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Quantum: Research, Scholarship & Creative Works at the University of New Mexico, 2004

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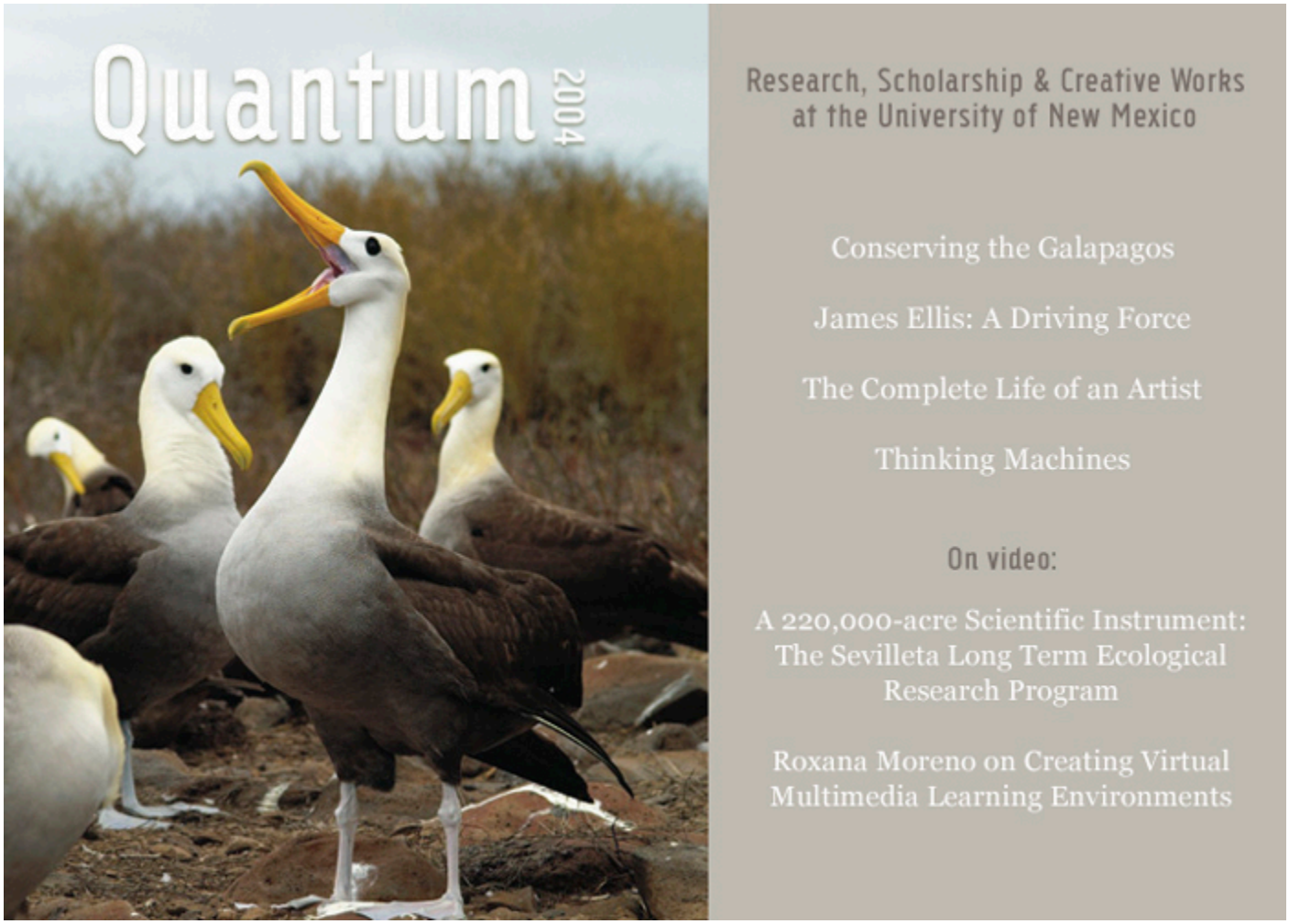

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To the Reader:

It is with great pleasure that we invite you to celebrate the 20th anniversary of *Quantum* magazine. The vibrant growth of the University of New Mexico, with research, scholarship, and creative endeavors at its core, is reflected in this issue of retrospect and vision.

UNM's pursuit of knowledge and discovery is made more exciting as we welcome Louis Caldera as the University's 18th president. With an extensive background in public service, President Caldera is committed to the development of this research climate, creating an environment that prepares our students for the realities of the modern world while building the intellectual property that will help ignite and sustain New Mexico's economic development.
UNM's growth can be witnessed in the upward trajectory of its research funding, as contract and grant awards for fiscal year 2003 top $255.7 million, a growth of more than $10 million over fiscal year 2002. Our students, researchers, and educators come from diverse areas of interest and expertise, and they come together with enthusiasm and commitment to create a vibrant academic climate.

In this issue of *Quantum*, we will look forward to our promising future, as we look at research in emerging areas. We will also visit accomplished researchers for updates on their work and celebrate the milestones of their scholarship. The University of New Mexico has a historical commitment to research. With pride we renew that commitment as UNM's quest for knowledge and discovery reaches beyond academic boundaries to meet the challenges of our local, national, and worldwide community.

A Driving Force

Professor of Law James Ellis has helped build a national consensus against executing the mentally retarded and has successfully argued its unconstitutionality before the high court.

by Laurie Mellas Ramirez

When University of New Mexico Professor of Law James Ellis began working on behalf of people with mental retardation nearly 30 years ago, he never imagined a court would sentence to death anyone with a condition that so severely limits intelligence and adaptive skills.

Believing it to be not only immoral but also unconstitutional, Ellis has dedicated much of his career to fighting the practice through his writings on mental health and the law. He has also worked with organizations such as the American Association on Mental Retardation (AAMR) and The Arc (a national organization of and for people with mental retardation and related developmental disabilities), has made numerous appearances before legislative and congressional committees, and filed friend-of-the court briefs in 13 U.S. Supreme Court cases.

Photo of James Ellis by Michael Mouchette.

Thus, a man more accustomed to working behind the scenes than befo emerged as a public figure in 2002. The National Law Journal named "Lawyer of the Year" after he helped build a national consensus agains executing the mentally retarded and successfully argued its unconstitu before the high court.

But even with 18 states and a Supreme Court ruling on his side, Ellis p the-clock to save lives. A number of states have yet to pass statutes to new standard.

In 1987 Ellis, working with UNM Special Education Professor Ruth L also a champion of individuals with mental disabilities, acknowledged reinstating the death penalty in 1976 brought new urgency to their rese

Milestones since 1987 include the 1989 Penry Supreme Court case, sa who represented several national organizations and was AAMR presid

Johnny Paul Penry, a convicted Texas murderer with an IQ of 55, had been viciously abused by his mother, never finished first grade, and as an adult still believed in Santa Claus. In Penry v. Lynaugh, the high court was asked to decide if executing defendants with mental retardation violated the Eighth Amendment ban on cruel and unusual punishment. The Justices ruled 5-4 that it did not, further indicating that such judgments are based on whether there is a national consensus for or against, as detected by enactment of state legislation. At the time only two

states, Georgia and Maryland, were saying no to executing the mentally retarded.

Ellis set out to boost that number, and by 2002, an additional 16 states prohibited it. Only then did the high court agree to reconsider the issue in the case of Atkins v. Virginia. So identified was Ellis with the issue that he was asked by the Virginia Capital Representation Resource Center to represent Daryl Atkins, a convicted killer on Virginia's death row with a measured IQ of 59.

"They thought it would be helpful to hear from somebody not from the death penalty community but from the disability community talk about the definition of mental retardation and someone who knew about the 18 statutes."

Ellis, who had never argued a case, "not even a traffic ticket in police court," credits UNM colleagues and students with providing the most valuable training.

"Obviously I needed a lot more preparation than lawyers ordinarily do," says Ellis, also crediting the NAACP Legal Defense Fund for its support.

"Every time my UNM colleagues and I work on a Supreme Court brief we essentially create a class of law students whom we invite to help us. We meet with students and announce, 'Okay, this is now a law firm so confidentiality attaches, and we're going to tell you everything – about our relationships with other lawyers, about our strategies for dealing with concerns of particular justices, our dealings with the other side,' and then we give the students research tasks. For most of the cases we attempt to take everybody back to hear the oral argument in Washington," Ellis says.

The UNM School of Law also offers students real-world experience through its Clinical Law Programs, consistently ranked among the best in the country, and recently ranked 10th in Clinical Training of top 10 programs (ranked in 2002) by U.S. News and World Report and listed in America's Best Graduate Schools 2004.

"What we do is separate from the clinic, but it's parallel. It's similar in that it gives students practical experience. I don't know of any other law school that has a program involving students in U.S. Supreme Court cases on a sustained basis. We have been doing it here at UNM for almost 20 years," Ellis says.

"Jim is an extraordinary teacher," says Michael Browde, UNM Professor of Law. "His command of the material he teaches is unparalleled; his keen sense of humor and quick wit electrify the classroom; and he has now trained two generations of mental health lawyers who have followed in his footsteps."

Since the Atkins ruling, Ellis says the work has shifted from a question of policy to one of procedure and has intensified.

"What truly changed was that from each year working in one state, maybe a couple, all of a sudden I was working in 20, because every state that didn't have a mental retardation statute had

to at least consider doing it. Right now I'm working on legislation in California and Pennsylvania. We've successfully gotten bills passed in Virginia, Idaho, and Utah. There is a bill on the governor's desk in Illinois, and Delaware passed a statute – we've got a bunch of them," Ellis says.

There is no precedent for this type of categorical ruling, Ellis says, and implementation is uncharted territory. He consulted with colleagues around the country and recently authored, "Mental Retardation and the Death Penalty: A guide to state legislative issues," a document to provide legislators and advocates with guidance in implementing the Atkins decision so each state's death penalty legislation is in full compliance with constitutional requirements.

"The guide has a model statute, as well as procedures for new cases and for those with someone already on death row. I distributed it through the magic of the Internet, and it has been a starting point for a lot of the states," Ellis says.

When and if all states conform, Ellis will stay busy with litigation challenges in those states where it is decided after sentencing whether the defendant has mental retardation.

Regardless of a criminal's own past victimization, society is usually without sympathy for them, so what fosters Ellis' humanity? Not unremarkably, the professor says an education at a small liberal arts school, Occidental College, Los Angeles, helped shape his views. He earned his J.D. at another haven for public interest advocates, University of California, Berkeley.

"Jim Ellis has the most generous, self-sacrificing spirit I have ever encountered," Browde says. "As a conscientious objector during the Vietnam War, he performed his alternative service in the wards of the Yale Psychiatric Institute. Searing images of shattered, wasted, and neglected lives impacted this young orderly as he emptied bedpans, leading to his lifetime devotion to the study of mental retardation and the development of law."

Ellis, described as "brilliant, yet humble," leaves his framed "Lawyer of the Year" plaque in a corner of his office, still wrapped.

"Jim is a compassionate person who works ceaselessly, not for any material reward but because he cares about people and how they are treated," says Barbara Bergman, UNM Professor of Law. "His mind is so quick. He sees issues, analyzes them, and finds solutions faster than most of us even realize there's an issue to be spotted."

Ellis has the ability to craft a brief into "a persuasive work of art," she adds. Every word is selected for a reason, and every argument is addressed to persuade the particular judge or justice he needs to convince.

"Through Jim's national work against the death penalty and as an advocate for people with disabilities, he has brought national recognition and respect to UNM. Our law students have had the benefit of working with one of the finest legal minds in the country. He challenges them in ways that make them not only better lawyers but better people," Bergman says.

Doreen Croser, Executive Director of AAMR, concurs that Ellis has been a driving force in disability law and public policy for more than three decades.

"He has made a significant contribution to students, to our future leaders, to persons with mental retardation and their families, to disability professionals, and to members of the legal community. He has made a difference, and the world is a better place because of him."

Efforts by All

Lois Meyer collaborates on an education research project based on a
Oaxacan communal work concept called *tequio*.

by Carolyn Gonzales

Photo of Lois Meyer by Laurie Mellas Ramirez.

In a world quickly losing language diversity, Lois Meyer, Associate Professor in the University of New Mexico College of Education, has helped adapt a Oaxacan communal work concept to help preserve a mixture of regional indigenous languages and community autonomy.

In a project funded by the Spencer Foundation called "*Tequio Pedagogico*: Pedagogical Collaboration in Community," Meyer works with teacher-researchers, academic advisors, and a direction committee of the Coalition of Indigenous Teachers and Promoters of Oaxaca, in the spirit of "tequio."

Tequio is a word describing the concept of collective work – constructing buildings, repairing roads, cleaning streets, etc. – carried out without pay in indigenous Oaxacan villages to benefit the community as a whole. Tequio is a practical cultural element that helps the community survive, and is also a cultural value taught to the community's children and youth.

"Organizing our research in the form of tequio was an idea that attracted teacher-researchers to the project and enticed others in their schools and communities to join in. The results have been favorable, reflecting communal efforts by all," says Meyer.

Meyer, an applied linguist, carefully takes on the role of collaborator and academic advisor rather than project leader.

Oaxaca, the most culturally diverse state in Mexico, has 16 ethnic groups and more than 50 variants of indigenous languages. The few books available in the village classrooms are Spanish-language, government-issued textbooks. The 24 Coalition teacher-researchers participating in the project represent nine languages, six preschools, and three primary schools throughout this southeastern state.

"The Mexican national education system provides little help in solving the problem of indigenous language loss, in that there are no serious efforts made to revitalize and strengthen the various languages and cultures of Mexico. Although the national and state education laws provide a good philosophical base for developing bilingual and intercultural education, the reality of educational practice is very different," Meyer explains.

As part of the research project, the group conducted field studies which included interviewing

parents and students. The children told the researchers their experiences and expressed their opinions about their educational preferences.

"All the concerns expressed by the children were taken into account, and we embedded these concerns into planning our classes. It is important to point out that all our activities that promote the children's learning of concepts are based on their own cultural experiences. Later, we converted these experiences to school content with the goal of achieving a significant learning experience for the children," Meyer says.

"Community knowledge serves as the springboard for achieving a greater understanding of the subject matter content of the national curriculum," she notes.

"Ultimately, the intent of the tequio project is to increase the cultural and linguistic meaningfulness of schooling, literacy, and completion rates of Oaxacan children," Meyer says. "Our goal is to achieve these outcomes by democratizing educational practice in indigenous communities in the most fundamental sense – by grounding the teaching strategies of schools in the knowledge, values, and aspirations of the parents and members of these communities."

Global Healthcare in a Borderless World

Howard Waitzkin continues his inquiry into the global effects of multinational corporate behavior on the health of people around the world.

by Cindy Foster

Photo of Howard Waitzkin by Michael Mouchette.

In 1998, an international 20-member working group was investigating the effects of exporting U.S. managed-care companies into Latin America. The investigation concluded: "The results of the team's research could have far-reaching consequences throughout the western hemisphere as governments wrestle with how to provide healthcare in the 21st century."

There have been some surprising twists and turns during the past five years, says Howard Waitzkin, Professor of Family Practice and Community Medicine in the University of New Mexico's School of Medicine and a principal investigator in the 1998 study.

Since then, it's been five years of publication, controversy, and dialogue throughout Latin America on the topic, says Waitzkin. The results of the group's study have also become the seeds of an expanding inquiry into the global effects of multinational corporate behavior on the health of millions of people around the world.

Along the way, the group reached a number of milestones. These achievements include the development of a database on Latin American social medicine, under a grant from the U.S. National Library of Medicine, to aid in the translation of important Spanish and Portuguese publications into English. Waitzkin and colleagues have also received grants from the John Simon Guggenheim Memorial Foundation of New York, the Fulbright New Century Scholars Program, the U.S. Agency for Healthcare Research and Quality, and the National Institute of Mental Health, to look at the effect of global trade on public healthcare.

According to Waitzkin, global trade raises important new challenges for health and the provision of health-related goods and services. Multinational corporations in the new millennium are increasingly becoming fluid, borderless entities that ultimately answer to no one. Globalization will affect key components of public health, from public hospitals and community health centers to government agencies, occupational and environmental health standards, and the availability and regulation of drugs and equipment. This is occurring as multinational insurance companies and managed-care organizations (MCOs) cross international borders.

Yet Waitzkin says that all too often policy decisions impacting public health occur as "silent

reforms," without participation of legislators, professional associations, or the media.

Since the early 1990s, institutions such as the World Bank and the International Monetary Fund have required state-owned hospitals and clinics in Third World countries to be privatized before loans are considered. Many times those formerly state-owned and -run hospitals were purchased by U.S. and European insurance companies that then introduced U.S. models of managed care, even though the history of healthcare in those countries was vastly different from the systems that had developed in the United States.

"We were so amazed at what was happening in managed care," says Waitzkin of the group's initial results. "Here's a policy that has been tremendously problematic in the U.S., and yet its export has been taking place throughout the world. And it all seemed to be happening without getting opinions from patients, doctors, and other healthcare workers."

The original group included scholars from the United States, Mexico, Argentina, Chile, Bolivia, Ecuador, and Brazil. This group began what is believed to be the first systematic study of the relationships between globalization and public health policies. The inaugural group expanded into a network of scholars around the world that spent a year collaborating on and researching the subject as part of the Fulbright New Century Scholars Program grant titled "Global Health in a Borderless World."

The research at UNM was already using an interdisciplinary approach that included faculty and students from the Department of Economics and the School of Law. This group had to examine the literature on global trade and public health and assess the orientation of pharmaceutical corporations and insurance companies. A logical next step was to include the voices of other groups, Waitzkin says.

"We wanted to map the entire lay of the land," Waitzkin says. To that end, the group has recruited members from health and consumer rights groups, faith-based organizations and advocates for the elderly and the mentally ill. They plan to examine firsthand the effects of global trade across the spectrum of a nation's populations.

To date, Waitzkin says, the group has found disturbing trends in healthcare, such as a reduced emphasis on preventive care by MCOs. "For instance, despite the advances in prevention research since the 1980s, managed care has become part of for-profit enterprise, and too often prevention activities have been pushed aside," he explains.

What has become even more troubling, says Waitzkin, are the ramifications of new international trade agreements enacted since the late 1990s. For instance, the World Trade Organization (WTO) was established in 1994 to consolidate international agreements with a goal of removing both tariff and non-tariff barriers to trade. Although the WTO sets criteria for permissible non-tariff barriers, such as domestic policies to protect the environment, food safety, and health services, several related provisions and legal cases are undermining those protections, says Waitzkin.

"In general, the WTO treats trade relationships solely as business issues and restricts the

consideration of other issues, including the impact on health and the environment," says Waitzkin. "This seems to be a way that companies can get around an individual country's laws and regulations."

The North American Free Trade Agreement (NAFTA), also signed in 1994, has raised major controversies in such areas as environmental and occupational health, he says. Under NAFTA's unique "investor's rights" provisions, for instance, companies have actually gone to court and been granted damages for "regulatory takings" when a government prohibited them from selling toxic substances to the public. It has had a chilling effect on governments enacting new public health and environmental safety measures, he says.

"New trade agreements have been imposed with very little discussion," says Waitzkin. "They are resulting in a loss of governmental sovereignty and are impacting public health."

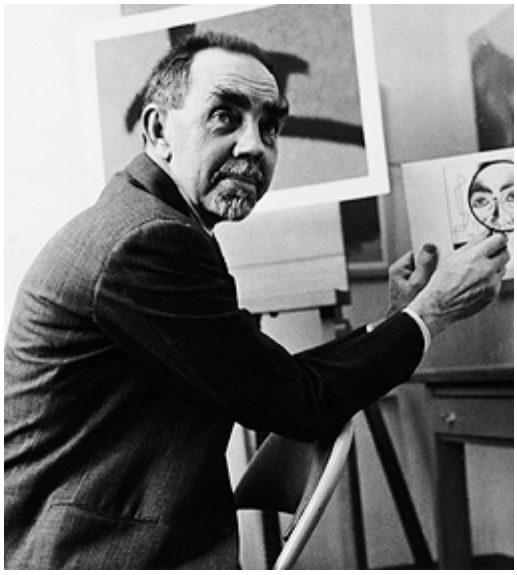
What's next?

The 21st century promises to bring about more fluid borders and new problems of healthcare and public health around the world, Waitzkin says. Raising the level of dialogue about the effects of corporate behavior and trade agreements on health and the environment should make the next five years as lively and controversial for the researchers as the past five have been.

The Complete Life of An Artist

Raymond Jonson, UNM's first and only permanent artist-in-residence, has greatly influenced a number of students, educators, and contemporaries through the legacy of his work, spirit, and gallery.

by Valerie Roybal



Raymond Jonson, 1956. Bequest of Raymond Jonson, Jonson Gallery Collection, University of New Mexico Art Museum.

Inspired by a visit to New Mexico in 1921, with its profound geological structures of mesas, rolling hills, and ancient eroded canyons, contrasted with a light-infused expanse of sky, Raymond Jonson made an important decision. He vowed to return to this place that captivated him and resonated with his ideas about the connection between the inner and outer life in art-making, and the connections between nature, formal composition, and spirituality in painting.

In 1924 Jonson returned. He not only became an influential art advocate and teacher at the University of New Mexico, where he began his University teaching career in 1934, but also one of the leaders of an important group of artists called the Transcendental Painting Group.

The year 1938 marked the formation of the Transcendental Painting Group, which was dedicated to championing a different and emerging approach to painting called abstraction. The group aimed to go beyond art that was more traditional in terms of style, format, and subject matter – called "representational" – into a realm that was experimental, nonobjective, spontaneous, drawn from inner resources and spiritual means, and concerned with form over content. Other members of this group included renowned artists Emil Bisttram, Lawren Harris, Stuart Walker, Agnes Pelton, Ed Garman, William Lumpkins, and Florence Miller Pierce.

Inspired by Vassily Kandinsky, who was at the forefront of the movement to paint what Jonson called "pure emotion," the group operated as an artistic alliance, interested in bolstering the aesthetics and intellectual ideals associated with and represented in abstract art. From 1938 until 1941, the members of the group supported each other and exhibited their work at a number of places, including the Museum of New Mexico in Santa Fe, the Golden Gate International Exposition in San Francisco, and the Guggenheim Museum in New York City.

The year 1941 was the start of World War II and the end of the group, with some of the

members being called into military service and others moving away from the region.

Despite the early demise of the group, the work of its members formed what Jonson called a "historical statement of the age," and contributed to a larger movement away from representational art towards the abstract.

Jonson himself continued to explore abstraction throughout his life. In 1950, he became UNM's first and only permanent artist-in-residence: living, working, and teaching at the Jonson Gallery, a home and gallery space designed for him by renowned architect John Gaw Meem. The gallery was important for a number of reasons. It served to represent "the complete life of an artist," notes Tiska Blankenship, former curator of the Jonson Gallery. More grandly, according to Blankenship, the gallery was a "monument to modern art" and the state's "premier modern exhibition space in the 1950s."

Jonson remained at the gallery until his death in 1982 and is remembered as an enthusiastic and welcoming host to those who visited the gallery. The space is now under the UNM Art Museum and is listed on the National Register of Historic Places. Today, the gallery, with its collection and exhibition space, serves as a great resource for students, faculty, art historians, researchers, and the community.

The collection, with over 2,300 works, the majority of which are by Jonson and the Transcendental Painting Group, has the objective of reflecting Jonson's ideas, with an eye towards abstraction and spirituality. The gallery also houses Jonson's complete archive, which includes information on many of Jonson's modernist contemporaries.

The exhibition space at the gallery is committed to showing work by regional and emerging contemporary artists that are lesser-known and under-recognized. "This was one of Jonson's objectives for the gallery," says Chip Ware, present curator of the Jonson Gallery.

"We also want to show work which is provocative," says Ware. "We want to show art that makes you think, but does not necessarily meet certain standards of aesthetics. We are interested in showing artists who create work that doesn't necessarily fit into a commercial gallery setting. I like to think of this gallery as an alternative space."
Included within the realm of the "provocative" and noncommercial are installation (site-specific work, usually based on a theme, and consisting of a collection of components and/or effects working together to create an environment); new media (which includes computer-generated, multi-media and digital work); and themes that address gender, race, and other contemporary issues.

Previous exhibitions have included a large-scale multi-media installation piece with large paintings and mechanical sculptures called "Sideshow of the Absurd" by Pamela Joseph. Current and upcoming exhibitions include a sculptural installation piece by Santa Fe artist Celia Rumsey called "Craving," which deals with the issues of food and temptation, especially during the holidays; and a photography exhibition by American Indian artist Zig Jackson called "Reservation Stories."

One of the other goals of the gallery is to maintain a strong connection to the University community. "We try to serve the University in a number of ways," says Ware. "We show numerous graduate student and faculty exhibitions in the gallery, we host a new graduate student and juried graduate student exhibition every year, and we host collaborative events with other UNM departments."

Jonson's artistic vision has and continues to influence a number of students, educators, and contemporaries through the legacy of his work, spirit, and gallery. In the locally-produced KNME Colores documentary "Vision & Spirit," Peter Walch, professor emeritus and former director of the UNM Art Museum, describes Jonson as "a great prophet," and "a great propagandist for modern art." Jonson, he says, "had this … absolute self-conviction that art was one of the noblest callings available to any human being."

Dialogues With the Dead

Bioarchaeologist Jane Buikstra retrieves life histories and works to solve some of the mysteries of the long deceased. .

by Frank D. Martínez

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UNM Distinguished Professor of Anthropology Jane Buikstra examines human remains that are several centuries old – not necessarily to solve a crime, but to shed light on the details of the person's life, surroundings, and the society in which they lived. "What we're doing is looking at problems that would help us understand the past," she explains.

Buikstra's work, which has drawn international acclaim, is grounded in a multidisciplinary approach, drawing from archaeology and the medical sciences. For more than 30 years, Buikstra has been retrieving the life histories of the deceased by studying their bones, teeth and the surroundings in which the remains were found.

Buikstra, who has been a member of the National Academy of Sciences since 1987, is given credit for coining the term "bioarchaeology," which describes the interconnectivity between physical anthropology and archaeology in research and excavation involving the remains of ancient humans and their environmental conditions. She is also cited as a pioneer and leader in the fields of skeletal biology and paleopathology.

Coming to UNM from the University of Chicago in 1995, Buikstra brought with her a 29-year association with the Center for American Archeology in Kampsville, Illinois, where she directs the Center's archaeological field school. In that capacity, she has worked with students to research the Middle Woodland people who lived in Illinois some 2,000 years ago.

Buikstra has also spent considerable time and effort exploring the past of the Mayan people, especially some of the Mayan rulers. She solved a riddle regarding the age of death of a Mayan ruler that had baffled the scientific community for some time.

In the 1950s, archaeologists had suggested the ruler had died between the ages of 40 and 50 years. But when the glyphs near his tomb were discovered and translated, they suggested that he lived to be more than 80 years of age. Buikstra was called upon to be part of an expedition to examine the ruler's remains and tomb to solve the ancient mystery.

"We applied new state-of-the-art methods and determined that he died at a much older age

than archaeology had earlier suggested. Our maximum estimate turned out to be 80.9 years old and the glyphs said 80.4, so we were very, very close," she says.

Buikstra's work also includes extensive research on the history and evolution of tuberculosis and its significance in recent human history. One examination and DNA analysis of a woman who died in Peru about 1,000 years ago revealed she probably died from tuberculosis. "This convincingly argued for a presence of tuberculosis in the New World prior to the Columbian excursion of 1492," Buikstra says.

Selected as the University's 48th Annual Research Lecturer, the highest honor UNM bestows on its faculty, Buikstra described some of the ancient puzzles she has worked on in her public lecture titled "Dialogues With the Dead: Mummies, Monuments, and *Mallquis*."

"*Mallquis*," Buikstra says, "is a Quechua (the language spoken by the Indian peoples of Peru and other South American countries) word that means 'ancestor'. As with so many other Andean words, however, mallquis has many meanings; notably, in this case, mallquis are also germinating seeds, sprouting plants that support the generative cycle of human existence."

Buikstra's work on understanding those cycles of human existence continues to set standards in scientific and scholarly circles.

Thinking Machines

Professor of Computer Science George Luger discusses the link between machines and intelligence.

by Robert Julyan

Architectures, by Thomas Barrow.

As George Luger sits at his desk in his Computer Science Department office, over his shoulder hangs a poster of the famous statue by Auguste Rodin, The Thinker.

Not a bad image for a computer science professor with appointments in two other departments, linguistics and psychology, and whose textbook on artificial intelligence (AI) is an international best seller in its field.

But the Rodin statue is made of brass, not flesh and blood. That makes The Thinker even more appropriate, because much of Luger's research is about the "thinking" of non-human agents, made of metal, plastic, silicon, and other non-organic components; in other words, computers.

The idea of linking computers and intelligence makes many people uncomfortable – remember the chilling line from Hal the computer in the movie 2001: A Space Odyssey, "I'm sorry, Dave, I can't let you do that."? But in reality, thinking machines already exist that are telling us what to do, and what not to do. For example, computers are the primary pilots on airplanes today – and we're safer for it. Physicians use AI-based programs to take patient symptoms and then work towards making a diagnosis.

Besides, Luger says, we humans run programs hundreds of times a day far more complex than current computers' abilities: we communicate.

"Human language is so amazing; it responds to the needs of an agent within its societal environment." And because of the all-but-infinite variety of societies and environments, language is both intricate and complex beyond our imagining.

Not that people like Luger don't try to figure it out.

What we discover when we try to devise a computer that can approximate speech, he explains, is that in our language – and in our minds – are embedded definitions and assumptions whose existence we don't always appreciate. For example, we assume that we exit a room through a door, but in fact we could also exit through a window; we simply assume windows are for something else.

Luger emphasizes that language must be understood not as a uniquely human attribute – and not solely as vocalized speech. A monkey's grunts, squeals, facial expressions, and arm gestures are all part of monkey language, just as facial expressions and gestures are part of human communication. "Monkey language, while not like human language, is the glue that holds their society together," he says. To further understand this, Luger and his colleagues have received a four-year National Science Foundation (NSF) grant to study primate and human communication.

Luger pursues his diverse interests through numerous projects funded by NSF, NASA, the U.S. Navy, and Sandia National Laboratories. One of these interests is computational psychology, with an emphasis on cognitive psychology. Cognitive psychology includes the analysis of human problem- solving skills in interacting with the environment. These skills include perception, game-playing, and learning, among many others. Luger, along with Professor Emeritus Peder Johnson of the Department Psychology, began the Cognitive Science program of studies at UNM in the early 1980s. Their book, Cognitive Science: The Science of Intelligent Systems, explores the computational approach to understanding cognition. "The role of neurological processing in cognitive domains is also critically important, especially now," says Luger. "Our current generation of neuroimaging techniques supports a new understanding of human processing that was simply unavailable earlier."

Keith Wiley, one of Luger's doctoral students, knows very well how difficult it is to transfer human understanding to machines. His research focuses on getting a group of robots to do something as simple as exploring and mapping an unknown environment.

"One of the biggest difficulties is common sense. A robot doesn't have common sense," says Wiley. "You tell a robot to get out of a room, and it doesn't know to go out a door because it doesn't know what a door is about. We can give robots sensors, but we are not good at telling robots how to interpret their senses."

When scientists like Wiley use the term "robot," they don't mean ambulatory shiny metal entitities resembling R2D2 in Star Wars. "There are very few physical robots around," says Wiley. Rather, because robotics is a subset of AI, most research is done with computers.

In describing his own research, Wiley asks people to imagine tossing some tiny robots into a room and then observing them as they find their way around. Each begins drawing a map of what it encounters, and when the little "geobots" meet, they share their maps, like bringing together tiles to form a mosaic.

This is more than just an academic exercise, says Wiley, because this might be how scientists will explore Mars or other unknown environments. A network of many small robots would weigh less and may be less vulnerable to breakdown than one large robot. Wiley sees his research having applications in disaster relief, because robots rather than humans would be sent into harm's way.

But the current and potential applications are vastly more far-reaching than these examples, so much so that Wiley predicts, "I think robots will change how the world works. Everybody will be using them."

Actually, artificial intelligence is already pervasive in our world – ATMs, sophisticated cell phones, automating booking and billing agents, and much more.

Kshanti Greene, a graduate student in computer science, is conducting research with funding by NASA. The goal of her research is to automatically interpret signal patterns in deep space. Because of the long delay times in communicating with Earth, space missions must be able to detect and interpret signals without the intervention of human experts. For example, if the electronics system of the space probe has to be temporarily shut down because of possible shock from intense solar flares, the decision to shut down will have to be made quickly, without time for analysis from Earth. This is where AI can come in.

Dan Pless, another one of Luger's Ph.D. students, has created a new first-order stochastic (probabilistic) logic-based computer language that supports diagnostic reasoning. It is based upon stochastic modeling, which has become an important representational tool because stochastic parameters can capture most interactions in the world, including cause and effect relationships. And the language being logic-based means that it is also good for capturing relationships. For example, when a system using the language is presented with data about a fault in the system, the system responds with a list, with probabilities, of most likely causes. The user then can evaluate possible causes of the fault by asking the system for related facts. The U.S. Navy is currently supporting this probabilistic modeling research, and several new Ph.D. students, as they test this language in the domain of fault detection in helicopter gear boxes.

Luger is quick to point out that humans remain critically important in the application of AI technology.

"We spend hours with the human experts, taking their diagnostic skills and putting them into these stochastic models," he says. "We really are dependent on the human expert."

Luger rejects the idea that intelligence is a single absolute quantity.

"Intelligence exists in a variety of situations," he says. "The Stanford-Binet IQ tests [the well-known IQ tests] just measure things that correlate with human skills, especially those related to educational success." There is also "conditioned intelligence," based upon training. Thus a physician's intelligence is different from a computer scientist's, an American's is different from a Kenyan's, and a human's is different from a machine's.

The notion of linking computers to intelligence still evokes in many people images of a nightmarish world controlled by machines. Luger doesn't quite scoff at this, but he says that computers acting too much like humans really isn't an issue.

Yet he is aware that a powerful and pervasive technology such as AI carries with it social costs and risks. Assigning certain tasks to machines will affect human workers. Technology changes society, often in unforeseen ways.

"One of our greatest responsibilities is to be ethical. It is the scientist's responsibility to design technology, and society's responsibility to use it appropriately."

Amid the clutter surrounding Luger's office computer is a CD by the legendary jazz man, Miles Davis. Humans don't have to worry. What computer could play like that – or appreciate such music?

Pushing Boundaries, Blending Borders

The Arts of the Americas Institute has an interdisciplinary approach to promoting understanding of the arts in the western hemisphere.

by Laurie Mellas Ramirez

Photo of Poncho Sanchez and his Latin Jazz Band during a workshop at UNM. Photo by Mario de la Huerga.

Focusing on Native American, Latin American, and African-American cultures, the Arts of the Americas Institute (AAI) in the University of New Mexico College of Fine Arts engages the talents of artists, scholars, and students in a variety of creative endeavors. Virtual museums, multimedia performances, film documentaries, lectures, Internet projects, workshops, and concerts are just some of the activities of the Institute that stretch the imagination.

Recent projects include "Cyber Sovereignty: The Tribal Virtual Network (TVN)," a collaboration with UNM's Center for High Performance Computing. A broadband infrastructure with very high-quality images and sound was developed to serve a consortium of geographically divided American Indian tribal cultural centers. This project uses an "access grid," which facilitates exchanges of virtual collections, distance education on the business of art and productions, training in curatorial practices, and tradition-sharing. A $1.6 million Department of Commerce grant is funding the project.

Related to TVN is the Native Americans and Culture Centers project funded by the National Endowment for the Humanities to support exchanges within the consortium. Workshops and professional training for museum staff were held at each of five consortium sites.

The National Endowment for the Arts funded The Virtual Museum, allowing the Jicarilla Apache Cultural Center and A:shiwi A:wan Museum and Heritage Center at Zuni Pueblo to purchase the resources to digitize images for the National Museum of the American Indian.

Music and performances are integral to the Institute's mission. Director Steven Loza, Professor of Music at UNM, hails from the University of California at Los Angeles, UCLA. He and Associate Director Maria Williams are both ethnomusicologists. In 2002, AAI invited Poncho Sanchez and his Latin Jazz Band to campus. Workshops and a downtown concert led to a documentary project, funded by the UNM Center for Regional Studies. AAI and the Center are also collaborating on a History of Latin Jazz six-part documentary series intended for national broadcast on PBS.

Another collaboration between AAI and the Center for Regional Studies is a docudrama on the late New Mexican actor and musician Al Tafoya. The film recounts Tafoya's ambitions enacted by a distinguished group of Hollywood Latin artists.

"The portrayal of Al Tafoya permits us the opportunity to reflect on Latin Hollywood from a different and refreshing perspective," says Loza, who continues to work closely with UCLA colleagues.
In spring 2004, AAI and UCLA are jointly hosting an international research conference called "Towards a Theory for Religion as Art: Guadalupe, Buddha, Orishas, and Sufi." Mexico's renowned contemporary composer, Arturo M_rquez, is composing a symphonic tone poem based on the Guadalupe cult and religious belief for premiere by UNM and UCLA orchestras. Conceptualized and developed within an interdisciplinary framework, the conference provides the opportunity for scholars and students from the arts as well as the social sciences, humanities, physical sciences, medicine, and law to be involved.

Says Loza, "By creating networks and significant programs with local and international communities, AAI enhances intercultural understanding and compassion among diverse cultures, age groups, social classes, and ideologies representing the human experience."

Spanish, English, or Both?

Rena Cacoullos is working toward dispelling the myths about the mixing of languages.

by Frank D. Martínez

Photo by Michael Mouchette.

It's as common, colorful, and flavorful as red or green chile in New Mexico – Spanish phrases peppering English sentences, Spanish words adding spice to English words, or vice versa, in informal conversations taking place *cada día por todas partes* of the state.

But is this wrong? Is this incorrect usage of one or both languages? Not in *Nuevo Mexíco*, says Rena Cacoullos, University of New Mexico Assistant Professor of Spanish and Portuguese.

"Everyone has an opinion about language – parents about the speech of their children, teachers about their pupils, monolingual speakers about bilingual speakers – and most of these opinions are negative," she says. "Under labels such as 'Spanglish' or '*Pocho*,' the Spanish spoken by bilingual speakers in New Mexico is often criticized as corrupt and inferior." Such criticism, she adds, "is destructive, since it leads to stigmatization not only of the linguistic forms, but also of the speakers who use them."

Cacoullos has been conducting sociolinguistic research to determine whether there is evidence to support negative assessments about the everyday language used by bilingual speakers in New Mexico. Ultimately, she hopes her work might help improve the state's education system.

In her research, she used a variety of databases, including the 2000 Census that provided information about the presence of bilingual speakers (Spanish/English) in New Mexico. "With actual speech data and information from the databases we tested the claims about bilingual speech. We were aided in this by the New Mexico-Colorado Spanish Survey, a mammoth corpus of thousands of hours of recorded everyday speech housed at UNM, recorded in the early 1990s under the direction of Garland Bills and Neddy Vigil," both faculty members in the UNM Department of Spanish and Portuguese, she says.

In the recordings, English-origin and Spanish words are mixed in spontaneous discourses. "For example," says Cacoullos, "one Bernalillo woman, who was explaining how she is a perfectionist, said, 'I'd wash the floor *de rodillas y le daba* wax.'" The sentence begins in English, is followed by the Spanish words "*de rodillas y le daba*," or "on my knees and I'd give it," and then ends with the English word "wax."

"These multiword fragments are clear examples of what linguists call ‘code-switching,’ the juxtaposition of sentences or sentence fragments from two languages, each of which follows the grammar of the language providing the words. Contrary to the widespread view that sentences like this indicate confusion and haphazard mixing of two languages, linguists have demonstrated that code-switching is highly constrained by the linguistic structures involved and entails a high level of ability in both languages," Cacoullos explains.

She distinguishes code-switching from lexical "borrowing," which, she says, "is a different manifestation of language contact. ‘Loanwords,’ words that are borrowed from other languages, are completely integrated into the grammar of the recipient language. Some of the loanwords in the corpus have Spanish equivalents; for example, people sometimes say sute for ‘suit,’ but also *traje* or *vestido*, while other loanwords have no native alternative, for example, f£tbol or rifle.

"The processes involved in borrowing and code-switching are distinct – the former involves recourse only to the grammar of the recipient language, while the latter employs the grammars of both languages," Cacoullos says.

However, the use of the solitary English word "wax" to end the sentence is not so readily explainable. "When New Mexican bilingual speakers use a single word from English in their Spanish, are they code-switching to English (inserting an English structure) or are they borrowing English-origin words – integrating them instantaneously into Spanish grammar? Another possibility is that no grammar or logic are involved at all and that words from the two languages are just thrown together spontaneously, neither proper English nor proper Spanish," she says.

To determine whether Spanish grammar, English grammar, or neither is at work, Cacoullos’ research identified "conflict sites," areas where the two grammars do not coincide in the use of articles such as "*el*/the" and "*un*/an."

An example of a "conflict site," she says, is the names of occupations. In English one would say, "he was a teacher," but the Spanish equivalent would be "fue maestro," with no article.
"To settle the status of contentious linguistic forms, we uncover their variable patterns of use," Cacoullos says.

"Ultimately, we found that when bilingual speakers use single English-origin nouns they make them grammatically Spanish. Linguists call these ‘nonce loans,’" she explains. New Mexican bilingual speakers, and other bilingual speakers, integrate single words of English origin upon using them in their Spanish discourse.

"So when members of bilingual communities in New Mexico say something like, ‘*cuando era* teenager,’ they are using ‘proper’ Spanish grammar," Cacoullos says.

And therein lies a valuable piece of information for the state’s educators. "Sociolinguistic research shows that negative opinions about bilingual speech are not empirically grounded in improper grammatical coherence or expressive clarity. This understanding can help us as

educators, often well-intentioned but sometimes ill-informed, not become accomplices to stigmatization. With understanding, we can contribute to dispelling at least the linguistic component of social inequality," Cacoullos notes.

Cacoullos, who has lived in Arizona and New Mexico, learned to speak the "local" Spanish. "My Spanish wasn't book Spanish. It was local Spanish. I realized when I came to study at the university that local Spanish was looked down on, so I became very interested in exploring why people think that and whether or not it is really inferior."

She also realized that people talked "about the problems with Spanish, especially with respect to education." The misperception, she says, "is that the Spanish children speak, the Spanish of their grandparents, is not real Spanish, is not good Spanish – and people use terms like 'Spanglish,' to describe it, which is often derogatory."

She also noticed that some educators held such views. "It surprised me to realize that there is such a thing as linguistic prejudice. We're used to thinking about racial prejudice, but the fact is we do make judgments about people as soon as they open their mouths.

"In education that's very pernicious because even though the intention isn't there, teachers often make assumptions about children's intelligence based on how they speak," Cacoullos says. It is possible that some children may have been put into special education programs or learning-disabled programs simply because they were bilingual and mixed their English and Spanish. By dispelling the misperception that code-mixing is linguistically inferior, Cacoullos hopes her research findings are heard loud and clear, in both *español y* English.

A 220,000 Acre Scientific Instrument

The Sevilleta Long Term Ecological Research Program has grown to become a world-class research facility.

by Larry Walsh

A prescribed burn set by the U.S. Fish and Wildlife Service at the Sevilleta National Wildlife Refuge. Photo by Scott Collins.

There is literally a roar as fire rushes across the dry grassland. Shrubs explode like roman candles and the grasses crack as they are transformed into clouds of smoke and heat. The world shimmers, as the Sevilleta National Wildlife Refuge (NWR) burns. But rather than rushing to put out fires like this one, the U.S. Fish and Wildlife Service is now setting them.

"Starting prescribed fires and letting natural fires burn, rather than suppressing them immediately, represents a 180-degree turnaround in the management practices for public lands," says Jim Gosz, University of New Mexico Professor of Biology. "The use of fire as a management tool is a national trend, but the Sevilleta Long Term Ecological Research Program (LTER) helped change local knowledge and practices."

Understanding the role of fire in the Southwest is one of the major accomplishments of UNM's Sevilleta LTER Program. Since its creation in 1989, other significant advances include the breakthrough work on the ecology of the sin nombre strain of hantavirus, which the National Science Foundation (NSF) called one of the 50 most important discoveries it has ever funded. Research at the LTER has also led to a series of profound insights into the dynamics of New Mexico's climate – its cycles of severe drought, and its complex interaction with life itself.

Early in the history of the Sevilleta LTER, researchers camped out in tents. Photo by Robert Parmenter.

The greatest feat of all, however, may be the creation of a world-class ecologic observatory. UNM researchers have transformed the Sevilleta NWR into a 220,000-acre scientific instrument that is revealing the interactions of life, land and water in New Mexico. These researchers' observations will help determine the state's – and the Southwest's – economic development, urban planning, agriculture, quality of life, and environmental preservation.

Yet the very existence of the Sevilleta LTER was serendipitous. In the mid-1980s, Jim Gosz was serving a tour of duty at NSF when he heard about a competition to add more sites to the national LTER network, which is a group research sites studying long-term ecological phenomena. He remembers, "I can back to UNM and started looking around New Mexico for a site. We looked at number of possibilities, but the Sevilleta NWR was the most interesting site in the state.

Located between Belen and Socorro, the Sevilleta NWR is the junction of four biomes (distinct ecological communities of vegetation and animals in a particular climate): the Great Plains Grassland, the Great Basin Shrub-steppe, the Chihuahuan Desert, and the Montane Coniferous Forest. The transition zones between these major biomes could be used to detect long-term climate changes. For example, the desert moving north or the retreat of the forest farther up into the mountains might be an indication of global warming.

In its first year of existence, the Sevilleta LTER was more a vision than a research facility. Clifford Dahm, UNM Professor of Biology, says, "We lived in tents. There was nothing there in terms of a field station."

"There were some individual research projects going on in the Sevilleta NWR at the time, but there wasn't any organized research," adds Gosz. "No weather stations, no instruments, no satellite photos, no databases, not even a land survey."

Fortunately, the scientific potential of the Sevilleta was recognized by then-UNM Provost Paul Risser, a respected biologist in his own right. "Risser played a pivotal role in developing the Sevilleta's infrastructure – he invested in the project," Dahm explains. This initial investment in turn attracted other funds, which over the years have helped to create a world-class research facility.

The quality of the facility and research programs have brought over 200 researchers from other states and countries and, perhaps more importantly, other disciplines. The Sevilleta LTER has become a multidisciplinary think tank of not only biologists, but also geologists, medical researchers, climatologists, economists, planners, agronomists, and educators.

"The Sevilleta LTER was a small research idea aimed at one group of people in one department," says Terry Yates, UNM Vice Provost for Research and Professor of Biology. "Now it has expanded to become a resource for the entire university, the region, the state, and the nation. It shows how one idea can mushroom from tents and trailers to something big."

And it is scheduled to get even bigger. In addition to the U.S. Fish and Wildlife Service's recently completed 8,000-square-foot visitor's and education center, the LTER is planning an 18,000-square-foot laboratory. "The expansion will allow us a much more sophisticated response in understanding ecological processes from genes to geology," reports Robert Parmenter, UNM Associate Research Professor of Biology and Preserve Scientist for the Valles Caldera Trust.

"The new lab will also increase our educational capacity. We are training a future generation of scientists," Parmenter adds. "Scores of undergraduates have benefited by being directly involved in the research at the Sevilleta, as well as dozens of graduate students and post-docs. We now also have a public school educational program."

Beyond conducting research, the Sevilleta LTER has benefited the people of New Mexico. In 1993, for example, there was an outbreak of a mysterious disease in the Four Corners area which filled the victims' lungs with fluid, resulting in a 50 percent mortality rate – second only to the Ebola virus.

Led by Fred Koster, UNM Professor of Medicine, a team of doctors rushed to identify the disease, and found that it was an unknown strain of hantavirus, which they named sin nombre – "no name." Realizing that rodents carried other forms of hantavirus, the medical research team turned to Terry Yates and the LTER researchers for help. They discovered that the deer mouse was the carrier of sin nombre.

Yates and his team were able to show that the 1993 hantavirus outbreak was the result of a rapid increase in the deer mouse population, which helped spread the disease throughout the mouse population and on to humans. "The winter of 1992-93 was particularly mild. There was a lot of rain, which promoted the growth of winter grasses. As a result, many more mice survived the winter than normal," he reports.

Understanding the ecological relationship of outbreaks of these types of zoonotic (animal) diseases led to statewide monitoring of the numbers of deer mice and their infection rate. Yates hopes that this system will reduce the severity of the next hantavirus outbreak by warning people of the danger that exists whenever deer mouse populations increase dramatically.

"The discovery of sin nombre was serendipitous," says Gosz, "but then serendipity is a big part of science. A lot of major breakthroughs are not the result of looking for them but come when you have the basic infrastructure and systems in place, like we did at the Sevilleta LTER." This groundbreaking research on infectious diseases was recently extended through a $1.7 million NSF grant to study the ecology of diseases endemic to New Mexico.

Another major contribution to the state has been the understanding of its climate and water resources. "Droughts come to New Mexico on a regular basis," reports Bruce Milne, UNM Professor of Biology. "Their impacts include regional insect outbreaks, wildfires, and tree mortality, as well as disastrous failures of agriculture, silviculture, and livestock production. But when we first started the Sevilleta LTER, we didn't know any of that."

The first indications of a regular cycle of severe droughts in the Southwest came from the studies

of tree rings by Julio Betancourt of the U.S. Geological Survey and Thomas Swetnam of the University of Arizona. Trees add a ring of new growth every year. More growth in wet years produces thick rings, whereas less growth in dry years results in thin rings.

Consequently, tree rings comprise a physical record of the climate stretching back hundreds of years. These studies showed the regular return of a severe, prolonged drought every 50 to 60 years.

Milne and Deana Pennington, UNM Assistant Research Professor of Biology, are studying the amount of moisture at the Sevilleta by looking at satellite photos of the grass cover every 16 days. In the satellite images each pixel represents a square kilometer of grass cover. "In 2000, zero percent of the pixels or cells showed signs of drought. By 2001, 20 percent of the pixels showed signs of drought. In 2002, the number had risen to 80 percent," says Milne.

While research seems to indicate that New Mexico entered another major drought in 2001, scientists are hesitant to make any predictions as to its length or severity, given the relatively short period of time for which historical data exists. However, as Julio Betancourt says, "there is no cause for optimism."

If there is any room for optimism, it is in the existence of the Sevilleta LTER. Research there is systematically revealing the complexities of New Mexico’s ecology – allowing us to better prepare to live in tune with its cycles of fire, pestilence, drought, and beauty.

A Look Into the Future

Several UNM professors make some educated guesses as to the futures of their fields.

by Ellen K. Ashcraft

Illustration by James Steinberg.

No one can predict the future, but UNM researchers can certainly make educated guesses. Faculty in five different areas have provided a glimpse into what the next 10 to 20 years may hold for their fields. Not surprisingly, most expect to see advances that relate directly to technology. More than ever before, high-powered computing is enabling them to process larger amounts of information faster, and that ability will expand as computer capabilities increase. Another common theme for the future is greater collaboration with others, be they fellow researchers, scientists in other fields, or those in the computer sciences. The following are some forecasts from UNM researchers.

Peter Fawcett, Associate Professor of Earth and Planetary Sciences, on Climatology

Amid concerns about global warming, climatologists have been working to understand past climate changes. Although the climate system has been stable for 10,000 years, during the past 100,000 years it was characterized by huge temperature and precipitation swings. Abrupt climate change – that is, 8 to 10 degrees Celsius change in mean annual temperature in three to five years – poses problems for society, for example, adapting to growing season and sea level changes.

Studies indicate that the climate is a globally interconnected system. Climate changes in New Mexico over the past 15,000 to 20,000 years correspond with changes in the Greenland Ice Core, at Yellowstone National Park, and in other parts of the northern hemisphere.

Researchers want to learn what drives abrupt climate changes, investigating how the ocean interacts with the atmosphere, the role of sun spot cycles, and El Niño. They use global climate and regional scale models, similar to those used by meteorologists, to simulate conditions that may have led to extreme fluctuations.

The next 10 to 20 years will include more sophisticated computerized climate system representations, increasing the knowledge of why climate shifts occur. In terms of global warming, understanding what drives these changes will yield better predictions of what the

climate will do in the future.

Mary Anne Nelson, Associate Professor of Biology, and Don Natvig, Professor of Biology, on Genomics

A genome is the collection of genes unique to a particular species of organism. In the past, scientists studied genomes one gene at a time. However, they can now analyze 10 to 20,000 genes, their "expression" (when a gene is turned on or off in a tissue or cell), and product interactions all at the same time. Using modern computer capabilities, researchers at UNM's eight-year-old Neurospora Genome Project are conducting this computational genomics work in collaboration with computer scientists.

Sequencing the entire genome allows researchers to develop better hypotheses and experiments so science can advance more quickly. Through genomics, scientists from various disciplines might study a single data set in terms of cell biology, cell architecture, and cell development.

For example, researchers are trying to understand how the functions of the non-pathogenic fungus Neurospora crassa can be applied to other fungi. Identifying and analyzing fungal processes will help scientists learn to control them – to stimulate the growth of beneficial fungi or to interfere with pathogenic fungi.

In the future, this knowledge may help control household molds, allergens, and plant pathogens that damage crops and cause famine. It may also give rise to new pharmaceuticals for treating annoying fungal infections like athlete's foot and yeast infections, or more serious infections that may be fatal to people with compromised immune systems.

William Bramble, Professor of Organizational Learning and Instructional Technology, on Education

A prominent focus in education today is how to integrate technology into curricula to best support education. That is, how computers and other information technologies can aid the process whereby a teacher transmits a finite amount of knowledge to students.

In the future, the process will involve redefining what education means in the context of vast amounts of information and easy worldwide communications. Rather than receiving information from the teacher, tomorrow's students will need to access information, evaluate its accuracy, merge it into an explanatory form, and then have schoolwork judged on the knowledge they can construct from this process.

As technology becomes faster, more compact, and less expensive, students won't be limited to a class period in a school's computer lab. Instead, they will have affordable individual handheld computers. Using these devices, they might read textbooks, download assignments, and transmit completed work to the teacher.
Technology will also lead to advances in distance learning, making education more available to

people no matter where they live. The result will be greater competition in higher education, among private sector and public institutions in the United States, and from foreign competitors.

William Miller, Distinguished Professor of Psychology, on the Treatment of Addictions

Over the past 25 years, researchers have come to better understand the many risk factors that may lead to addictions, including genetics, brain chemistry, and social networks. Today, addicted persons can benefit from many treatment options, including new medications. However, some of the most strongly supported methods for treating addictions aren't yet widely used. Psychologists at UNM's Center on Alcoholism, Substance Abuse, and Addictions (CASAA) are exploring the process of disseminating new, effective methods into community practice.

CASAA is the Southwest's research center for the nationwide Clinical Trials Network, funded by the National Institutes on Drug Abuse. CASAA works with seven addiction treatment programs in New Mexico. One of the Network's main purposes is to disseminate and test the most promising treatment approaches in community programs where these methods ultimately need to be applied.

The future will hold better integration of science-based psychological treatment with medications. Treatment will also expand beyond specialized programs, to serve people in the same settings where they receive healthcare, social, or correctional services – places where people often seek assistance with problems that arise from substance abuse. This in turn will increase awareness of substance abuse as a public health problem and promote earlier identification and intervention.

Kimberly Leslie, Professor of Obstetrics and Gynecology, on Disease Detection and Prevention Using Proteomics

Proteomics is a cutting-edge field that looks at the proteins created by genes. Mass spectrometry maps a thousand or more protein peaks in a pattern shared by patients with a particular disease. High-powered computing technology analyzes and compares the data with a control group, resulting in an algorithm that can predict disease.

In a year or two, proteomics will result in a screening test to detect uterine cancers in women before they have symptoms, and before the cancers become incurable. Proteomic screenings will have much greater accuracy than existing tests. In addition, proteomic screenings will eventually detect which endometrial cancer patients are at risk for recurrence, leading to intensive preventative therapies.

In the next 10 years, look for proteomics to identify new diseases and sub-classify diseases previously grouped together. Physicians will have new screening tests and new markers for outcomes. Through proteomic analysis people will have a series of blood tests and receive a profile of their disease risk.

In 20 years, expect specific therapies identified by proteomics. Medications will be tailored to each patient's individual biology and specific disease presentation. Nanomolecules will be developed to block specific pathways that control growth in a patient's tumor cells. One such nanomolecule is being tested now to fight endometrial cancer.

A Good Investment

Since 1983, the Center for High Technology Materials has conducted cutting-edge research, created jobs, and formed new companies.

by Robert Julyan


Photo of Steven Brueck by Michael Mouchette.

Between conferences and meetings, Steven Brueck sits in a small coffee room near his office at the University of New Mexico Center for High Technology Materials (CHTM), where he is director, and attempts to explain the principles behind nanolithography and why they're important. The difference between traditional fabrication of electronic components, says Brueck, and what researchers at CHTM are attempting is that rather than building materials only from the top down, they also are building them from the bottom up, one atom layer at a time.

Interesting, because creating both from the top down and the bottom up describes how CHTM itself has grown.

The top-down approach began in 1983 when the New Mexico Legislature, believing the state's economic future was linked to high technology, created five Centers of Technical Excellence. UNM was designated to create CHTM as one of those centers.

But it was not until 1985, the year Brueck joined CHTM, that the program actually began, from the bottom up, literally, in the basement of Tapy Hall on UNM's main campus. In 1986, the year Brueck became CHTM's director, the Center moved to the then-new Electrical Engineering and Computer Engineering building, and in 1997 moved to UNM's south campus Research Park and a new 60,000-square-foot facility.

Currently at CHTM are approximately 30 faculty members and 90 students working in offices and laboratories, and using molecular beam epitaxy and metal-organic chemical vapor depositon machines, used for the growing of crystals with atomic-layer precision. These researchers also work in "cleanrooms" necessary for fabricating devices out of the crystals.

Summarizing the Center's growth since the Legislature's initial decision, Brueck says simply, "We're a good investment."

Indeed, since 1983 CHTM has returned to the state – in the form of grants and contracts obtained, new companies formed, and new jobs created – approximately 10 times the original appropriation, including: five spin-off companies, such as SCB Technologies, Inc., and Zia Lasers, Inc., both with development and manufacturing in Albuquerque; external

funding that since 1983 has totaled $101 million; and cutting-edge research that has resulted in numerous patents being held by the Science and Technology Corporation @ UNM.

And much of this is based upon materials so small that only powerful electron microscopes can see them. Materials measured in nanometers – billionths of a meter, as small as a protein molecule, or a short strand of DNA. Materials such as "quantum dots." These are minute crystals comprised of just a few hundred atoms, small enough to be incorporated into living tissues, allowing researchers to examine life processes never before seen. The potential for medical and biological research is enormous, says Brueck.

But electronics still dominates CHTM's research, especially lasers and semiconductors. In 1988 CHTM was designated a Center of Excellence by SEMATECH, the international semiconductor manufacturers association that includes such giants as Intel. CHTM remains a major player in the endless quest for faster data transmission and smaller circuits.

"Moore's Law is far from dead," says Brueck, referring to the famous electronics dictum that says: "The number of transistors per integrated circuit doubles every two years." (Compare your first computer to your present one.)

Brueck glances at his watch. A very busy day. Yet he still exudes enthusiasm for such advanced topics as molecular beam epitaxy and vapor deposition, quantum wells and vertical-cavity surface-emitting lasers. For as he puts it, "If you're not excited, nothing happens."

A Better, Healthier Life

The Prevention Research Center is working with communities and families to help solve their healthcare problems..

by Cindy Foster


Photo of Sally DavisMichael Mouchette.

We've long known that risky behaviors such as smoking and lack of exercise can cause chronic diseases such as cancer, heart disease, emphysema, and diabetes. The physical, economic, and psychological costs of such diseases to individuals, their families, and their communities are huge.

Prevention researchers seek to identify what works best in changing behavior and the environment in ways that promote health and prevent disease. What better way to do so than to involve, from the beginning, the people directly impacted by the research?

Today, every research project within the Prevention Research Center at the University of New Mexico Health Sciences Center routinely incorporates the voice of the community. However, the practice of involving communities as partners in research has been one of the most controversial issues during the past 20 to 30 years.

For researchers and funding agencies, the questions surrounding such research seemed endless. How would a community's knowledge of a research project impact the project's outcome? Wouldn't involving the community, by definition, lead to a dilution of pure research? How are academic scientists to deal with such pragmatic, modern-day challenges as local politics or deciding which members of the community should be selected to participate?

"Solving those problems so that communities could become true participating partners is partly what drew me to the field," says Sally Davis, Professor in the Department of Pediatrics, Chief of the Division of Health Promotion and Disease Prevention, and Director of the Center for Health Promotion and Disease Prevention (CHPDP) in which the Prevention Research Center is housed.

"The entire idea of involving the community was controversial. There wasn't much written about the participatory community approach, but we knew this was the direction we needed to go – and it was the direction communities wanted to go," Davis says.

Davis had come to the UNM School of Medicine to develop a school health component to help pediatric residents understand the world their young patients inhabited. In pediatrics, it is especially important to incorporate the family into the care of any patient. For instance, successfully changing a child's eating and exercise habits requires changing the habits of the entire family.

And as challenging as these projects might be in large metropolitan areas, there were different challenges in New Mexico, in rural areas, and especially in American Indian communities.

In the past, American Indian communities had suffered from the results of some research projects and were hesitant to participate in any further studies. Many felt exploited as academics made careers out of studying American Indians without giving anything of value back. Yet the community members, like parents, still wanted a better, healthier life for their children.

After Davis received a large grant from the National Heart, Lung, and Blood Institute, teams of researchers began working under her direction around the state. One of the biggest benefits, they realized, was that people in the communities saw UNM as being unbiased.

"There is a neutrality people recognize when your focus is on the health of families and kids," she says. "Once schools and communities became aware that resources were out there, they began to approach us to ask if we would be involved in local health programs, especially in the schools."

Another key to success was recognizing that the programs had to be specifically tailored to each community's needs.

"It's important, before working with communities, to determine how the potential results of the study will benefit the communities, and to respect the beliefs and customs of the people," she says. Equally important is holding feedback sessions afterward so that people can know what has been learned.

"Ultimately, if you are going to be successful, you must work in ways that connect with a community's knowledge, attitudes, and values," she says.

Davis is adamant that research must meet high standards. "We turn down opportunities all the time because we don't think it's good science. To do otherwise would dilute our role and compromise our relationships with the communities," she says. "You have to design research that is rigorous and solid and meets the needs of the community."

The mid-1990s saw the initial funding of the UNM Prevention Research Center. Today, it is one of 28 centers in the nation funded by the Centers for Disease Control and Prevention to conduct innovative health promotion and disease prevention research, and is the core of CHPDP.

At any given time, there are 55 to 65 people employed by the Center and 12 principal investigators in charge of research project grants. A generation of researchers at the Center has trained by participating in prevention research at UNM and within communities around the state. Research projects have included topics such as preventing obesity and diabetes in school-age students and understanding the "functional values" of tobacco for New Mexico

American Indian adolescents, meaning the social and cultural values that these youths attach to tobacco use. Another major initiative is the study of the utilization of research in practice and policy. Two new upcoming studies include smoke-free families and diabetes prevention in middle-school-aged children.

The next step, Davis says, is working with communities to increase skills needed to advocate for the health issues that are important to them as they deal with local, state, and federal governments. While this is a new direction, researchers at the Center have a foundation to work from: gather input, ask the community what is important to them, and then listen to their answers.

"You don’t compromise integrity, ethics, honesty, or management, and you don’t compromise the integrity of the community," Davis says. "It can be slow, it can be frustrating, but as trust grows on both sides it can develop into something rich and meaningful for all participants."

75 Years in the Making

The UNM Department of Anthropology celebrates its anniversary and fosters the future of anthropology.

by Terry Gugliotta

Photos courtesy of UNM Archives.

Since the founding of the UNM Department of Anthropology in 1928 by then-UNM President James Zimmerman and renowned anthropologist Edgar L. Hewett, the Department has attracted students and scholars from around the world.

Believing that hands-on experience was a major part of learning anthropology, Hewett established an archaeological field school in the summer of 1928 with sixty students. From that time to the present (except during a brief period during World War II), the field school has excavated and studied several important archaeological sites in New Mexico, including Jemez Pueblo, the ruins at Chaco Canyon, and the Pecos ancient pueblo ruins.

In the early years, the focus of the department was on the subfields of archaeology and the ethnology and linguistics of indigenous peoples.

"Not only – as the saying goes – does every Navajo family include an adopted anthropologist member, but all Native American groups of New Mexico have been among the most extensively studied of all American Indian communities," says Lawrence Straus, Professor of Anthropology and editor of The Journal of Anthropological Research.

"New Mexico is known to be anthropologically interesting and has set itself up as a cultural Mecca," says Regent's Professor Marta Weigle. "Students come here to study indigenous peoples."

In 1932 the Department opened the first public museum in Albuquerque, later named the Maxwell Museum of Anthropology in 1972. Today, the museum exhibits a broad range of materials representing the history of humankind, an emphasis on the Southwest, and holdings from cultures throughout the world.

Along with the University, the Department fell victim to the Great Depression of 1929, but in 1935 Zimmerman and then-UNM Comptroller Tom Popejoy managed to obtain WPA funding

for the University. Anthropology received money to study New World cultivated plants and Navajo material culture and mythology, among other subjects.

Professors and students in the Department include names that are part of the cornerstone of anthropological research in New Mexico: Reginald Fisher, Marjorie Ferguson Tichy, Clyde Kluckhohn, Kenneth Chapman, Florence Hawley Ellis, Donald Brand, Frank Hibben, Leslie Spier (founder of the Southwestern Journal of Anthropology, later named Journal of Anthropological Research), Lewis and Sally Binford, Louise Lamphere, Jeremy Sabloff, and Alphonso Ortiz, among others.

Throughout the years, the areas of research within the Department expanded to include biological anthropology and human evolutionary ecology.

Currently, UNM anthropology professors represent all subfields and conduct research around the world. UNM professors are now practicing a more inclusive approach to their subjects. This approach, called public anthropology, seeks to involve communities in preserving their own histories.

"Anthropology has moved from cataloging people and artifacts to engaging with people as equals," says Carol Nagengast, chair of the department.

Weigle agrees, "We participate with community members and bridge the academic with the community – giving them a voice."

As the Department of Anthropology celebrates its 75th anniversary, one of its goals is to create an endowment for graduate students. Says Nagengast, "we have some of the finest students in the nation and they deserve our support, they are the future of anthropology."

The Biologist's Dream

Howard Snell, UNM Professor of Biology and Director of Science at the Charles Darwin Foundation, works for the conservation of the Galapagos Islands.

by Russell Moore

Photo by Heidi Snell.

"I originally became a biologist because I liked to hike, to be outside. I liked to catch lizards," says Howard Snell, University of New Mexico Professor of Biology.

Photo of Howard Snell by Heidi Snell.

Since 1977, Howard Snell has been working off and on at the Cha Research Station (CDRS) on Isla Santa Cruz, one of the Galapago Ecuador. His jobs have ranged from volunteer – he started there w Peace Corps in 1977 – to the leader of the Department of Vertebra Monitoring, to his latest position as the Director of Science for the Darwin Foundation. Snell, the first appointee to the position, starte 2003 as part of a collaboration between UNM's Department of Bi Darwin Foundation. Snell spends the spring semesters and summe Research Station, and the fall semesters teaching at UNM.

In the past, while Snell and others were catching and studying liza CDRS researchers in the invertebrate, vertebrate, marine biology, programs were studying different animals and plants in the same h even when researchers' paths crossed, their research often didn't c team would work on a particular project independently and then re program leader.

But that wasn't the best way of doing things, says Snell. It didn't make sense for one group to spend time and money learning something essential to their research that another group knew but hadn't published yet.

Now Snell's work at the Foundation is more thematic, he says. As the Director of Science, he no longer investigates specific ecological questions, but oversees several research groups and tries to help them work with each other and find commonalities. Even if two research groups seem unrelated – the marine biology and the botany groups, for example – their interests are still linked, he says.

Though groups may study very different areas of the Galapagos, there's no such thing as an independent ecosystem. "Some problems are common to all areas of conservation biology," Snell

explains. While the same environmental change that kills marine iguanas on one island might not affect the sea life off the coast of another, any decline in biodiversity is certainly of concern to both groups. And when groups of researchers work together, larger patterns begin to emerge. This in turn can help scientists understand the Galapagos – and by extension, the world.

Snell's position also represents a conceptual change at the Charles Darwin Foundation. "Where before we were largely reactive – we'd see what was happening and then try to fix it – we now try to anticipate tomorrow's problems and prevent them," he says.

But some things are impossible to predict. In January 2001, the oil tanker Jessica ran aground and foundered in Wreck Bay, Isla San Cristobal, Galapagos. The resulting spill of about 180,000 gallons of diesel and bunker fuel soon dominated the lives of Snell and his colleagues.

"We designed a program to track the effects of the oil spill, and that took over our research for three months," Snell says. "We then prepared a report on the spill's effects and tried to predict its long-term impact...that took over a year."

The resulting report, published in January 2002, concluded that the ecological impact was not as severe as it could have been. However, Snell says, researchers have recently found that more Galapagos marine iguanas are dying – probably as a result of eating oil-contaminated algae, which could be killing the symbiotic microbes in their stomachs that help digest their foods.

In addition to its direct impact on the archipelago's ecology, there are indirect effects that may be even more threatening. "An outcome of the Jessica spill," Snell says, "is that it increased awareness of and plans for alternative energy uses in the Galapagos." That may seem like a good thing, but it isn't, according to Snell. Though the idea of alternative sources of energy is popular, he says, installing wind-driven generators would probably cause more harm than good. Not only would the generators need to be placed on the highest points of the various islands – which is some of the last available habitat for the endangered Galapagos petrel, a bird already known for flying into structures and dying as a result – but switching all electrical generation in the Galapagos from diesel to wind-powered would only reduce the amount of petroleum in the area by seven percent, Snell reports.

"That's not worth the risk," he says, but he and other scientists in the area do advocate switching to solar power. That's unlikely to happen any time soon, he predicts, because solar power is expensive to install.

The real challenge for conservation efforts is a sociological and political struggle, Snell says. "Conservation requires that we limit human activity. Limiting human activity is never a popular thing for politicians to be involved in...most political systems don't seek difficult problems to solve, they seek easy ones. And this [human impact worldwide] is not an easy problem to solve.

"Five years ago, I believed we could preserve the Galapagos in a near-perfect state," Snell says. "I've stopped believing that." He and his colleagues are sometimes frustrated with conservation efforts and research. "No matter how much research we do and how much we learn, our results don't have the role in government policy that would allow policy to promote sustainable activity.

"But, there’s always hope, and the Galapagos will always be a wonderful place," Snell says. However, it will likely change so much that in 15 years it will be a very different place than what someone sees today. "In the future, places that are relatively pristine will be extremely rare. As they become rarer, their value should increase, and I hope people will become more interested in protecting them," says Snell.

Snell expects that his current assignment will end in about 2006, and although he may spend less time in the Galapagos and more in New Mexico, he hopes some of his American and Ecuadorian students will continue conservation research at the CDRS, thus continuing the conservation biologist’s dream of achieving sustainable human activity on the Galapagos Islands.

From Card Catalog to Computer

The UNM General Library has experienced tremendous growth and change in how information is made available.

by Carolyn Gonzales

Photo by Michael Mouchette.

Where the card catalog once stood as both resource for and symbol of library access, computers now offer a gateway to a worldwide network of information, books, and journals. Along with the acquisition of computers has been a shift in the skills, knowledge, and methods librarians use to make information available – at the UNM General Library and in libraries worldwide.

New Mexico was still a territory when UNM was established in 1889, and a small library was part of the fledgling institution. Since the beginning the library has experienced dramatic growth, and in 1981 celebrated the acquisition of its one millionth volume. Then, in just over 20 years the collection doubled, reaching two million volumes in 2002.

Linda Lewis, director of collection management and resource acquisitions for UNM libraries, thinks it will take a long time before the library doubles its collection again. "Most of the boom in publishing now is in the mass market – popular fiction and how-to books. Not as much is being published in the academic arena," she says.

No one appreciates the advancements in library science and the rapid growth of library collections more than Lewis. Arriving at UNM in 1969 as assistant humanities librarian, she observed the integration of various library reference services departments into one department during the 1970s. In the late 1980s, she assumed leadership of collection management, and about five years ago resources acquisitions was added to her domain.

Dramatically changing information access is the Online Computer Library Center (OCLC), a worldwide computer library service used to locate, acquire, catalog, lend, and preserve library materials. It has increased information available on specific books

while reducing the time that libraries take to get books on the shelves. "We – and other libraries – used to have years of backlogged materials. Now an online record may indicate ‘item in process,’ and if it’s requested we can make it available in a few days. Previously we couldn’t even tell if it was on order," says Lewis.

The library subscribes to 8,000 print journals. "However, we make twice that number available to our users electronically," says Lewis.

Electronic access provides instant gratification to the student or professor when a journal’s full text is available. Nationwide, libraries are still trying to figure out how to balance print versus electronic access.
Lewis’ job has changed with the times. "No longer do I spend as much time deciding which volumes to buy, but rather I negotiate licensing contracts for electronic access to publications for the University," she says.

What hasn’t changed is the level of service provided by library staff and faculty. Some librarians have developed in-depth knowledge in the subject areas for which they buy materials. For example, people in the Center for Southwest Research have worked with subject-specific dealers to locate materials published by small presses that general book dealers don’t know about.

Although the way information is accessed and retrieved has changed, basic library service hasn’t. The most important interaction in the library is still between librarian and patron.

Far From Ordinary

Roxana Moreno is creating virtual, multimedia learning environments where teachers can sharpen their skills in dealing with diversity within the classroom.

by Larry Walsh

Movie stills of virtual classroom scenarios. Images by Arjun Urs

How do children learn? Is student gender a factor in learning? How does culture or ethnicity affect learning?
These are some of the basic questions that Roxana Moreno, Assistant Professor of Educational Psychology, is trying not just to answer, but also to translate into computer code. Her goal is to create a virtual, multimedia classroom where teachers can sharpen their skills in dealing with student diversity.

This task is far from an academic exercise, for in New Mexico, diversity within the classroom is not a goal, it's a fact. Over 50 percent of all public school students are Hispanic, 11 percent are American Indian, 17 percent are in special education, and 28 percent live in poverty.

"Teaching in diverse classrooms requires not only being knowledgeable in the subject matter and instructional methods, but also being able to process many variables for each student," Moreno says. "The complexity of the classroom environment constantly threatens to overwhelm teachers."

Creating a virtual classroom environment where educators can practice teaching a range of learners is the goal of a project funded by the National Science Foundation (NSF) that Moreno launched last year, titled "Bridging the Gap Between Theory and Practice in Teacher Education: Guided Interactive Virtual Environments (GIVE)."


Photo of Roxana Moreno by Michael Mouchette.

Moreno also received an NSF grant to study why American Indian a children under-perform white children in learning mathematics. This will provide many of the parameters needed to construct virtual clas Together, the projects total over $2.3 million, a remarkable amount for a young professor just starting her career.

But then, Moreno is far from ordinary. A motorcycle-riding vegetari Argentina, she first earned a B.S. in economics. Her interest in econ led her to learn programming in a number of computer languages. Ir she earned her law degree.

Her work with computers engendered an interest in artificial intellig she moved to Berkeley to study at the University of California (UC) allowed her to become a multimedia designer and consultant.

Soon Moreno's interest in artificial intelligence evolved into the study of human intelligence and how multimedia techniques could aid learning. This brought her to the UC, Santa Barbara, to study cognitive and perceptual science, where she earned a Ph.D. in psychology, and was awarded a prestigious NSF post doctoral fellowship.

"I started out giving talks, very theoretical talks on psychology, and then I got a taste of what it was like to teach in a classroom. I decided that I had to work in education," Moreno says.

Her investigations of multimedia learning techniques, coupled with working with students in schools around Santa Barbara with large concentrations of Hispanics, led her to study differences

in cultural and gender learning styles and how best to incorporate those differences into the design of multimedia programs.

For example, she examined how well students learned about the mechanics of lightning from a computer-generated animation with concurrent narration or with text. The subjects were asked open-ended questions to measure their understanding of the information.

When reviewing the answers, Moreno and her co-investigator, Richard Mayer from UC, Santa Barbara, discovered an anomaly in the answers to one particular question: "How do you decrease the intensity of lightning?"

"Over and over again, we found a significant number of females who did not produce any answers to the question, but rather wrote that it was not possible to alter nature," she reports. "In contrast, almost no males stated that it was not possible to alter nature."

Moreno suggests that gender differences may be attributable to the design of the question, rather than problem-solving abilities. "It is important to distinguish between the assessment of problem-solving skills and the assessment of communication styles."

In this case, the open-ended question was a factor. Open-ended questions seek to measure the students' understanding of concepts, whereas multiple-choice questions attempt to measure retention. However, understanding necessarily entails the integration of what was learned into the student's view of the world and his or her place in it.

"Consistent with prevailing sex-role stereotypes, women are more likely to think of themselves as being submissive and harmonious with the environment, whereas men are more likely to think of themselves as dominant and in control of the environment," Moreno says.

"It is clear that race, culture, ability, gender, or age may affect the mental schemas and the performance of the individuals and should be taken into consideration for testing-design purposes," she adds.

As more and more schools, teachers, and students are being judged on high-stakes tests, the implications of this research are critical, particularly as educators are increasingly dissatisfied with multiple-choice tests and are calling for alternative assessments, such as open-ended questions. Moreno's work demonstrates that open-ended questions have their own pitfalls.

The answer to this dilemma might lie in Moreno's design of the virtual classroom. While it will include models of a wide variety of student learning styles, it will also automatically adjust to the individual learning style of each teacher.
The ability of computer-based teaching to conform to individual needs may well replace the current "one size fits all" approach. Clearly Roxana Moreno is on the leading edge of this movement.

Collecting Dust

UNM graduate student Melissa Pfeffer traveled to the upper atmosphere to gather Leonid meteor dust.

By Steve Carr

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In the fall of 2002, University of New Mexico student Melissa Pfeffer boarded a KC-135 aircraft that is normally used to fly scientific missions. She flew in the upper atmosphere in an attempt to gather Leonid meteor dust left in the wake of the comet Tempel-Tuttle as it journeyed through the heavens above Earth.

Leonids are an astronomical phenomenon caused when earth annually passes through dust from comet Tempel-Tuttle. However, every once in a while the comet dust is unusually dense, producing more meteors than usual, providing scientists with the chance to gather more data.

“Every 33 years you have an enhancement of Leonid meteors,” says Professor Frans Rietmeijer. “Leonids are an annual shower. Every November you’ll see Leonids, but every 33 years, you get a storm.
“We don’t really know a lot about meteors. These showers come in and we make models of them, but because they have such a low density of particles it’s not really worth our while to go out and set up expensive equipment.”

Pfeffer has this opportunity because of an aerosol sampling device she created for her master’s thesis to study volcanic particles. Rietmeijer, one of Pfeffer’s instructors in the Department of Earth and Planetary Sciences, was trying to figure out an effective way, along with Peter Jenniskens, of the SETI Institute, to capture the dust when he thought of Pfeffer’s instrument and asked her if she would like to work on the project.

“Dr. Rietmeijer asked if I would be interested in modifying the device I developed to attempt collection of meteoric dust—and I jumped at the opportunity,” says Pfeffer.

Pfeffer had a great deal of preparation before the flight in order make sure the devices would be an effective dust-gatherer. The dust collector consisted of a hollow tube that was rotated from within the airplane. Inside the tube were sampling grids. When the tube was rotated towards the front of the plane, the grids were exposed to any particles that the plane flew through.

“It was very important to modify the sampling device so it could survive being outside a moving airplane and operated from within the aircraft without threatening the integrity of the plane,” she explains.
For this task, Pfeffer enlisted the help of Bob Macy, a research engineer from the UNM

Department of Earth and Planetary Sciences.

Flight preparations were conducted at Edwards Air Force Base/NASA Dryden, California, in the days leading up to the flight. Two airplanes took part in the scientific research dubbed the Leonid Multi-Aircraft Campaign (MAC). Several scientists were involved in the MAC project, installing their equipment on the airplanes along with Pfeffer.

Pfeffer's four dust collectors were mounted from the hull through a front row window port in the airplane. Despite prior testing, Pfeffer was unsure if the dust collectors would be effective. The dust collectors would prove to not only worke as well as she had hoped, but better than everyone had expected.

The flight from Edwards Air Force Base to Omaha, Nebraska was used to test the collectors during take-off and landing. Dust was collected in three stages of the MAC campaign: the Omaha to Torrejon, Spain flight; the return flight during the storm; and the flight from Omaha to California, when both storm peaks occurred in the atmosphere.

"We were hoping to collect meteoric dust from a known source, letting us analyze material known to be from the comet," says Pfeffer. "The dust is still being analyzed. It is possible that we collected particles related to Mount Etna, on the island of Sicily, which was erupting at the time of the flight."

More than 980 particles, identified by criteria including shape, color, transparency, and luster (properties determined by the Cosmic Dust Program), were collected during the different flight stages. Three different dust groups offered clues to possible particle origins.

The first most abundant group included particles that were transparent to translucent, light reddish brown to dark brown, had irregular thin flakes, and thick shards. These particles were determined to be natural and terrestrial in origin, meaning they were volcanic dust. The second group of particles were opaque with sharp angular flakes, had rods and needles, and had a distinct metallic luster and were determined to be anthropogenic in origin, meaning they were produced by human activity. The third group of particles were small, dull-dark, equi-dimensional, and spherical. If any Leonid dust particles were found, they would be tiny—approximately 10 micron spheres—with a unique composition high in titanium, aluminum, and calcium.

Models predicted only a slim chance for Leonid debris, traveling at 72 kilometers per second, to survive as collectible interplanetary dust particles. At that speed, they are the fastest moving dust entering Earth's atmosphere. Scanning electron microscope analyses conducted by Lysa Chizmadia, a graduate student in the UNM Department of Earth and Planetary Sciences, has identified 10 titanium-oxide spheres, showing that Pfeffer probably collected Leonid debris.

"The meteor shower was beautiful," says Pfeffer. "I'm lucky to have been able to see it from above the clouds. It was a lot of fun and I learned that new knowledge can be gained when scientists from different disciplines work together."

It's All in the Numbers

The UNM Health Sciences Center has experienced tremendous growth over the past 30 years.

by Lynn Melton

To describe how the University of New Mexico Health Sciences Center (HSC) has grown, some might say it's all in the numbers.

Thirty years ago, the HSC was a handful of employees and students occupying a few buildings; today the HSC occupies 2 million square feet, employs more than 6,000 faculty and staff, and has graduated more than 10,000 students. Research dollars acquired by the HSC increased from about $25 million in 1982 to more than $116.5 million in 2003. There were more than 130,000 patient days – a "patient day" being the unit of measurement for the length of stay for care – at UNM Hospital in 2002.

Indeed, statistics make it easy to describe the HSC as a growing, dynamic, energetic place. But to those who have inhabited it, its history isn't simply a tale of getting bigger – it's a story of becoming a widely recognized leader as a healthcare provider. Growth at the Center continues to spawn discoveries, programs and inventions that have profoundly changed the way people take care of their health.

Early in its development the HSC secured a prominent place in the history of radiopharmacy. When radiopharmacist Richard Keesee was looking for a place to start the country's first centralized radiopharmacy – that is, a place where radioactive drugs are prepared for distribution to healthcare facilities – in the early 1970s, he found an ally in former UNM College of Pharmacy Dean Carmen Bliss. The radiopharmacy at UNM, now closed, was the first in the country to be licensed by a Board of Pharmacy. The curriculum inspired by the radiopharmacy, one of just a few in the country today, has also produced numerous notable graduates who lead radiopharmacy companies nationwide.

In the 1980s, the HSC would lay claim to an important development in the management of diabetes. R. Philip Eaton (now Vice President for Health Sciences at UNM) and David Schade of the UNM School of Medicine teamed up with scientists at Sandia National Laboratories to implant an insulin pump in a 41-year-old Albuquerque man. Designed to mimic as closely as possible the human pancreas, the pump promised diabetics more control of their disease and

more freedom. While Eaton and Schade focused on the medical, clinical, and surgical aspects of the pump, their counterparts at Sandia applied weapons technology to its design. The resulting small device was programmable by an external device to deliver a variable dose of insulin based on what and when the person was eating.

In the next decade, the HSC made headlines during a scary time for New Mexico and the world. In early 1993, cases of a mysterious illness and deaths were referred to UNM Hospital and the state Office of the Medical Investigator. People suffered shortness of breath and other symptoms, many dying within a few hours or days. While the national Centers for Disease Control and Prevention took samples and ran them against every known viral agent, a team of UNM scientists led by Brian Hjelle also investigated the cases and went on to discover seven strains of hantavirus. The team also developed diagnostic tests by cloning pieces of the virus, and identified rodents as hantavirus carriers. They also discovered key steps in the development of the disease. Cementing their place in hantavirus history, Hjelle and his colleagues also developed the first and only deer mouse model for hantavirus infection, including the development of the first outdoor containment facility.

Today UNM Cancer Research and Treatment Center director Cheryl Willman is keeping the HSC on the map, working alongside Sandia researchers and UNM computer scientists to identify a gene that can predict how children will respond to leukemia treatments. The gene research has also prompted a new way of categorizing types of infant leukemia and theorizing about their causes. Willman, who is in the process of patenting the team's findings, conducted the research using a leukemia tissue repository at UNM. The repository is regarded as a valuable resource by scientists worldwide and contains samples from about one-third of all adults and one-half of all children in leukemia clinical trials.

While many discoveries and developments have made headlines over the years, many others have also defined the HSC as a leader in patient care, education, and research. For example, since establishing the New Mexico Tumor Registry in the mid-1960s, the HSC has become the primary national data source for cancer incidence among American Indians and Hispanics, two of the nation's largest minority groups. Efforts by the Center for Community Partnerships in the UNM School of Medicine to expose primary care residents and health sciences students to areas of need have defined the HSC as a nationwide model of providing healthcare to rural populations.

New milestones, it seems, are celebrated all the time. In 2003, as Lifeguard – one of the nation's first air medical services – commemorates its 20th anniversary, the HSC also celebrates receiving full funding for the National Institute for Environmental Health Sciences Center to study asthma, cancer, and other environmental health issues that impact the Southwest.

To imagine the future of the Health Sciences Center, numbers come in handy again – enrollments are up this year in the Colleges of Nursing and Pharmacy, and patient days, births, and surgeries are all on the rise at UNM Hospital. The campus is forecast to grow another million square feet in the next 20 years. And the future holds the promise of more innovations in patient care, education, and research, indefinable by numbers and bounded only by imagination.

Making A Difference

Roger Hagengruber works to educate in areas where technology is linked to security threats.

by Steve Carr

Photo by Michael Mouchette.

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Over the past 30 years, and dating back to his days as an undergraduate, Roger Hagengruber has built a career on his vision to make a difference in the world and serve the public interest.

So when Hagengruber became the first director of the Office for Policy, Security and Technology (OPST) at the University of New Mexico, it was a natural fit.

OPST was established in 2003 through a $1.25 million grant from the Lockheed Martin Corporation. OPST's misssion is to illuminate, investigate, and educate in areas where technology is linked to threats to national or international security. It was designed to create multidisciplinary approaches to a diverse set of issues in areas such as weapons of mass destruction, arms control and non-proliferation, terrorism and homeland security, and regional conflict.

"The vision was to create something special that would capitalize on the successes of past relationships between UNM and Sandia National Laboratories that involved collaborative projects, especially with the UNM Political Science Department," says Hagengruber.

"It was intended to forward the public service commitment of both institutions, as well as to become an instrument for growth opportunities at UNM. We hope that other organizations and institutions will support OPST and help expand the multidisciplinary research within the University and the larger community," Hagengruber says.

OPST facilitates policy studies, workshops and conferences, the development of specialized curricula, and collaborations between institutions and across disciplines.

Hagengruber recently retired as Senior Vice President for National Security and Arms Control at Sandia National Laboratories. At Sandia, he spent over 31 years managing nearly every area of national security activity – and is well known in the national security community.

As an undergraduate, he developed a diverse background in both social and physical sciences,

later earning his Ph.D. in nuclear physics. He was a physics professor at Western Michigan University in the early 1970s, before he moved to New Mexico. He has taken political science courses at UNM, and since 1975 has periodically taught a course in international conflict and arms control.

"The problems facing the world today, where technology and security are interrelated, are tough ones. Any new start-up office faces hurdles in obtaining recognition and funding. But the unique mixture of intellectual assets available in New Mexico offers the possibility that we can compete with the better-known think tanks and bigger universities by emphasizing a different approach," says Hagengruber.

"There are days when I think about the vision for OPST and realize it is a very powerful one that is as energizing as it is daunting."