engineering principles.

Dr. William L. Fisher (Geological Sciences) was a 2002 recipient of the university's Presidential Citation awards for his significant impact on the university and Texas. Fisher, who directed the Bureau of Economic Geology for 25 years total, also received the Don R. Boyd Medal for Excellence in Gulf Coast Geology from the Gulf Cost Association of Geological Societies, the Hats Off! Award from the Texas Independent Producers and Royalty Owners Association, and the Houston Oil and Minerals Corporations Faculty Excellence Award from his department.

Dr. Daniel S. Freed (Mathematics) has been appointed a Guggenheim Fellow based on his applications of K-theory to geometry and physics.

Dr. Mohamed G. Gouda (Computer Sciences) received a 2002 IBM Faculty Award.

Dr. Stephen Keckler (Computer Sciences) received a 2002 IBM Faculty Award, and a 2002 Sloan Fellowship for his work in advanced computer architectures.

Dr. Michael J. Krische (Chemistry and Biochemistry) received a Cottrell College Science Award from the Research Corporation for research on catalytic methods. Krische also received the ACS Frasch Award from the Herman Frasch Foundation and Lilly Grantee Award from Lilly Research Laboratories.

Dr. Robert M. Krug (Molecular Genetics and Microbiology) received the Interbrew-Baillet Latour Health Prize in Belguim for studies of the molecular mechanisms that influenza viruses use to replicate within infected cells. Krug received the $147,000 prize in Brussels from Princess Astrid of Belgium.

Dr. Alan Lambowitz (Molecular Genetics and Microbiology) was elected a Fellow of the American Academy of Microbiology.

Dr. Edward M. Marcotte (Chemistry and Biochemistry) received a 5-year, David and Lucile Packard Foundation Fellowship for Science and Engineering to study protein function and protein interactions using computational approaches.

Dr. Ilya Prigogine (Physics) received the Commander of the World Order, "Science, Culture, Education," at the European Academy of Information. The Nobel Prize winner also was awarded the Antonio Roberti International Prize and was named honorary president of the Italian Institute for Philosophic Studies in Naples, Italy. In addition, Prigogine was invited to become a member of the London Diplomatic Academy and received a D. Honoris Causa at the Academy of the Slovak Republic.

Dr. Mark G. Raizen (Physics) received a 2002 Max Planck Research Prize for his research achievements at the boundary between atomic physics and condensed matter physics.

Dr. John F. Stanton (Chemistry and Biochemistry) was the Kapuy lecturer at Eotvos Lorand University in Budapest and the Robert S.

Mulliken Memorial Lecturer at the University of Georgia.

Dr. Robert H. Tatham (Geological Sciences) was awarded life membership in the Geophysical Society of Houston for exceptional meritorious service.

Dr. John Tesmer (Chemistry and Biochemistry) received a Cottrell College Science Award from the Research Corporation.

Dr. Steven Weinberg (Physics) received the 2002 Humanist of the Year Award based on a unanimous vote by the American Humanist Association's board of directors. The Nobel laureate also testified before the Senate Committee on Foreign Relations about U.S. plans for nuclear weapons and received an honorary doctorate of science from Bates College in Maine, where he gave the commencement address.

Dr. Zhen Yao (Physics) was selected to receive a 2001-2002 Outstanding Young Researcher Award from the Overseas Chinese Physics Association.

Teaching Awards

Dr. S. Martin Shankland (Molecular Cell and Developmental Biology) was elected to The University of Texas at Austin Academy of Distinguished Teachers.

Dr. J. Craig Wheeler (Astronomy) was elected to The University of Texas at Austin Academy of Distinguished Teachers.

Dr. Edward R. Anderson (Human Ecology) received a 2002 College of Natural Sciences Teaching Excellence Award.

Dr. Roger D. Bengtson (Physics) received a 2002 College of Natural Sciences Teaching Excellence Award.

Dr. Douglas C. Burger (Computer Sciences) received a 2002 Texas Excellence Teaching Award from the Texas Exes.

Dr. Michael W. Downer (Physics) received a 2002 President's Associates Teaching Excellence Award.

Glenn P. Downing, MS (Computer Sciences) received a 2002 College of Natural Sciences Teaching Excellence Award.

Dr. Judith L. Edmiston (Molecular Genetics and Microbiology) received a 2002 College of Natural Sciences Teaching Excellence Award.

Dr. Henrietta N. Edmonds (Marine Science) received a 2002 College of Natural Sciences Teaching Excellence Award.

Dr. Mark A. Helper (Geological Sciences) received a 2002 College of Natural Sciences Teaching Excellence Award.

Dr. Arlen W. Johnson (Molecular Genetics and Microbiology) received a 2002 College of Natural Sciences Teaching Excellence Award.

Dr. Mark A. Kirkpatrick (Integrative Biology) received a 2002 College of Natural Sciences Teaching Excellence Award.

Dr. Michael J. Krische (Chemistry and Biochemistry) received a 2002 College of Natural Sciences Teaching Excellence Award.

Dr. Martin Poenie (Molecular Cell and Developmental Biology) received a 2002 College of Natural Sciences Teaching Excellence Award.

Dr. Austen F. Riggs II (Neurobiology) received a 2002 College of Natural Sciences Teaching Excellence Award.

Dr. David J. Saltman (Mathematics) received a 2002 College of Natural Sciences Teaching Excellence Award.

Dr. Donald E. Winget (Astronomy) received a 2002 College of Natural Sciences Teaching Excellence Award.

Dr. Steven Weinberg

Dr. Judith L. Edmiston

Dr. Henrietta N. Edmonds

Dr. S. Martin Shankland (left) and Dr. J. Craig Wheeler (right)

IN MEMORIAM

Professor Emeritus Edsger W. Dijkstra (Computer Sciences) died Aug. 2, 2002, in the Netherlands. A faculty member at the university for 15 years, Dijkstra was a noted pioneer of the science and industry of computing. He understood that mathematical logic could form the basis for constructing computer programs, and contributed knowledge on mathematical methodology to foster this area. Dijkstra also is responsible for the idea of building operating systems as explicitly synchronized sequential processes, for the formal development of computer programs, and for the intellectual foundations of the disciplined control of nondeterminancy.

A winner of many awards, Dijkstra was the 1972 recipient of the Association for Computer Machinery's Turing award, often considered the Nobel Prize equivalent for computing. He also posthumously received a 2002 prize from the C & C Foundation of Japan for his pioneering contributions in establishing the scientific basis for computer software.

Friends and Supporters

New Corporate Awards

Two high-technology companies recently received the first Corporate Partners in SolUTions Award from the College of Natural Sciences. The college's Foundation Advisory Council honored National Instruments and Advanced Micro Devices at a dinner on campus in November.

The two corporations have provided ongoing support to a daylong outreach program hosted by the college and The University of Texas at Austin. Austin Science Fun Day attracts thousands of visitors to campus each March, and stimulates K-12 students' interest in mathematics and science.

National Instruments' co-founder, Jeffrey Kodosky, was recognized separately at the dinner with the first Trailblazer Award. Kodosky spearheaded an employee-funded campaign to create a college scholarship, with the corporation matching employee contributions. The National Instruments Endowed Scholarship for Excellence will support gifted undergraduates in natural sciences who study computer sciences, mathematics or physics.

Top: James Truchard and Ray Almgren receive the Corporate Partners in SolUTions Award for National Instruments. Lower left: National Instruments co-founder Jeffrey Kodosky accepts the Traiblazer Award. Lower right: Kevin Lyman from Advanced Micro Devices accepts its Corporate Partners in SolUTions Award. Photos by: Bob Nagy

Dedicated Researcher's Legacy Continues

The Karl Folkers Foundation for Biomedical and Clinical Research dissolved late last year. But as is fitting for an entity established by a man who lived and breathed health science research, its nearly $2 million in remaining assets, including equipment and patents, will allow biomedical research positions to be established at the College of Natural Sciences.

The assets will provide for a Karl Folkers Chair and a Karl Folkers Professorship in Interdisciplinary Biomedical Research in his honor. The funding for these interdisciplinary positions is in addition to the more than $3.3 million the foundation previously distributed during 10 years of support to health sciences research at the university.

Folkers was considered one of the most productive, imaginative biological chemists of the century. The Decatur, Illinois, native developed an interest in this area as a child dabbling with chemistry sets, and then pursued undergraduate and graduate degrees in this field.

While at Merck and Co. in New Jersey in the 1930s, he spearheaded pioneering investigations, such as a six-year-effort to isolate vitamin B-12. Folkers also is known for synthesizing vitamin B-6, biotin and other chemicals that are key to normal body function. He left Merck in 1962 to become president and CEO of Stanford Research Institute. After five years there, Folkers accepted a chemistry professorship at The University of Texas at Austin in 1968 that allowed him more time for research.

"His commitment to research was overwhelming," says William Hilgers, who led the board of directors for the Folkers Foundation. "He was absolutely dedicated because he wanted to bring about research developments that would help people's lives."

In 1990, Folkers was recognized for this dedication by receiving the National Medal of Science at the White House from former President George Bush Sr. Folkers' numerous other honors include being the first recipient of the Welch Foundation award, and a recipient of the Priestley Medal, the highest honor given by the American Chemical Society.

The late Dr. Karl Folkers, who was the Ashbel Smith Professor and director of the former Institute of Biomedical Research.

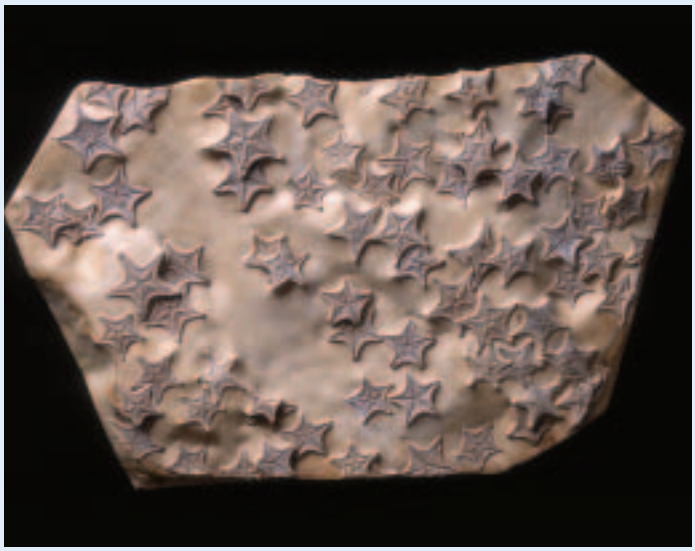
Folkers established the foundation in 1991 to provide funding support for biomedical research, principally that of the university's Institute for Biomedical Research, which he directed. Before his death in 1997, the foundation funded his efforts and those of Dr. Richard Willis and others at the institute. Many of the studies focused on coenzyme Q. The enzyme, which Folkers had helped isolate at Merck, holds promise for treating pernicious anemia, certain kinds of heart disease and other ailments.

Dick Curran, the former executive director of the Folkers Foundation, notes that the faculty positions established with the remaining funds "will serve as a lasting memorial to Karl Folkers and will continue to encourage research in the areas in which he had a life-long interest."

Blast from the Past

Frank Bell shows 1930s visitors to the Texas Memorial Museum an 80-million-year-old slab dotted with starfish. Photo from: Archives of the Texas Memorial Museum

A detailed group of fossil starfish *(Cratenaster mccarteri)* is one of the Texas Memorial Museum's treasures. The specimen came from Bouldin Creek in Austin, and was part of the Adkins Cretaceous deposit. The museum has housed one of the largest collections of invertebrate fossils in the world since it opened in 1936. The museum's recent decision to focus entirely on science (see page 16) is expected to expand the number of specimens like this that it can display.



A close-up of the 21-inch-long specimen. A four-pronged starfish rests below one of the many five-pronged starfish on the image's right side. Photo from: Billy Moore

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