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Quantum 2010

Research, Scholarship & Creative Works

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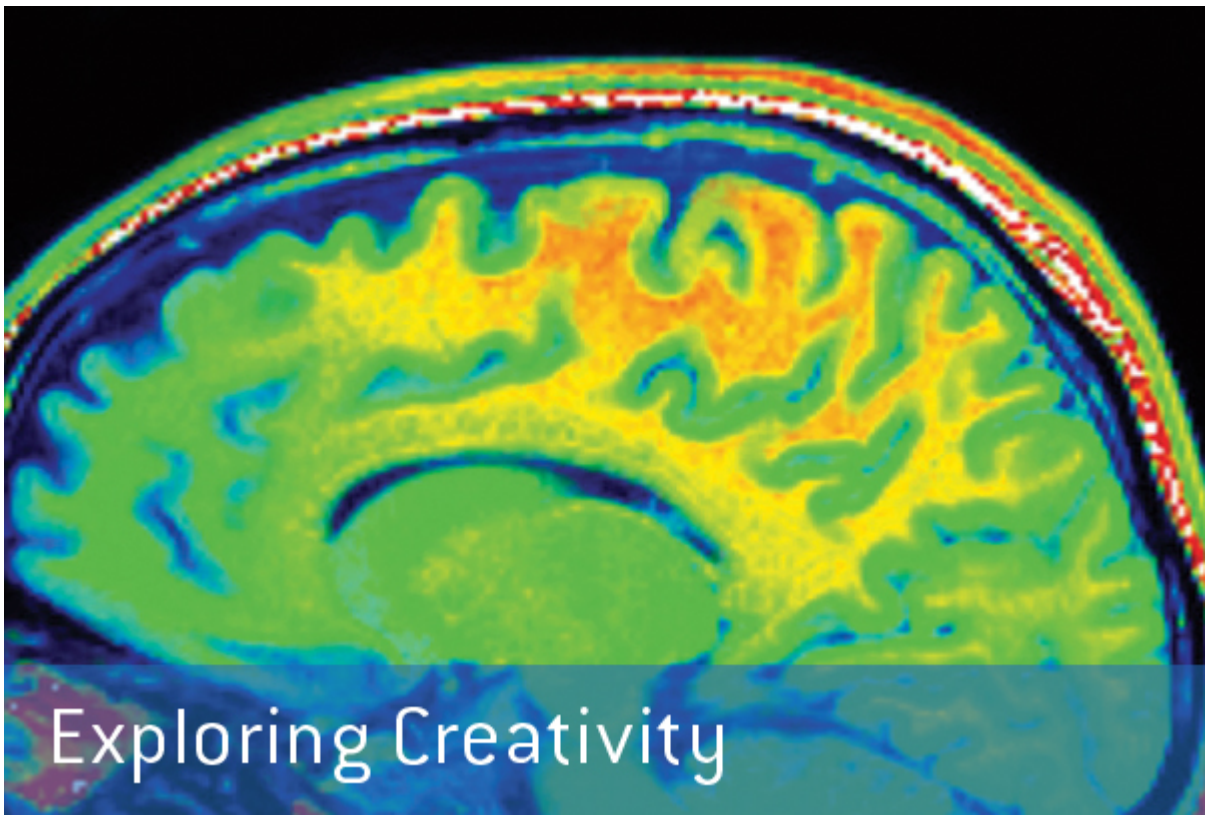


Neuroscientist Rex Jung uses neuroimaging to discover the origins and processes behind human creativity.

by Luke Frank

Imagine if your creativity had no limits. The possibilities of what you could conceive would be endless. Where might humankind be without the combined power of creativity, intelligence, and personality? Would we have gone to the moon?

For some, creativity seems to come effortlessly; for others it takes concerted effort. Rex Jung, an associate professor at UNM School of Medicine's Department of Neurosurgery and research scientist at the Mind Research Network (MRN), was awarded a three-year, $600,000 grant in 2007 from the John Templeton Foundation to investigate why creativity appears in different forms in different people.

A natural adjunct to Jung's widely respected work using advanced neuroimaging to study human intelligence, he now is making inroads to the origins and processes behind human creativity. "Can we locate creativity centers and networks in the human brain?" Jung asks. "Is human creativity domain-specific -- different for the visual arts, hard sciences, or mathematics -- or is there a 'creativity network' in the brain that applies across all disciplines?"

"There has been no systematic study of the neurological correlates associated with the creative process," Jung says. "Numerous individual studies exist, but we are attempting to get at the heart of how creativity is manifested in the brain of all people, in a coordinated manner. There are numerous and significant societal benefits to understanding and nurturing creativity."

Jung has begun and will continue to examine several distinct areas of research: How and where is creativity manifested in the brain? Are we all creative or only a special few? How can individual creative capacity be fostered and developed? Are creativity and intelligence linked in any meaningful way?

There are three distinct groups of people for Jung's research: visual artists, scientists, and "normal" control subjects. "We want to investigate groups of people who use their brains in a

more divergent, creative way on a day-to-day basis," Jung says, "as well as people who are using their brains in 'regular' ways. We'll use both structural and functional imaging to compare brain traits, like size, tissue volume and composition, chemistry and connectivity."

Understanding Creativity

The notion of "genius" has always brought to mind a highly intelligent, highly creative individual -- think of Leonardo da Vinci or Marie Curie. Only recently have researchers appreciated that human intelligence might involve strengths different from those that foster creativity. Jung has spent the last 10 years of his career studying human intelligence, and new questions beg his attention. Is there a line in the structure and/or function of the human brain that links creativity to, or separates it from, intelligence? Or do they overlap?

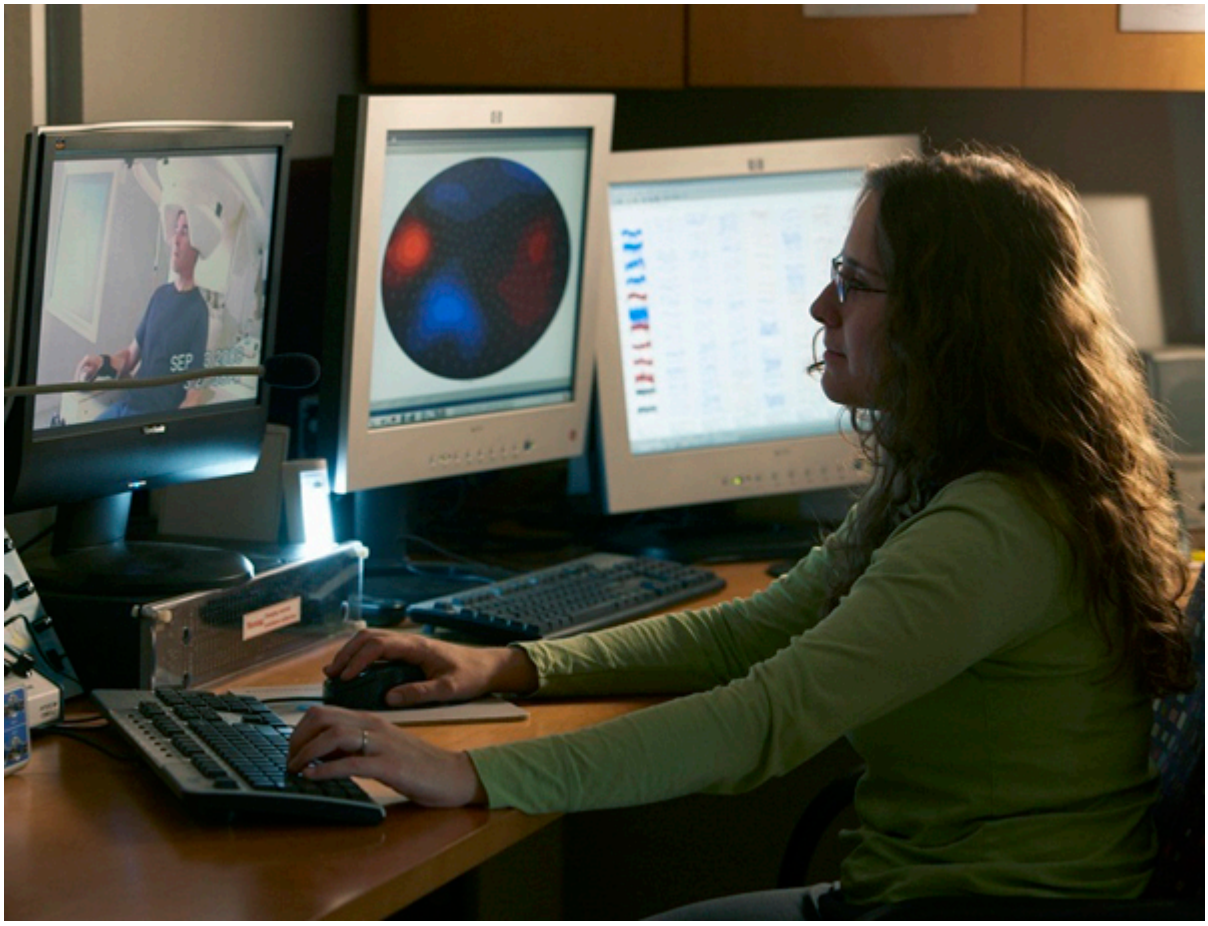
While intelligence is a highly adaptive quality of the brain, allowing us to solve problems in the environment quickly and correctly, Jung offers that creativity is the quality of human existence that allows us to modify the environment to our needs to make something new and useful. While this might seem like a subtle distinction, it has profound implications: one is more reactive while the other is invariably proactive.

"This is where personality factors really begin to play a big part in creative success, as an individual must push ideas forward, usually in the face of opposition from the environment," Jung explains. "Environmental constraints might include a lack of resources; societal constraints could be a lack of acceptance."

In the context of scientific discovery, creativity refers to the production of something both novel and useful within a given social context. "Essentially, creativity is the productive free-flow of ideas sufficiently structured to efficiently pinpoint a best solution," Jung says. "Where are the brain centers and networks that generate such creative productivity?"

The Neuroanatomy of Creativity

According to Jung, his would be the first study linking structural measures in the brain to psychometric measures of creativity in a normal, healthy cohort. He defined his initial research tasks as: administration of psychometrically valid and established measures of intelligence, personality and creativity to a large sample of healthy subjects; undertaking the first structural magnetic resonance imaging study linking constructs central to creativity to cortical thickness; and linking results to previous studies across neuro-scientific, behavioral neurology, and psychometric literatures.



More than one hundred University of New Mexico students were recruited and qualified for the study. They were asked to complete the Creative Achievement Questionnaire, an established measure of creativity that includes visual arts, music, creative writing, architecture, humor, scientific discovery, and four other measures. Subjects were also administered tests of "divergent thinking" -- extrapolating "new and useful" responses to common stimuli (e.g., name all of the creative ways you can think of to use a pencil). From these responses a score called a composite creativity index is derived. They also were scanned in a 3Tesla structural MRI machine.

Results were compared to brain structural measures, with the imaging focused on the cortical results. "We found in several discrete clusters an indication of decreased cortical thickness in relation to higher creativity," Jung asserts. "This network, however, was not limited to one lobe nor one hemisphere of the brain."

"These inverse relationships between cortical thickness and creativity measures speak to the possible importance of efficient information flow among brain areas," Jung says. "We believe that the generation of novel, original ideas is associated with less cortical thickness within frontal and specific posterior cortical regions."

Last year, the *Journal of Human Brain Mapping* reported Jung's initial research findings in a paper titled "Neuroanatomy of Creativity."

Positive Neuroscience

Jung's creativity research is part of the Positive Neuroscience Initiative at the Mind Research Network on UNM's North Campus, developed to address issues of mental health and individual differences in human behavior that provide positive benefits to society. According to Jung, Positive Neuroscience is the study of what the brain does well under the combined auspices of intelligence, creativity, and personality.

Jung has spent the past 10 years studying human intelligence; the last several at the MRN, one of the most sophisticated neuroimaging facilities in the world. Jung's imaging work with MR Spectroscopy, Diffusion Tensor Imaging, fMRI, and other technologies has revealed important differences in male and female cognitive processing that ultimately could affect mental health diagnoses and treatments, and prevention of brain injuries and diseases.

Recently, Jung and colleague Rich Haier, with the University of California at Irvine, introduced the Parieto-Frontal Integration Theory (P-FIT) of Intelligence, which identifies a very discreet network of gray and white matter in the human brain that predicts performance on intelligence tests. These two researchers believe that the P-FIT Theory will become the model on which future human intelligence research will be based.

"P-FIT is the first testable, physical model of where in the human brain intelligence resides, and what neural factors might result in improved cognitive performance," says Jung. "Intelligence is not located in one place in the brain, nor is it everywhere in the brain. It spans a very discrete but identifiable network."

Pinning Down Personality?

His initial work in human intelligence and current work in creativity could lead Jung down the path to exploring human personality, completing a personal trifecta in investigating Positive Neuroscience.

"Creativity is a critically important human undertaking, involving playfulness with ideas, potential risk of failure or rejection, and ultimately confidence in the underlying value of an idea to change others' lives in a positive way," Jung adds. "Humans find meaning in life when allowed to cultivate and express their individuality through creative outlets."

"Moreover, it's vitally important that we understand how the brain is put together and functioning well to understand what's happening when it begins to unravel," he concludes. "We need to know the brain's capabilities and limits in both a healthy state and in a diseased state."

For more information on the Mind Research Network and Jung's Positive Neuroscience research, visit: www.mrn.org

New research identifies specific combinations of ecological traits that may put some mammal species in greater jeopardy of extinction.

by Steve Carr

As the human population continues to grow and resource demands soar, biodiversity conservation has never been more critical. Researchers Ana Davidson, Marcus Hamilton, Alison Boyer, and James Brown in the UNM Biology Department, and collaborator Gerardo Ceballos at the Instituto de Ecologia, Universidad Nacional Autonoma de Mexico (UNAM), have studied extinction in mammals through multiple ecological pathways and published the findings in the *Proceedings of the National Academy of Sciences.*

The research represents an important advance and is vital to understanding the causes of extinction risk in mammals. It also goes beyond previous analyses on extinction risk by identifying specific combinations of ecological traits that cause some species to be at greater risk than others.

"One-quarter of all mammals are in danger of extinction and over half of all mammal populations are in decline, making it critically important for scientists to identify the characteristics of species that make certain ones at greatest risk," says Davidson.

Using a new database of nearly 4,500 mammal species, out of a total of more than 5,400 known mammals, Davidson and colleagues are using a novel methodological approach--decision-trees--to determine different pathways to extinction in mammals and provide simple rules of thumb that can be used for guiding conservation practice. They are discovering that extinction risk varies widely across mammals and that all kinds of mammals, across all body sizes, can be at risk depending on their specific ecologies.

Decision trees predict outcomes of interest, in this case extinction or survival, based on the nested relationships between predictor variables. The models are designed to identify non-linear, context-dependent associations among a suite of correlated predictor values. They require fewer assumptions and don't assume a specific distribution of predictor values. "Decision tree models offer an alternative to traditional methods for modeling complex ecological data and they are often more accurate for predicting complex outcomes like extinction" says Boyer.

In the research, they discovered that although large mammals are well-known to be at risk, 40 percent of all smaller mammals below 5.5 kg are also at risk of extinction. This was a particularly significant finding as 75 percent of all mammals are smaller than 5.5 kg. Yet, conservation efforts worldwide tend to focus primarily on large, charismatic species, such as jaguars, pandas, elephants, and polar bears.

Mammals with certain ecological traits such as small geographic range, low population density, slow life history, and large body size are known to be at risk of extinction.Davidson and colleagues have taken this knowledge to the next step by identifying how these kinds of traits interact to make some species at greater risk than others. For example, species with small

geographic ranges are known to have a proportionally greater risk than those with larger geographic ranges. Because it is not enough to estimate risk from a single variable, this study identifies how traits like the size of the geographic range interact with combinations of other traits such as reproductive rate, population density, and social group size to cause variation in risk.

Davidson and colleagues also have identified other traits not commonly thought to be important predictors of extinction risk, such as living in trees versus living below ground. These kinds of insights highlight the urgent need for more information on the basic natural history of most species, which is still poorly known even for the most well studied groups like mammals, yet, is essential to achieving conservation goals.

Unlike previous studies, Davidson and colleagues also identify what is "small," "large," "fast" and "slow" by providing a map of extinction pathways that include the ranges of trait values where species are at greatest risk. This map outlining the pathways to extinction in mammals provides tangible "rules of thumb" for conservation practice. Their model also provides lists of species predicted to be inherently at risk based on their ecologies, many of which are have not previously been identified as at risk.

"Since there is extremely limited funding for conservation, it is critical to provide tangible results that help conservationists prioritize their efforts, and that is a key goal of our research," says Davidson.

"This newer statistical approach is much better at extracting information than traditional linear techniques," adds Hamilton. "Many researchers are seeing the usefulness of this tool. It is less restrictive and more flexible, and allows ecologists to work with large, complex data sets."

Walter Putnam explores philosophical and literary attempts at understanding the human animal in the context of the larger animal world.

by Carolyn Gonzales

Walter Putnam, professor of Foreign Languages and Literatures, was hired at UNM to teach 20th century French literature. Giraffes and kangaroos don't generally come to mind when reflecting on the works of Marcel Proust, Jean-Paul Sartre, and Albert Camus. But, Putnam's early interest in European colonialism in Africa led him to go beyond French lit and look at the animal kingdom.

He developed a course, Zoophilosophy, where he and his students explore philosophical and literary attempts to locate, define, describe, and understand the human animal with respect to the larger animal world. He focuses on continental philosophers who have based some aspect of their thinking on animals: Nietzsche, Heidegger, Deleuze, Derrida, and Agamben, among the most prominent. Identity and ethics direct his thinking as he deals with issues of status and treatment of animals.

"I also like to devote some attention to the visual representation of the postmodern animal. This multidisciplinary approach allows us to gauge the range and richness of thought not only 'about' but 'with' the animal," he says.

The 21st century will be dominated by the question of the animal, Putnam learned at a UNM conference on the philosopher Derrida. But before looking at the current condition of fish, fowl, and furry friends, Putnam takes us back to a wilder, untamed world.

Putnam points out that Aristotle wrote the first study on animals, saying that what defines being human is in reference to what is animal. "Plato said that man is nothing but a 'featherless biped.' Greek philosopher Diogenes responded by fetching a plucked chicken and calling it "Plato's man," he says. Descartes, he continues, referred to animals as "soulless machines." "That set in motion two and a half centuries of how we view animals in the western world," he says.

Animals on Exhibit

On the way through Holland, Napoleon's armies sent back wild animals to join those liberated from the Royal Menagerie in Versailles in the French Revolution. "Menageries had been the privilege of nobles and the wealthy under the *ancien regime.* These private collections contained animals from Africa and Asia. The elephant couple sent to Paris were a source of fascination and raised questions about their nature, habits, and temperament."

"People didn't know what to make of them. The French put on a concert of classical music and even some revolutionary hymns to see if the elephants had a natural revolutionary tendency. They got the animals agitated. They wanted them to procreate, but the animals didn't," Putnam says. "Animals have often performed for humans, but this was a rare moment when humans actually performed for animals."

People flocked to see the elephants, not unlike how people reacted when President Nixon received giant pandas from the Chinese government, Putnam says. "Paris was the site of the first public western zoo in 1793, and it is still located on the banks of the Seine in the *Jardin des Plantes.* It was also a place of scientific research where Buffon, Lacepede Saint-Hilaire, and others invented the field of natural history," he says.

"In the late 18th and early 19th centuries, they became interested in observing and classifying the world's flora and fauna. Taxonomy emerged, and with it, the distinction between species in a great scheme invented by Linnaeus," he says. Mammal groupings, for example, included species as different as humans and whales, based on one common factor: lactation. "At the same time Rousseau was encouraging women to breast-feed, reflecting the importance of this practice, whether on land or at sea," Putnam says.

Plants and animals were sent from one part of the world to another for Western scientists and philosophers to understand.

"Greater international trade and shipping made it possible to send new and unusual animals from the far ends of the earth to Europe. Through global commerce, the animals were sent on ships," says Putnam. Then, in 1827, at the end of the Restoration Period in French history, a giraffe was shipped to France.

"Imagine, a giraffe hadn't been on French soil since the Roman Empire -- some 1,900 years. It was a diplomatic gift to Charles X, King of France from the Pasha of Egypt," Putnam says. "Two calves were captured, one for France, the other for England. The giraffes were brought up the Nile by boat and across the Mediterranean by ship -- they had to cut a hole in it to accommodate them -- and they were fed cow's milk."

Once in France, the giraffe spent the winter in Marseilles at the museum/zoo in the private garden of the prefect. Her promenades around town were attended by ladies who fed her flowers from their hats and flirted with her Egyptian keepers. (The giraffe destined for England died.) "A party then walked the giraffe from Marseilles to Paris, where the king met the giraffe on the steps of the palace."

Putnam wonders what French peasants thought in 1828 when, while plowing a field, they saw this bizarre animal coming over a hill. "Animals have always created that sense of wonder in people. It must've been jaw-dropping to see something that is not supposed to be there, but is," he says.

Is it curious, then, that the British sent out an expedition in the late 18th century to look for a unicorn in Southern Africa?

That same curiosity exists in people today. Many have searched for a giant squid that has the biggest eye of any being on the planet. "They have washed up on shore, but no one has captured one to put on display," Putnam says.

Zoos were popular public institutions in the colonial world and their popularity continues to this day. "Zoos have a larger attendance than professional baseball, football, and basketball combined," says Putnam.

Zoos educate and entertain. International trade in animals is up all over the world. Zoos are a source of public pride -- such as the Bronx and San Diego zoos. "There is an increased demand for animals to fill zoos, at the same time certain institutions such as the Philadelphia Zoo, are closing elephant exhibits and sending animals to refuges where they will live out their lives in happier conditions," Putnam says.

Zoos have also influenced people's perceptions of the world. "The African world is recreated and visitors assimilate what they see and believe that that's how it is in the real world, when in reality, many species in Africa don't inhabit the same regions," he says.

"Zoos justify incarceration because of endangered species and threats to their populations because of politics, economics or ideology," he says. The silverback gorilla is native to Eastern Congo, a region with some of the most fragile and interesting species on the planet. "The war, the most devastating since World War II, has deep colonial roots."

A scandal erupted around 2001 that centered on the mining of coltan, the colloquial African name for columbite-tantalite -- an ore used in cell phones, DVD players, video game systems, and computers. Export of coltan from the eastern Democratic Republic of the Congo to European

and American markets has been cited by experts as helping finance the war in the Congo, a war where an estimated 5.4 million people have died since 1998.

"Impoverished people in the Rwandan/Congo border rush to provide electronics manufacturers with the metal for resisters in cell phones. And they need to eat, so they started killing the gorillas for 'bush meat.' As consumers, we need to see the political and economic choices we make as having an impact on people and species," Putnam says.

It's difficult to encourage people to set aside reserves for animals. "We have to find a way to deal with competing demands for conservation of species and expanding demographic pressures," he says.

Currently, the silverback gorillas are "paying for themselves" through tourism. Conservationists use Facebook to try to save them, and people fly in to see the rare species. As a result, they are being protected against poachers. "Still, there are only a few hundred left in pockets," says Putnam.

The animal and human worlds are interconnected and there is a massive species collapse as many of the world's creatures are facing extinction. Poaching and traffic in rare species is up, especially in fish and birds. "Some are intrigued about being close to 'wildness,' but it can be a risky venture," Putnam says. "And like Charles X, the rich and famous still like to collect animals as symbols of power. The policies and practices related to animals present one of the most vital challenges to our survival on this planet. We need to understand their richness and diversity if we are to thrive as a population."

Chief Joseph of the Nez Perce tribe once said: "If all the animals were to vanish from the earth, then men and women would die of a great loneliness of the spirit."

Researchers create polymers that trap and kill bacteria.

by Karen Wentworth

They check in, but they don't check out. The bacteria move towards microscopic hollow spheres on a sterilized surface of a medical device, slowly moving through the openings, when suddenly a light is turned on, triggering a chemical reaction. The bacteria start to die.

UNM Research Professor in Chemical and Nuclear Engineering and the Center for Biomedical Engineering David Whitten and University of Florida Professor of Chemistry Kirk Schanze have spent the last decade working on electricity-conducting polymers. These polymers have a unique trait when they are exposed to light. They produce singlet oxygen, a reactive form of oxygen that is highly toxic to bacteria, like bleach and other potent sterilizers.

The researchers theorized they could use coatings of the polymers to sterilize surfaces, so UNM doctoral student Thomas Corbitt has worked with colleagues to test the spheres, using a safe laboratory strain of *Pseudomonas aeruginosa,* a common, persistent, and lethal bacterium in hospitals. That bacterium is so ubiquitous it often unintentionally introduced via contaminated medical devices and can sicken or kill patients suffering from burns, cancer, AIDS, and other serious conditions. He tested the effectiveness of the light induced chemical reaction in killing

the bacteria. Corbitt says, "It was very exciting to see the microspheres immobilizing and killing the bacteria so quickly."

Whitten explains, "We expected that these hollow capsules might behave on the micro scale with bacteria much like the insect-trapping Roach Motels™. We had done some work with *Pseudomonas aeruginosa s*train PAO1 with one of the two polymers used in constructing the capsules and found some activity against it," he says. "We also realized that it was difficult to kill Pseudomonas compared to other bacteria we were working with. Our finding that the 'micro roach motels' are far more efficient at both entrapping the bacteria and then killing them with light was a wonderful result, even taking into account that we specifically designed the capsules for this purpose."

Microbiologist Linnea Ista, a research scientist at the Center for Biomedical Engineering, worked directly with Corbitt in the test phase. "There is something fascinating going on at the interfaces between these surfaces and bacteria," she says. "In addition to the potential for being useful biocides, these are intriguing surfaces because they trap so many bacteria so quickly."

The group outlined their results in a paper in the debut issue of the American Chemical Society Journal *Applied Materials & Interfaces*. Collaborating on the paper are Thomas Corbitt, Sireesha Chemburu, Linnea Ista, Gabriel Lopez, and David Whitten from UNM and Jonathan Sommer, Katsu Ogawa, and Kirk Schranze from the University of Florida.

Schranze and Whitten say further tests are needed to nail down the potency of the spheres, but initial experiments indicate they wiped out more than ninety-five percent of nearby PAO1 bacteria after exposure to light for about an hour. Since the publication of this manuscript, the group has tested the technology on other organisms and found it equally effective. A very interesting result was the killing of spores of Bacillus atrophaeus, a benign model organism similar to that which causes anthrax. Similar spores are also important in the transmission of *Clostridium difficile,* an emerging hospital-borne threat.

They point out the spheres are far from the only "biocide" on the market or under development, but they are unique in the materials used and the method of trapping the bacteria. That might be important as the bacteria evolve to become more and more resistant to standard disinfectants.

Funding for the research came from the Defense Threat Reduction Agency, and the spheres might be used in filters to trap bioterrorism agents. Schranze and Whitten say the materials used for the spheres are not exotic or expensive, and may have potential to be produced at an industrial scale. UNM and UF have filed a joint patent application for the spheres.

The reproductive lives of beetles prove to be more complicated than previously known.

by Steve Carr

On the eve of Charles Darwin's 200th birthday, researchers at the University of New Mexico and University of Montana reported a new twist in sexual selection theory -- the realm of evolutionary science that Darwin founded alongside his more generally known theory of natural selection. This news appeared in *Science* magazine last February and celebrated Darwin's immense legacy. The new findings were advantageous because they were made during studies of some of the same species that Darwin used to develop his ideas.

As part of National Science Foundation-funded research on the evolution of male dimorphism in insects, biology professors J. Mark Rowland, UNM, and Douglas Emlen, UM, were surprised to find that many species of beetles are capable of producing not only two, but three morphologically different types of males.

The reproductive lives of animals is known to be complicated business. Where competition in mating is particularly intense, many kinds of animals produce enlarged weapons that function in male combat, and they have evolved tactical alternatives in deploying them. Such exaggerated structures include antlers in elk and deer, and tusks in elephants and walrus.

Elaborate male weapons are also known to occur in many types of insects. It now appears, as the research of Rowland and Emlen illustrates, that male weaponry and alternative mating tactics can be much more complex in the lives of beetles than previously imagined.

"We discovered a novel mating system in which the individual males of various species of beetles have the capacity to express one of three alternative morphologies," says Rowland. "Alpha and beta males use their horns as weapons in contests for mating opportunities, but both forms can switch to non-combative, sneaking tactics depending on the status of their opponent. The gamma males, however, are always completely hornless with female-like in morphology and may thus depend on a tactical deception to evade combat and earn sexual encounters. A mating strategy involving three such tactical repertoires implies considerable complexity, but may actually involve operational rules reminiscent of the old rock-paper-scissors game."

The study initially discovered male trimorphism in dung beetles. Once recognized, the research was expanded to encompass more than 11,000 specimens and scores of additional species from across the world: Elephant dung beetles from Mozambique; rhinoceros beetles from the Himalayas; Malay Archipelago to the South Pacific; the 'minotaurs' of Spain; Chinese stag beetles; and dozens of other types of horned beetles from Topeka, Kansas to Entre Rios, Argentina. Trimorphism was found in diverse families of beetles, and included other weapon systems, such as head horns in dung beetles, mandibles in stag beetles, and ventral spines in weevils.

Another twist to the story is that trimorphism is also known to exist in other animals -- although it is extremely rare -- and in these species the three different male forms are determined by inheritance of different alleles, or genetic characteristics. However, male trimorphism in beetles appears to be facultative in nature. That is, the different forms of males are expressed by individuals not according to the inheritance of particular alleles, but according to the specific environmental conditions that they encounter.

"This likely means that facultative trimorphism operates by new and very different evolutionary rules than do 'allelic' trimorphisms -- the latter of which have been intensively studied because of the insights they have provided about sexual selection," says Rowland.

Laboratory studies of social interactions under facultative male trimorphism reveal that the three male morphs employ conspicuous and differing behavioral tactics in competition for mating opportunities. However, the females appear passive or cryptic in mate selection -- and even engage in copulation before reaching sexual maturity. Moreover, this suggests that in addition to robust pre-copulatory male mating strategies, post-copulatory mechanisms such as female sperm storage and associated sperm competition may also represent critical features of this male-trimorphic mating system. Field studies of seasonal variation in male morph frequencies are also underway and enjoy the enormous benefit of being close as at hand in Texas and Florida.

One-hundred-fifty years ago Darwin raised the yet enduring central question in evolutionary biology of how some species can stably maintain two alternative intrasexual phenotypes. The present studies of species expressing three such phenotypes will provide an additional perspective toward that question.

Chuck Paine studies how writing can enhance learning across courses and disciplines.

by Sari Krosinsky

When he started looking for data to support the connection between writing and learning, Chuck Paine, UNM associate professor of English and an advocate of Writing Across the Curriculum, was surprised to find how little was available.

"It makes good intuitive sense that students who write more in all their classes engage more deeply," Paine says.

However, intuition is not evidence, so Paine began working with the National Survey of Student Engagement (NSSE) and the Council of Writing Program Administrators (WPA) to develop a supplemental survey that would help colleges understand how writing can increase student engagement. Other lead researchers on the project are Robert Gonyea, Indiana University-Bloomington, Chris Anson, North Carolina State University, and Paul Anderson, Miami University, Ohio.

At a WPA conference in 2007, writing experts generated a list of about 140 questions relating to writing and student engagement. Anderson and Anson tested those questions with student focus groups on their campuses. The final list was whittled to 27 questions looking at the types,

variety, and amount of writing assignments, how assignments are used, and how faculty design and present assignments -- all factors teachers can control, Paine emphasizes.

In 2008, the supplemental survey was administered to 23,000 students from a random sample of 82 campuses. Last spring, NSSE and WPA formed the Consortium for the Study of Writing in College, with 75 additional colleges -- including UNM -- volunteering to administer the supplemental survey, bringing in about 40,000 additional responses. "Itâ€™s more than twice as big as any NSSE consortium before," Paine says.

A second component was also added this year -- an addendum to the Faculty Survey of Student Engagement. Paine says the data from the faculty survey will provide additional insights into faculty's beliefs about the purposes of writing in course work and how students' learning can be supported through that writing.

Early Conclusions

In the student survey, controlling for characteristics such as gender, race, and major, as well as how much students write, the data so far support one of the underlying premises of Writing Across the Curriculum, that faculty who assign certain kinds of writing not only help their students become more proficient writers, but also enhance learning in all courses and disciplines. Students whose faculty assigned writing that required them to integrate, reflect, and use higher-order thinking reported greater personal, social, practical and academic learning and development.

Paine says past research shows that students who are more engaged devote more time and energy to their coursework, tend to have higher grade point averages, and are more likely to stay in college. The supplemental NSSE survey showed that the more students wrote, the more they engaged in active and collaborative learning, student-faculty interaction, enriching experiences, and deep learning. That may mean that writing can also improve grades and retention.

Though the survey shows gains for all students, some traditionally underrepresented groups may see a greater benefit, Paine says. "Connecting the Dots," a recent study using NSSE data, indicates that "Educationally Purposeful Activities" have a significantly higher impact on G.P.A. and persistence among Hispanic and African American students than White students. Whether this holds true for writing activities will require further investigation.

The survey also indicated that design and presentation of writing assignments are more important factors than the amount that students write, Paine says. This suggests that teachers will get better results from refining the ways they assign and guide students through writing projects than from assigning more pages. Interactive writing activities -- like getting feedback from classmates, teachers, and writing centers -- appear to help all students, and the more types of activities students engage in, the better the gains. Other best practices include designing writing projects that integrate the concepts and information from the course, and connecting assessment criteria to specific learning goals embedded in the assignment.

Next Steps

It will be necessary to combine NSSE results with institutional data to fully understand the effect of writing practices on G.P.A. and persistence, Paine says. He pointed out that while improved performance might be the direct result of students' increased writing and reflection, it could also result from teachers using student writing to get feedback about their learning, and tailoring instruction to particular classes or individual students.

The Consortium for the Study of Writing in College plans to follow up with this and other lines of research and analysis, but it may take several years to work out data sharing agreements and other logistical issues.

Paine notes that it will be interesting to see particular effects of best writing practices among students in STEM fields -- science, technology, engineering, and mathematics -- where writing is less often employed.Using an $800,000 grant from the National Science Foundation, Miami University, and North Carolina State University will develop a model curriculum that uses these best practices throughout the four years of students' study in computer science and software engineering. A similar study at UNM could be beneficial because UNM has something many universities don't -- a large number of minority students in STEM fields, Paine says.

Pediatric robotic surgery offers advantages over open surgery and traditional laparoscopic surgery.

by Lauren Cruse

It seemed like a movie plot: Robot saves boy.

In the case of three-year-old Ellion Reval from Dulce, New Mexico, a meeting with a robot was not a movie, it was real life.

Ellion needed a robot's help, but not to fight bad guys or find his way back home. He needed the robot to help him with one of his kidneys.

Ellion was born with a condition called vesicoureteral reflux. Urine normally travels from each kidney to the bladder via the ureter, the muscular duct that propels the urine, but in Ellion's case, the direction of the urine flow was reversed, causing infections and a non-functioning kidney.

At the University of New Mexico Children's Hospital, Ellion's family discussed surgery options with Jason Wilson, associate professor in the UNM Department of Surgery and section chief of Pediatric Urology.

"In a situation like Ellion's, when the kidney is non-functional and it's high-grade reflux, the most prudent thing to do for the child's overall, long-term health is to remove the whole system," says Wilson.

Wilson suggested using the Da Vinci System, UNM's new robotic surgery technology that offers advantages over open surgery and traditional laparoscopic surgery.

"When we remove the ureter down close to the bladder, we often have to reconstruct an area or sew up an area, and that can be quite challenging in laparoscopic surgery," says Wilson. "That's where the Da Vinci System really improves our ability to deliver good surgical technique."

The robot had already been used at UNM on several adult patients for procedures in adult urology and obstetrics and gynecology, but Wilson was confident that the robot could be used for pediatric surgeries too. Ellion was the first child in New Mexico to receive robotic surgery.

"I wanted to know what the recovery time was going to be for Ellion," says Marlena Reval, Ellion's mother. "I was concerned about his pain tolerance after the surgery. We were told that the actual robotic surgery takes a little longer, but the recovery time is a lot quicker. We were also told that there was less chance of an infection. So, my husband and I discussed it and we decided to go ahead with it."

In contrast to traditional laparoscopic surgery, the arms on the surgical robot are capable of movements similar to the human wrist, giving the surgeon more dexterity. This capability, says Wilson, is very helpful when performing on smaller pediatric patients.

The robot is also equipped with advanced instruments and a miniature camera that provides a high-definition, three-dimensional view inside the body. The surgery delivers precision that is not possible in conventional laparoscopic surgery.

"The surgical robot allowed us to get the whole system out like we would with open surgery, but it gave us the benefit of laparoscopic surgery with small incisions and a fast recovery," says Wilson.

"In the beginning we were afraid," says Reval. "Any surgery your child is going through, you wish you can take it upon yourself instead of having your three year old go through it. But, his recovery time was really good and everything went very well. We are very happy with the results. Having the robotic surgery eased our minds."

Ellion was able to go home from the hospital in less than 24 hours after his surgery. Conventional surgery is usually associated with a hospital stay of at least 3 to 4 days.

With the success of Ellion's robotic surgery, Wilson and surgeons at UNM Children's Hospital plan on performing more pediatric robotic surgeries.

Robot Gets a Name

Pediatric patients at the University of New Mexico Children's Hospital were given an

opportunity to come up with creative names for the surgical robot. The winning name was Smarty.

For more information on UNM's surgical robot, visit:
http://hospitals.unm.edu/robotic/index.shtml

Researchers at the Center for Evolutionary and Theoretical Immunology study immune systems across all organismal life.

by Steve Carr

Designed to study the evolution and diversification of immune systems across all organismal life, researchers at UNM's Center for Evolutionary and Theoretical Immunology, CETI, seek to understand the functional principles underlying immune systems and their interactions with pathogens, based on both theoretical and comparative approaches. Since 2003, CETI investigators have published more than 450 scientific papers, including several scientific journals such as *Science, Nature,* and *Proceedings of the National Academy of Sciences*.

Additionally, CETI scientists have made fundamental contributions to the study of mammalian genome and immune system organization, and by focusing on marsupials and egg-laying mammals, have provided unique evolutionary insights for the evolution of placental mammals.

They have discovered new kinds of immune receptors, and provided new evidence to indicate that the immune systems of invertebrates, which often are involved as vectors of disease, are capable of more sophisticated and diverse responses to pathogens than previously thought. CETI's theoreticians have played an important role in advancing the basic understanding of virus population dynamics in humans, how signals are propagated in immune cells to allow their eventual activation, and how design principles of immune systems share properties with computer security systems.

Current CETI research projects include: modeling of host immune responses and antiviral therapy against Hepatitis C virus infection; modeling viral pahogenesis and immune response in vertebrates; how invertebrates defend themselves from pathogens--using Trematodes and *Biomphalaria glabrata* as a model; and a number of projects involving Schistosomes and Schistosomiasis.

"*Biomphalaria glabrata*, one of the favorite subjects of study in our lab, is a tropical freshwater snail indigenous to ponds, marshes, and streams of South America and some of the Caribbean islands. It is an important intermediate host of the parasite *Schistosoma mansoni*, which is a significant cause of infection in about 83 million people," says Eric Loker, director of CETI.

Under the direction of Loker, and infrastructure core director Rob Miller, CETI projects are a collaborative effort, with researchers from UNM's biology and computer science departments, and theoretical biologists from Los Alamos National Lab (LANL).

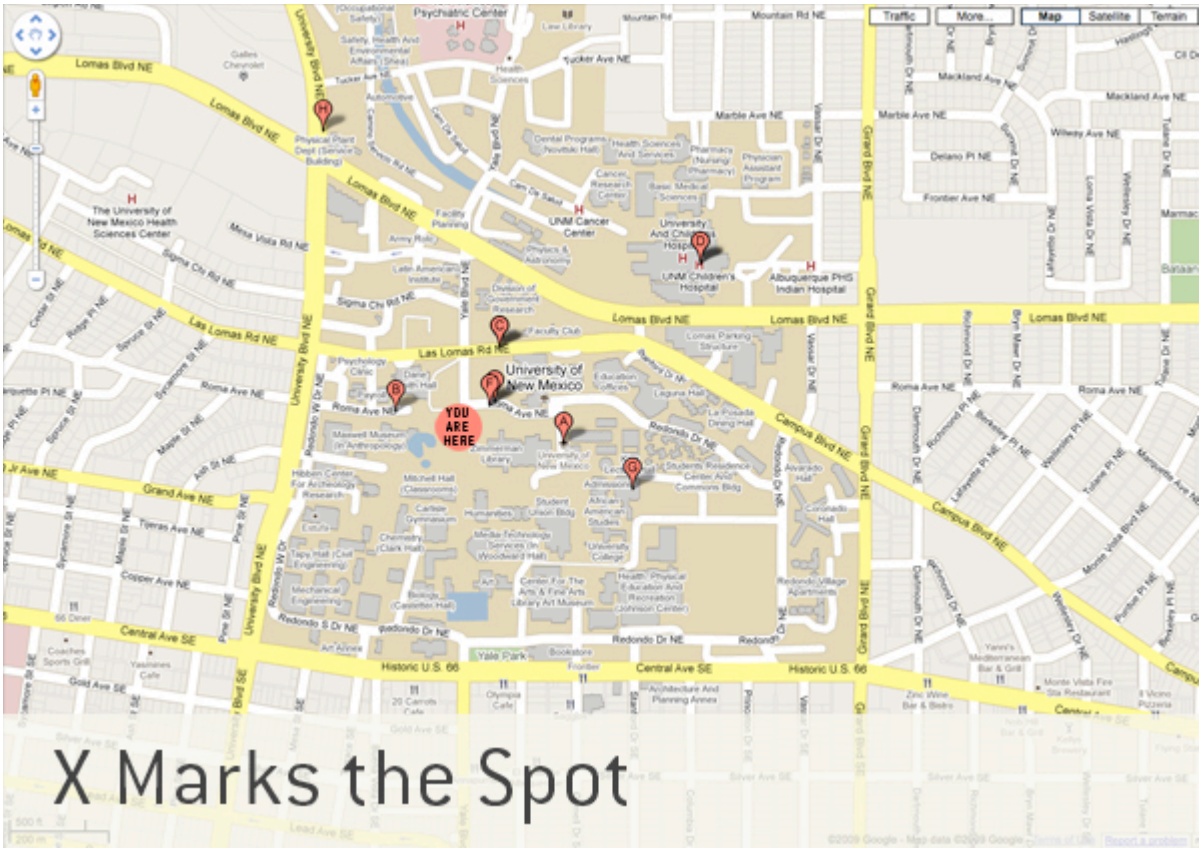
CETI is housed in the University of New Mexico's Department of Biology, and was recently awarded a five-year, $10.7 million grant from the National Institutes of Health (NIH) National Center for Research Resources (NCRR) Centers for Biomedical Research Excellence (COBRE) program. This is the second COBRE award for CETI, and it assures the center's ability to further strengthen, consolidate, and position itself as a preeminent center in evolutionary and theoretical immunological research.

"The new CETI COBRE award, coming in a cash-starved economic climate, offers our research community some very creative possibilities that we would simply not have otherwise," says Loker. "It allows us to continue to develop and enhance an internationally prominent presence for UNM in the growing field of evolutionary immunology."

"CETI has given me the opportunity to apply biological theory and computational models to increase our understanding of how diseases progress and epidemics spread between different species. This has practical implications for how we fight emerging pathogens like West Nile Virus," says Melanie Moses, assistant professor of Computer Science and a CETI mentored faculty member. "CETI has enabled cross-disciplinary training of students in biology and computer science and provided mentoring from world class researchers in immunology and epidemiology."

CETI has a number of plans in the works for growth, expansion, and improvement. Such plans include: further support for a Molecular Biology Facility which provides services such as automated DNA sequencing to the entire UNM community, improvement and upgrades in other vital institutional research infrastructure, and support of the National Parasite Collection by UNM's Museum of Southwestern Biology. All plans lead to increasing UNM's international research prominence and continuing CETI's presence as a leader in the field of evolutionary immunology.

For more information on CETI, visit: http://biology.unm.edu/ceti



Paul Zandbergen studies geographic information systems: their accuracy, reliability, pros, and cons.

by Benson Hendrix

Pirates used maps to mark the spot of buried treasure. In recent times, geographic information systems, GIS, go beyond maps, able to pinpoint the exact location of people, places, and things.

Geography Professor Paul Zandbergen researches the science behind GIS, these systems that present data based on a specific location. As many popular online geographic tools, including Google Earth and Google Maps with Street View, have grown in popularity, Zandbergen realizes the importance of accuracy and reliability. "As these maps become more widely used, expectations for precision and dependability increase, as do privacy concerns," he says.

Those privacy concerns have grown with the collection of location-based data provided by cell phones and certain applications available in smartphones, such as Apple's iPhone and Research in Motion's Blackberry.

Free Agent Data Collection and the "Wikification" of GIS

According to Zandbergen, in many countries geographic data has not been freely available, so individuals and entities started collecting needed geographic information themselves. For example, a quick trip through neighborhoods and towns via car equipped with a GPS unit could involve information gathering on roads, which then become part of a collaborative global mapping project -- a map that could be edited by anyone.

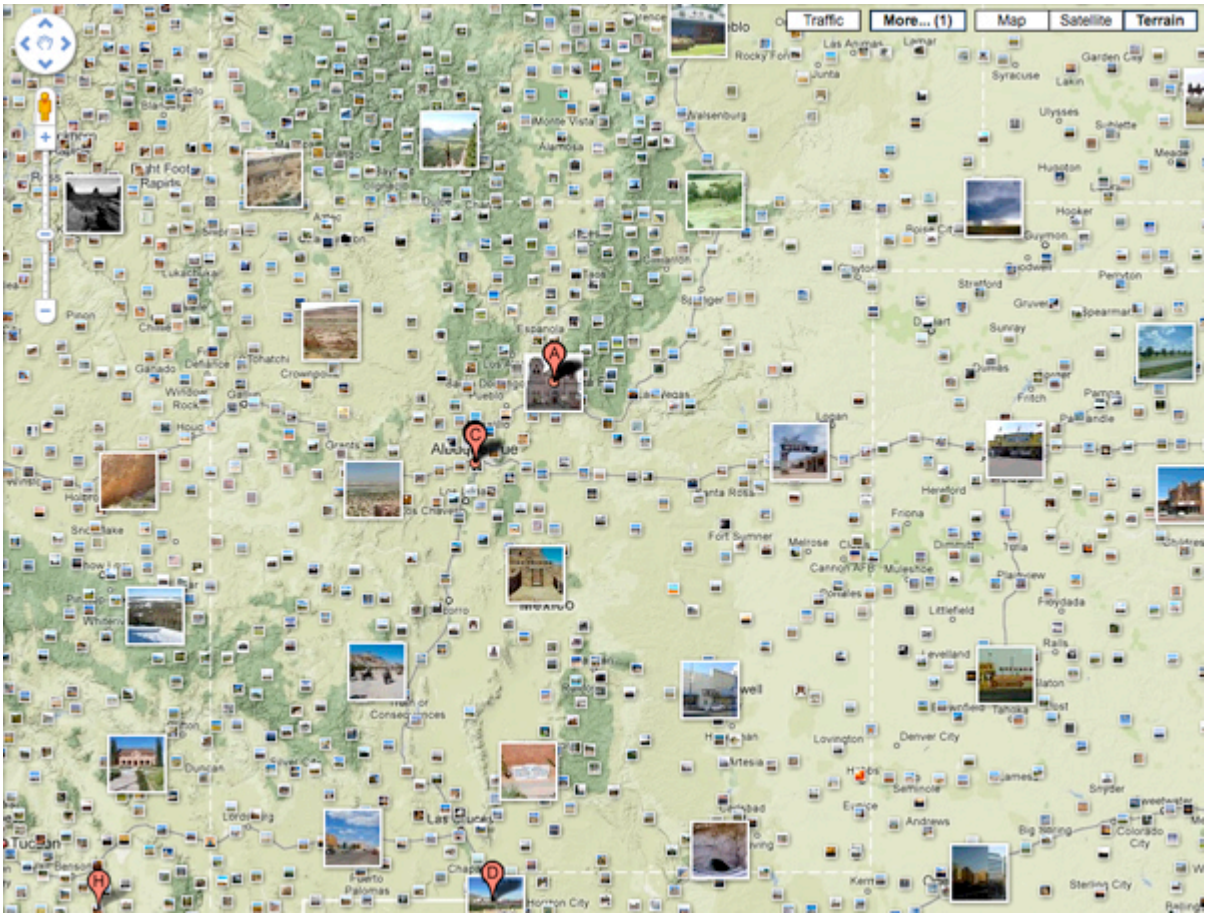
"It's known as Open Street Map and it's nearing global coverage. Its intent is to be global database of, in this case, street data, which anybody can use under a commons agreement. It has no licensing fee, and it may be better or more complete than government data. It knows no boundaries. Anyone who wants to collect data for an area that hasn't been covered can go and do it," says Zandbergen.

"There are still issues regarding information access because of a 'digital divide' between more and less technologically-advanced countries, as well as issues of accuracy," says Zandbergen. "But the trend is toward a lot of different systems that collect information that is geographically tagged ('geotagged') outside of a government agency and governmental control."

"We refer to this as the 'wikification' of GIS," Zandbergen says. "Anybody can contribute, and it's a self-moderated community that ensures consistency and quality."

Flickr, the photo-sharing site, is an example of data 'wikification.' People submit pictures to the site, many of which are geotagged. Based on geographic tags, countries could be roughly outlined and boundaries displayed, based on nothing more than a point on a map showing where the picture was taken.

"People tag their pictures with 'the Netherlands'," Zandbergen says. "Show me all of the pictures tagged in 'the Netherlands' and that should show the boundary of the country. I think the shapes they come up with are still rough, but the idea is that a phenomenal amount of spatial information that is collected through non-traditional means."



With spatial social networking, companies combine geotagged information with smartphone social networking applications, using the GPS tracking chips all mobile phones now have.

"Think Facebook, but geotagged," says Zandbergen. "You have a smartphone being tracked by your cellular provider. You sign up for a service and say 'please track me,' for whatever purpose, and show me whoever else allowed me to see them. We know where individuals are in real time."

Unintended Consequences?

The amount of freely available information raises serious security concerns not previously considered.

"Take a high resolution image of a hotel in Bombay. Who would have thought that would be a security issue?" asks Zandbergen. "But we found out that the 2008 Mumbai attack was planned with Google Earth and a GPS unit."

What about moving beyond tracking a cell phone user or their friends? What about the potential to track everyone?

Many of the original location-based tracking technologies were used to keep track of criminals for years, prior to their commercial use. In recent years these technologies were miniaturized and were marketed to the general public to keep track of pets, children, and elderly people suffering from diseases like Alzheimer's.

In Georgia, the government is proposing to ban GPS tracking for private individuals, something that has become a staple for some private investigators.

"I don't think they'll stand up to the Supreme Court, if it gets that far," Zandbergen says. "But there is definitely a broad debate."

Some people take their protest further. In England, a community saw the Google Street View vehicle -- a vehicle armed with a panoramic camera that continually swivels, takes pictures and logs its location -- approaching their village. They created a human chain to keep the vehicle out. Zandbergen expects more situations like this, some of which will be approached through action and others though the court system.

What's Next?

Once these technologies advance to the public arena, it may be too late to dictate how they are used. "You can throw out your cell phone, turn off your computer and when you drive around, try to avoid the traffic cameras," Zandbergen says. "But it's become unrealistic to opt-out all together. As you use new technology, be careful what you opt into."

"That cell phone agreement, those eight pages that you signed, it's worth a closer look," he adds. "That car rental agreement that says that you shall not drive into Mexico when you go to San Diego, what do you think car companies are doing? With a little GPS device, they will charge you after the fact if you broke the agreement"

Some local governments have already decided to put GPS trackers on every school bus and equip each student with a Radio Frequency Identification tag. Once students are on the bus, the school district can access the system and see which child is on which bus and track the bus in real time.

Zandbergen predicts what's next. "I think in three years we'll have a 'LoJack' device for toddlers -- a simple, painless injection under the skin that allows tracking where your kid is in real time. Technologically it's possible. I think the market isn't quite ready for it, but I'm a bit pessimistic. It could happen."

Research finds that the people of Chaco Canyon drank chocolate in rituals.

by Karen Wentworth

Inhabitants of Chaco Canyon drank chocolate from ceramic cylinders about a thousand years ago. Distinguished Professor of Anthropology Patricia Crown and W. Jeffrey Hurst, her collaborator at the Hershey Center of Health and Nutrition, published their findings in the *Proceedings of the National Academy of Science*.

Crown has long been fascinated by the cylinders excavated at Pueblo Bonito in Chaco Canyon during the Hyde Exploring Expedition from 1896 to 1899 and the National Geographic Society Expedition from 1920 to 1927. Only about 200 of the cylinders exist and most were found in a single room at the site. The cylinders are now housed at the Smithsonian Institution in Washington D.C. and at the American Museum of Natural History.

Archaeologists generally agree the vessels were used for some ritual, but there has been great disagreement about the specific use of the vessels. Crown was thinking about how the Maya drank chocolate from ceramic cylinders, and wondered whether the cylinders found at Chaco might have been used in the same way. It was clear that the Maya used the cylinders for chocolate. Experts could read the glyphs on the vessels that said they were chocolate containers.

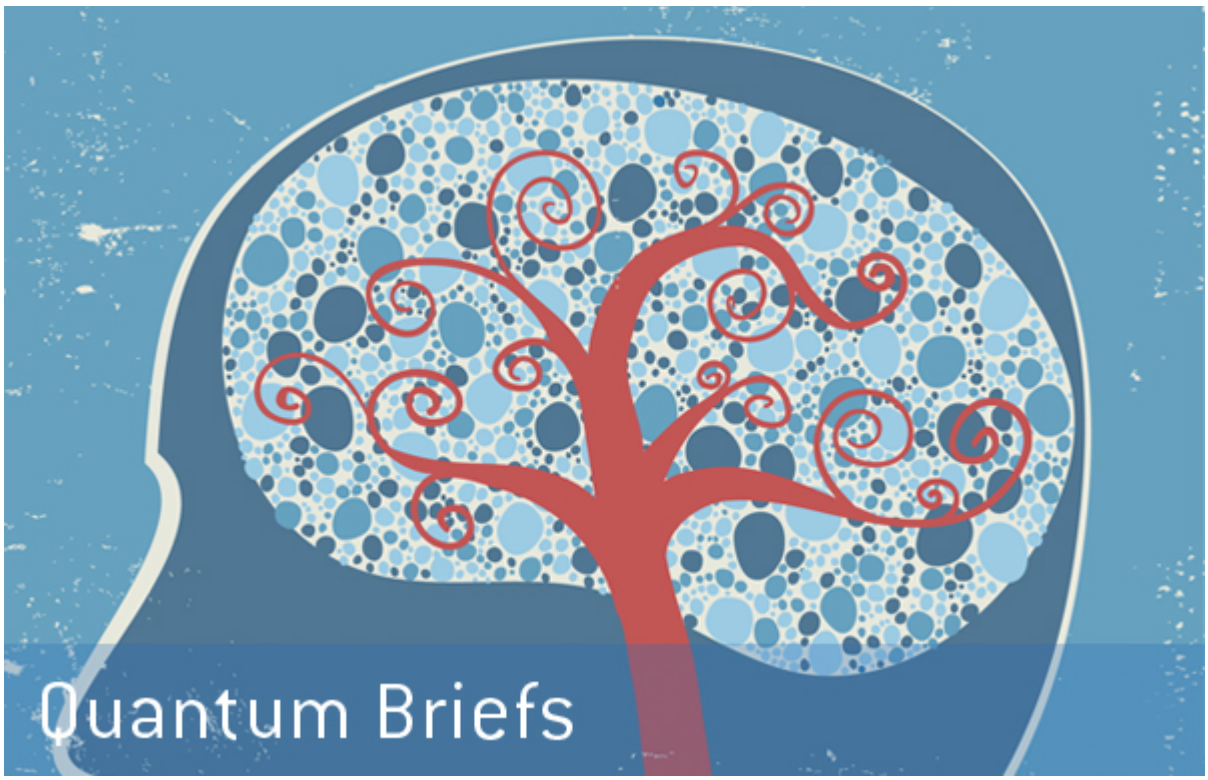
Crown collected fragments of pottery--sherds--from cylinders or pitchers when UNM graduate and undergraduate students excavated trash middens south of Pueblo Bonito during summer field schools from 2004 through 2007. Based on the decorative style, the sherds were dated between

1000 and 1125 A.D. Crown selected a few sherds and worked with a graduate student to grind off the edges for testing. The material fragments were sent to Hurst at the Hershey Center, where they were tested using an analytical method he had developed. The results yielded the presence of theobromine, a marker for Theobroma cacao or chocolate.

The finding is the first concrete evidence that the people of Chaco Canyon or anywhere in the Southwestern United States traded for cacao beans. It's long been known there was trade with the Maya in the southern lowlands of Mexico from evidence of copper bells, cloisonné, and scarlet macaw skeletons. Until this discovery, cacao had been found no further north than central Mexico.

Crown says anthropologists don't know whether the people at Chaco walked to Mesoamerica to trade for the cacao beans, whether traders brought them north, or whether the beans simply passed from hand to hand from one group of people to another.

What we do know is people who live in the Southwest have been drinking and savoring chocolate for the last thousand years.



Indentifying Mutant Lukemia Genes

by Luke Frank

University of New Mexico Cancer Research and Treatment Center (CRTC) researchers recently identified a genetic mutation underlying one of the most common childhood cancers, acute lymphoblastic leukemia (ALL). The discovery could lead to more effective treatments for a subset of ALL patients who experience minimal benefit with current therapies.

Acute lymphoblastic leukemia occurs when white blood cells, which normally help fight off viruses and bacteria, don't mature properly. As more of these underdeveloped cells build up, healthy, infection-fighting cells are crowded out. The disease accounts for about three out of four childhood leukemia cases, and affects about 1 in 29,000 children nationwide every year; New Mexico has an average of 37 ALL cases diagnosed annually.

With the most advanced treatment options available today, cure rates are now upwards of 85 percent. The challenge lies in treating the remaining high-risk cases, which have proven especially difficult to overcome because they arise from different, unidentified genetic mutations.

"Our studies of these leukemia subtypes indicate that leukemia is not necessarily a single-cause disease," says Cheryl Willman, director and CEO of the UNM Cancer Center and senior co-author of the study. "A patient may have multiple different genetic lesions that target different cellular pathways to induce leukemia. Therefore, it is very important to develop new therapies that target these specific mutations."

The CRTC research team worked in collaboration with St. Jude Children's Research Hospital, the National Cancer Institute (NCI) and the Children's Oncology Group/CureSearch. For more information, visit http://cancer.unm.edu.

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Helping Rural Communities Compete Economically

By Steve Carr

The North American Free Trade Agreement or NAFTA, which was signed between Canada, the United States, and Mexico 15 years ago, has enabled a number of collaborations between the neighboring countries. For the University of New Mexico, it has produced three higher educational ventures, one of which involves the creation of the North American Rural Entrepreneurship Network consortium to help rural communities compete economically.

"Following NAFTA, the United States Department of Education's Fund for the Improvement of Postsecondary Education (FIPSE) created a program with the Canadian and Mexican governments to promote student exchange in North America," says Dante Di Gregorio, Associate Professor at UNM's Anderson School of Management, who holds the Albert and Mary Jane Black Professorship in Economic Development. "It's analogous to what's going on in the European Union, only on a smaller scale."

The consortium, with the help of four-year, $200,000 grant from the FIPSE North American Mobility program, was developed to prepare students to help rural communities sustain themselves and prosper by competing in the global economy. With that goal in mind, collaborations with the six partner universities began to develop.

"The concept involves a more integrated education system similar to the European labor market, where you are more productive and competitive as a whole if you have integration of labor markets and integration of education. In North America, the emphasis is on integration of education instead of labor markets," says Di Gregorio. "The primary goals are to prepare more students for working across North America, to enhance their foreign language skills, and to expose students to new ideas and perspectives. These students will then be better prepared to contribute to their home communities."

The way the program is set up, the three governments are involved and each supports the universities in their own country. The program provides student scholarships for semester-length study abroad exchanges as well as support for institutionalizing the programs. Each partner supports incoming exchange students and arranges for internships so that students may engage in experiential learning during their exchange.

The program promotes a student-centered, North American dimension to educate and train in a wide range of academic and professional disciplines that complement existing forms of bilateral and trilateral exchange programs among Mexico, Canada, and the United States. There are six universities involved including two from each country. UNM and East Tennessee State

University are the U.S. institutions, Dalhousie University and the University of New Brunswick are the Canadian entities, and Universidad de Guadalajara and Tecnologico de Monterrey in Chihuahua is the Mexican participant.

"We formed our consortium with universities that also operate in regions that include less prosperous rural communities that are facing greater challenges to compete economically," says Di Gregorio. "We educate students so they can compete globally, which is particularly needed in rural areas. To meet that challenge, we are turning to entrepreneurship. Students take classes and complete internships hosted by local entrepreneurs and organizations in another country with relevant issues that we face here in New Mexico. Afterward, they are better prepared to come back and work here."

The NAREN consortium is one of three current FIPSE North American Mobility grants at UNM. Professor Ted Jojola, Regents Professor in the School of Architecture and Planning, directs a grant focusing on indigenous planning. Richard Schaefer, Associate Professor in Communications and Journalism, directs a grant focusing on water issues.

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Patents and Inventions at UNM

By Karen Wentworth

Flow Cytometry for High Throughput Screening
UNM Researchers Larry Sklar, Department of Pathology and Bruce Edwards, Pathology/Cytometry have developed HyperCyt(tm) High-Throughput Flow Cytometry System which runs 30 times faster than other screening devices for molecular biomarkers in cells. The technology is ideal for drug discovery research because it analyzes many samples rapidly. For more information: http://www.intellicyt.com.

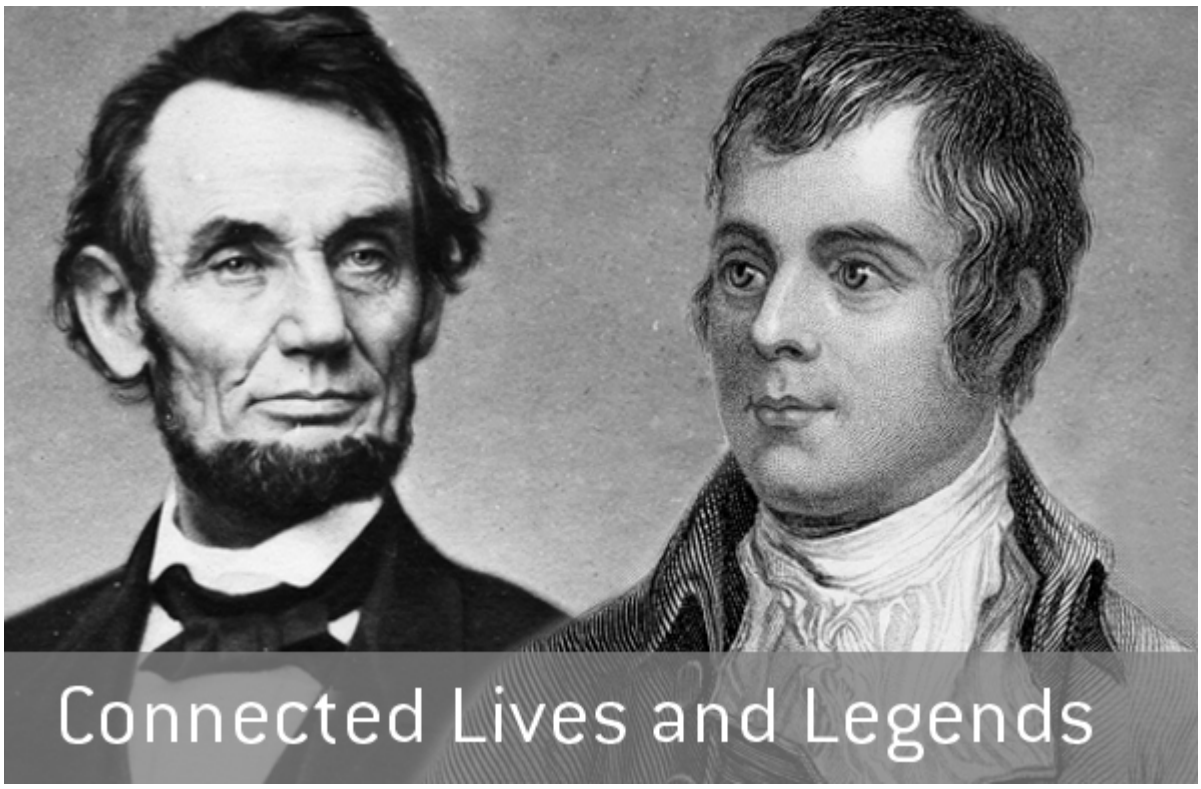
Wavy Interface Mixer

The type of mixing that is commonly observed (for example, smoke in the atmosphere, or milk in coffee) is strongly aided by turbulence, which acts to quickly stretch and fold the interface between the different phases, thereby reducing the diffusion distance. At low Reynolds numbers, turbulence is absent, and therefore other mechanisms to stretch and fold interfaces must be devised. This invention allows mixing of small volumes of fluid at relatively low flow rates, i.e. low Reynolds numbers. The primary application is in the field of drug discovery by high throughput flow Cytometry. This research was developed by Larry Sklar, with Andrea Mammoli, and Peter Vorobieff, both of the Department of Mechanical Engineering.

C-Reactive Protein to Treat Immune Complex-Mediated Renal Disease

Researchers Terry Du Clos, Internal Medicine, and Carolyn Mold, Genetics and Microbiology, have developed a technology that has been used to test the reduction of inflammation on kidneys in mice. It's been optioned for licensure by a start-up company, Azano Pharmaceuticals. The company is interested in using the technology for treatment of lupus patients, about half of whom have kidney inflammation.

More patents and inventions at UNM can be seen at: http://stc.unm.edu



Ferenc Szasz studies the overlapping legends of Abraham Lincoln and Robert Burns.

by Carolyn Gonzales

In 2009, the University of New Mexico recognized Professor of History Ferenc Szasz as its 54th Annual Research Lecturer. His lecture, "Abraham Lincoln and Robert Burns: Connected Lives and Legends," was fitting, with the year marking the 200th anniversary of Lincoln's birth as well as the 250th anniversary of Burns' birth. Once upon a time, Burns was as popular in the United States as he was in his native Scotland. One of his biggest fans was Abraham Lincoln, born 50 years after Burns.

Although the men were not alive during the same time period, the legends of the two men overlapped, says Szasz. Themes of Burns' poetry--equality, human empathy over judgement, and religious skeptism with a deep appreciation of the Bible--are mirrored in Lincoln's work and legacy.

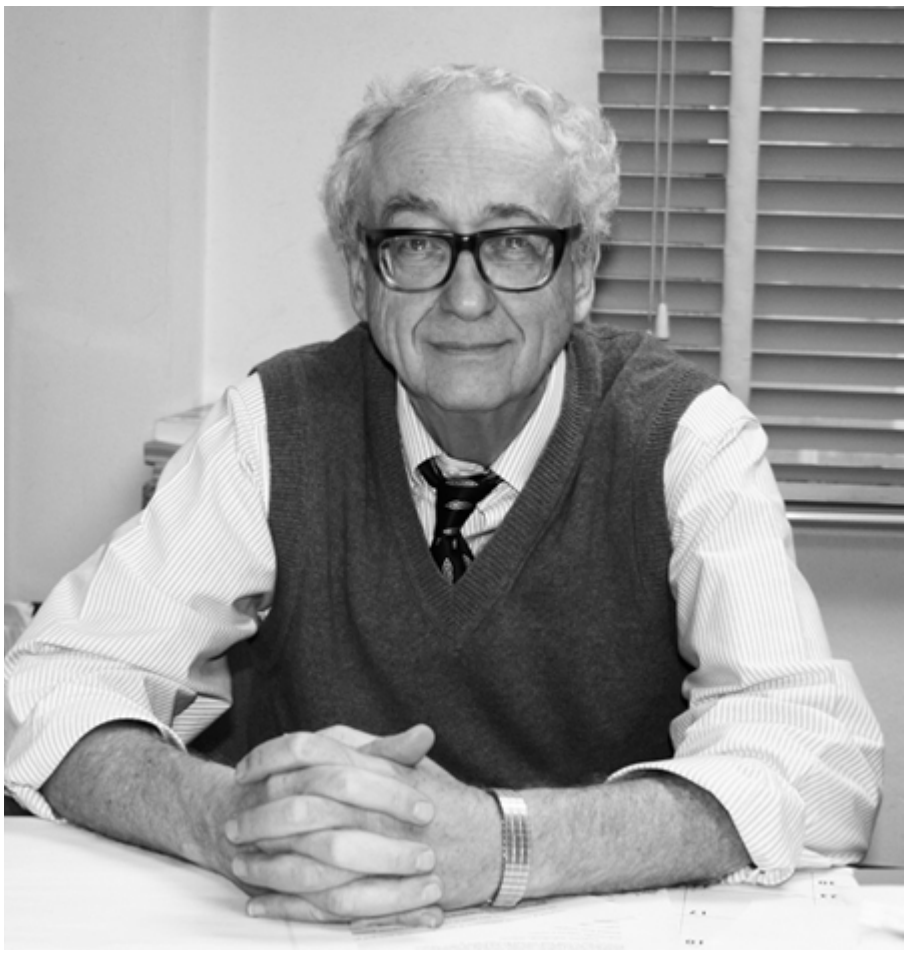
"Each shared a semi-Calvinistic faith--God is using every activity for his own purpose that humankind can't fully fathom," Szasz says.

In the 1850s, Americans loved Burns. His line "A man's a man for all that," proclaims the same ideal set forth in the Declaration of Independence that "all men are created equal." Burns was a Scottish peasant, and Lincoln grew up on a hardscrabble farm before becomingcountry lawyer; but the social strata of the U.S. were not as rigid as in Scotland. "Burns felt himself socially inferior to the aristocracy that both wined and dined him, and looked down on him," Szasz says. "His humble background and egalitarianism is part of the reason why Lincoln was so taken by Burns." Similarly, the Scots view Burns as the embodiment of their nation's hopes and ideals, much as Americans view Lincoln.

Both men incurred tragedy. Burns had a problem with alcohol and died in deep poverty at the age of 37. Of the nine children he had with his wife, only three survived infancy. "Lincoln lost two children, his mother, and a sister. This was beyond normal losses in the nineteenth century," says Szasz.

"Burns may have faded from the American pantheon of great poets, but he is upheld in Scotland," Szasz says. People may not recognize Burns' work, but almost everyone is familiar with some of his lines, particularly those that were later set to music. Auld Lang Syne; My Love is Like a Red, Red Rose; and "the best laid plans of mice and men..." are familiar Burns lines.

"Lincoln had a photographic memory and Burns' poems stuck in his mind. Without consulting a book he could recite lines," Szasz says. Lincoln not only borrowed some of Burns' ideas, but also his rhyming scheme with its powerful rhythmic beat. Evidence of the rhythm is found in Lincoln's state papers, particularly in the Gettysburg Address and his Second Inaugural Address, where he said, "Fondly do we hope--fervently do we pray--that this mighty scourge of war may speedily pass away."



A statue of Lincoln was erected in Scotland in 1893. "In 1880, a statue of Burns was erected in New York. There are 12 Burns statues in the United States because he embodied the same social goals as America," says Szasz. Places associated with both men have become sacred national spaces. "People enter the Lincoln Memorial and tomb with hushed voices. So too with the Burns Memorial in Dumfries."

The restored Ayrshire cottage where Burns was born ranks as one of the most visited tour destinations in Scotland, Szasz says. "Atlanta has a replica of the cottage and the Burns Club of Atlanta meets there...in kilts."

The National Trust of Scotland--the Scottish equivalent of the National Park Service--has built a world class museum in Alloway to ensure Burns' heritage for future generations.

In 1859, at the 100th anniversary of Burns' birth, 60 American cities held gala celebrations in his honor. "Lincoln attended the gathering in Springfield and toasted Burns' memory," says Szasz. Later, Scotland was the first country outside the United States to erect a statue of Lincoln--in Edinburgh in 1893.

"Fifty or 60 years ago, Burns was studied in schools in the United States, but not anymore. Now only the Scots and Irish know him," Szasz says.

In 2009, the Library of Congress hosted a Burns' 250th anniversary festival in February funded partly by the Scottish Executive. In April, the University of South Carolina will similarly celebrate Burns. "Those are the only major US events," Szasz laments.

Scottish photographer Andy Hall has put together a book titled, "Touched by Robert Burns," a striking photographic collection illustrating short pieces by various individuals--including one by Maya Angelou and another by Szasz--whose piece centers on the Lincoln-Burns connection. "In line with Robert Burns' writing on human rights, all royalties for the book go to UNICEF," says Szasz.

Another piece in Hall's book was penned by Tom Sutherland, dean of agriculture at the American University of Beirut, who was seized by Islamic Jihad terrorists. He was held captive for six and a half years. "He wrote about how Burns' words helped him survive the ordeal," Szasz says.

Another essay was written by a black South African woman who attended a Catholic girls' school. Once she visited the nearby white girls' school, which had a library. "She writes about how she discovered Robert Burns and through his line 'a man's a man for all that,' realized that all social divisions were artificial. She saw the sameness that is the essence of mankind," Szasz says.

Szasz includes similar stories about Lincoln's impact on people in his book about the Lincoln-Burns connection published by Southern Illinois Press in 2008.

Concludes Szasz, "both Burns and Lincoln believed that the quest for equality should lie at the core of each nation's goal."

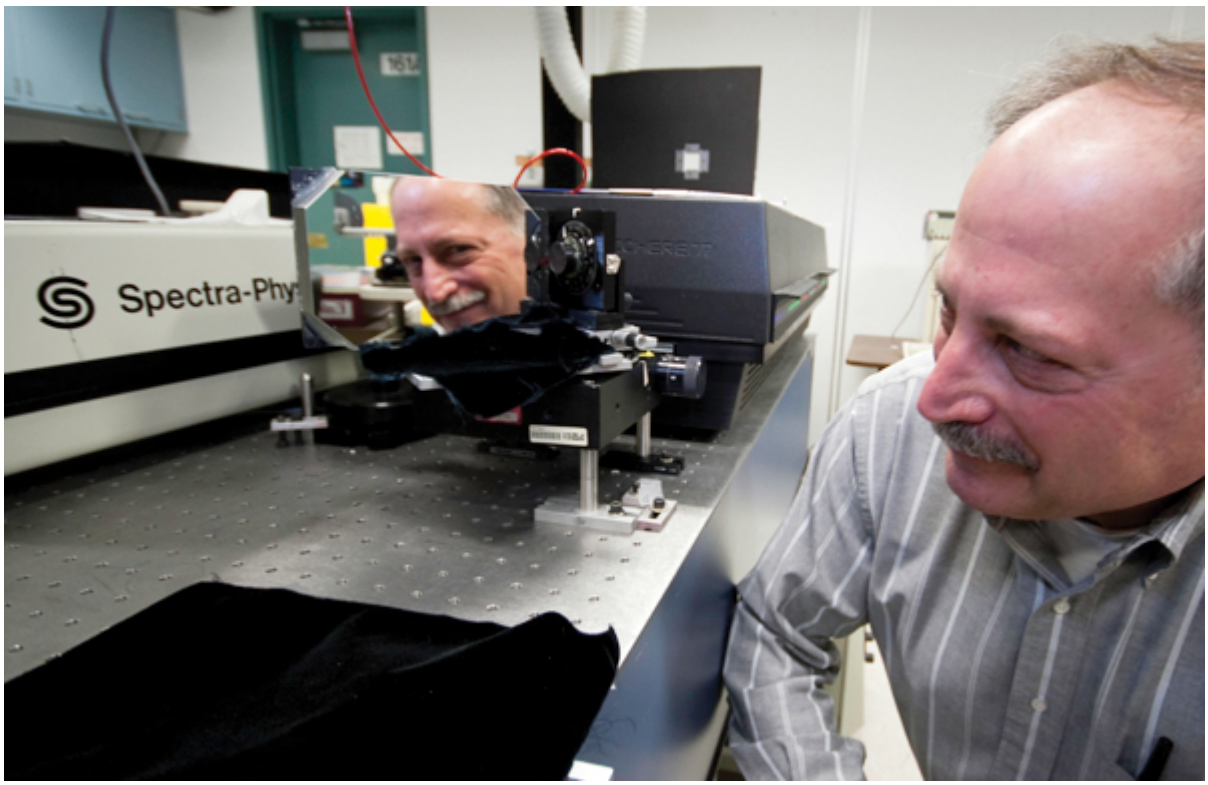
The Center for High Technology Materials celebrates 25 years of making fundamental discoveries.

by Karen Wentworth

UNM celebrated the 25th anniversary of the Center for High Technology in 2009. Funded by the New Mexico legislature in 1983 as one of five centers of excellence in the state, CHTM has functioned as a laboratory for generations of future researchers.

Steve Brueck, director of CHTM since 1986, is a highly regarded researcher in his field. "What I am most proud of is the students that we have turned out. We've had somewhere between 350 and 400 students that have gotten advanced degrees," he says. " That's a pretty significant accomplishment." About 200 former students have continued to live in the Albuquerque area, working at local companies, Sandia National Laboratories, and Intel.

Research at the center is basic science, making the fundamental discoveries needed to support the development of technologies. Since the founding of the CHTM, researchers have been awarded 65 patents and technology developed there has spun off into eight companies, many of which have been absorbed by larger companies.



Optics Research

Companies searching for ways to make computers smaller and more powerful use the technology developed at CHTM. Brueck says computer chip makers once strongly resisted putting water into their products during the lithographic process that defines the ever smaller transistor structures. However, research at CHTM has shown that that was one of the few options available to improve the performance of computer chips. Now all the newer computers use the technology.

Brueck specializes in improving lithography techniques and his work with SEMATECH, a semiconductor manufacturing company, has provided cutting edge research that allows computer companies to continue building smaller and more powerful computers. His work on double patterning is leading the way to the manufacturing technique used for the coming generation of computer chips.

Another Brueck project, in collaboration with scientists at Sandia and Los Alamos National Laboratories, has led to a very high speed optical modulator that's ten thousand times faster than the ones currently in use in the telecommunications industry. That may have major implications for simplifying the transmission of information.

Nanofluidics

Brueck's research in nanofluidics also has great potential. CHTM can now build channels on a scale of tens of nanometers, a size that changes the dynamics of screening for specific things in fluids and could change the way DNA analysis is done.

Directed Self-Assembly

Remember the children's game that you tilted to roll small metal spheres into various holes? Brueck and his team can do that with millions and billions of 50 nanometer balls that can be maneuvered into channels and stacked on top of each other into porous walls. The walls could then filter bits of material. This technique is so new they've just begun to explore possible ways it can be used.

Infrared Detectors

The military has always been interested in using infrared detectors, and the Air Force Office of Scientific Research has just funder CHTM to develop a new molecular beam epitaxy machine. Researchers at CHTM use it to precisely grow crystals atom by atom to prove the technology for sensitive detectors.

Current research at CHTM by Electrical and Computing Engineering Professors Sanjay Krishna and Majeed Hayat allows a camera to photograph thermal photons emitted from objects. The military uses the technology to identify people and objects in the dark. Civilian use of the technology includes machines that can detect heat coming from homes for energy audits.

Nanowires

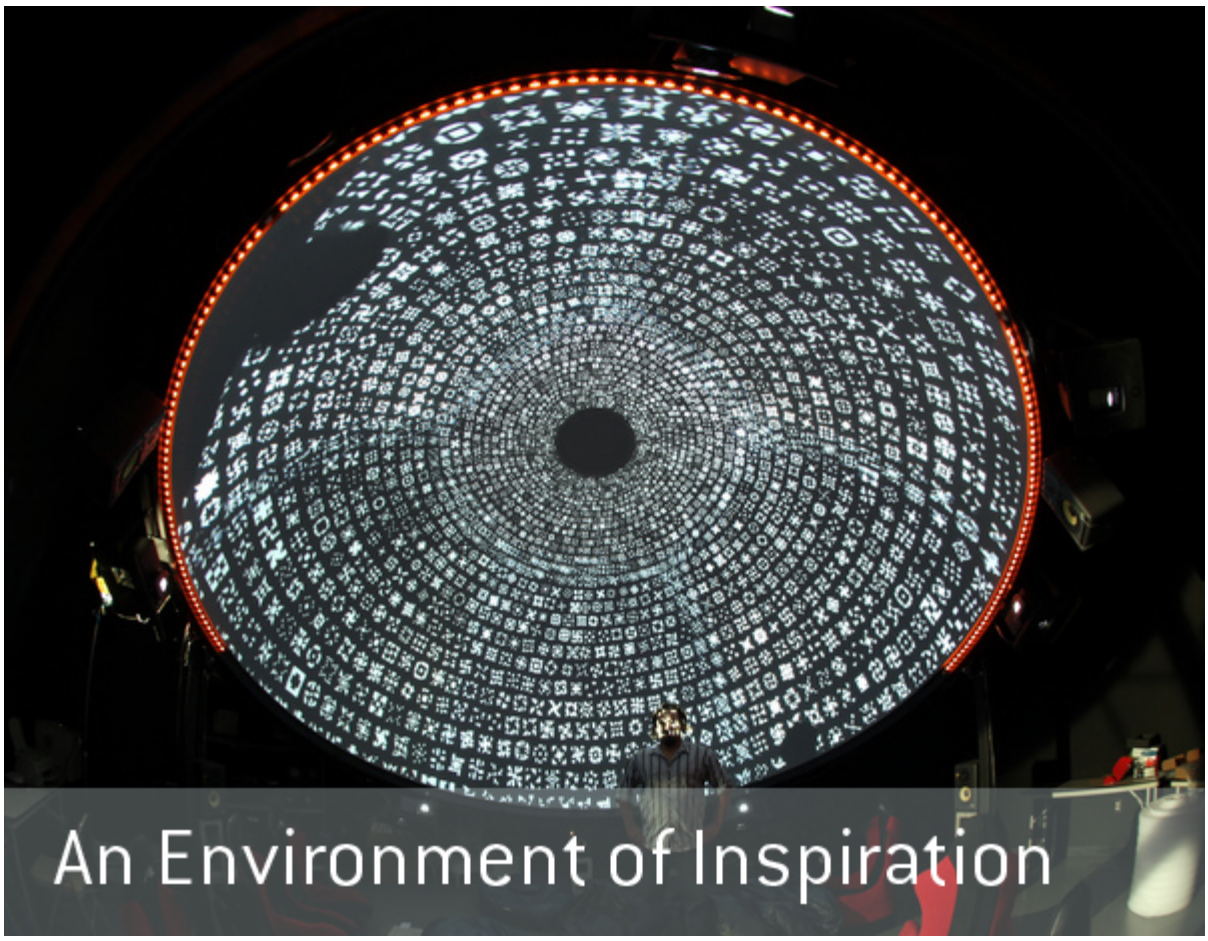
Electrical and Computing Engineering Professor Steve Hersee is growing nanowires, by setting up masks and allowing the wires to grow through them. Hersee is excited about this because the technique eliminates many defects that are common in nanowires. The nanowires may eventually be used to make efficiency improvements in LED lighting.

Microscopy

Hersee is also working on a project with the Wadsworth Institute in New York State. He is developing a more controllable light source for microscopes that may allow automation in reading routine health test results, freeing technicians to concentrate on unusual results that need more attention. The idea is to make diagnosis quicker and more consistent for patients.

In another project, Brueck is extending some of the ideas developed for lithography to microscopy and has demonstrated a resolution beyond the classical diffraction limit. Most research now underway at CHTM is multidisciplinary.

Says Brueck, "It comes out of being an active research group with different people contributing different ideas, which is what science is all about. That's what makes the center so exciting--you have this multiplicity of different inputs."



The ARTS Lab brings creative minds into an inspiring and collaborative environment.

by Valerie Roybal

Imagine living on Earth during the time of the ancient Mayan people. Envision the massive temples, and look up to the sky as they did, gathering clues about the moon, the stars, and the passage of time.

The Maya developed an incredible knowledge of the cosmos, which enabled them to create an elaborate calendar and predict events such as lunar eclipses. How Mayan astronomers were able to understand the sky has long been a mystery, one that has recently been revealed in a collaborative fulldome film.

Utilizing a variety of innovative technology, the UNM ARTS Lab was part of a team that produced "Tales of the Maya Skies," bringing this amazing story to life in an immersive digital theater environment.

Funded by a number of organizations, including the National Science Foundation, and involving a number of collaborators including the Chabot Space and Science Center, the Institute for Study and Integration of Graphical Heritage Techniques, and the Instituo Nacional de Antropolgia e Historia in Mexcio, "Maya Skies" is just one of the innovative projects the UNM ARTS Lab has been involved in.

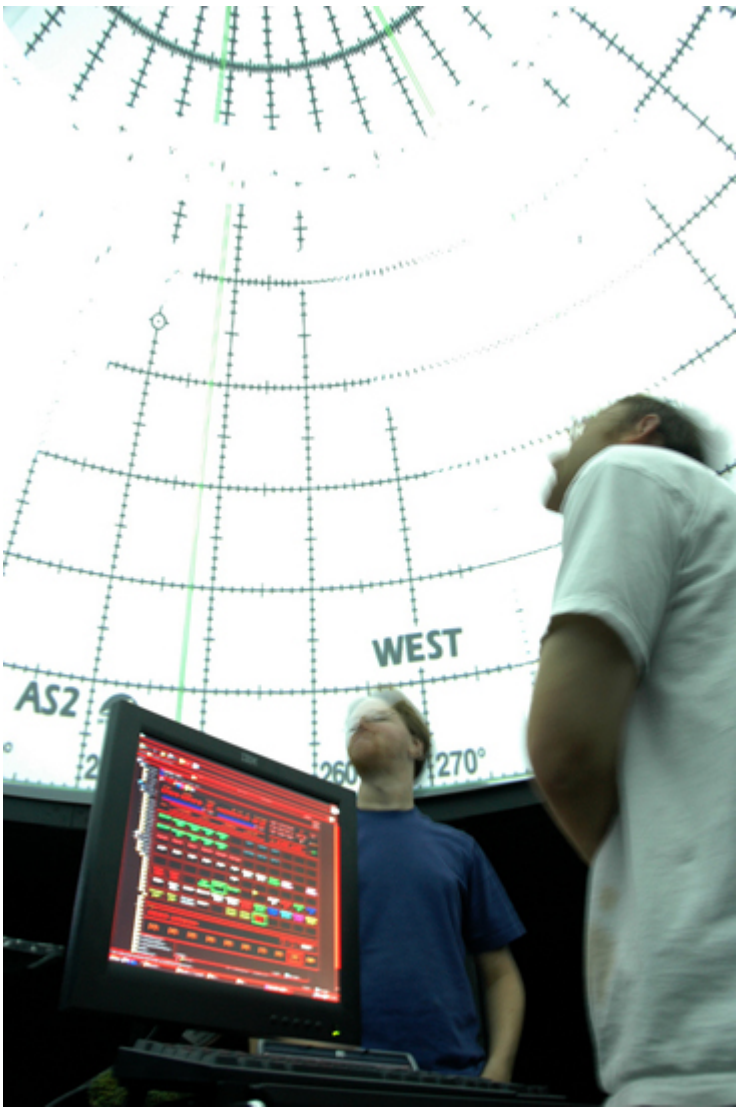
"There is so much that happens at the ARTS Lab," says Andrea Polli, director of the Lab and the Interdisciplinary Film and Digital Media Program at UNM. "We're a real resource, a place where people take an inventive and progressive approach to creative research."

The ARTS Lab (which stands for Art, Research, Technology, and Science Lab) was established in 2004 in response to Governor Bill Richardson's Media Industries Strategic Plan, which was designed to cultivate the state's digital media and film industry initiatives. The ARTS Lab works to foster "creative relationships," by connecting UNM art, science, business, and technology-oriented faculty, staff, and students with each other--and with people outside of the academic environment--to nurture a progressive media industry in the state.

ARTS Lab projects take form throughout UNM. "We welcome faculty from all over campus," say Polli. "We're always bringing in new collaborators for projects and research. We currently have faculty from Architecture and Planning, Anderson Schools of Management, Arts and Sciences, Engineering, and Fine Arts working with the Lab, and are forming collaboration groups focusing on visualization, gaming, and robotics."

The physical space at the ARTS Lab contains an impressive arsenal of equipment, outfitted to enable production and experimentation in digital film and graphics, performance, sound, and immersive theater projects such as "Maya Skies." The core of the Lab is the Digital Media Garage, which contains an immersive fulldome theater (the "gDome," a 15 foot hemispheric domed projection surface), a 3-D projection system, a Vicon motion capture system, a 30 by 40 foot Green Screen studio, an audio production suite able to produce multi-channel surround sound, and more.

The Lab also hosts and produces DomeFest each fall, providing a showcase for a variety of immersive media projects from around the world. The 2009 DomeFest premiered "Maya Skies" and other films created for the unique environment of dome-shaped projection spaces. Other events include community educational opportunities for film, video, and animation. "As an interdisciplinary center, we are hoping to provide the 'missing piece,'" says Polli. "The resources of the ARTS Lab are here to encourage and inspire people to think, create, and reach out to others, giving life to productions, projects, performances, and ideas that have never been seen or experienced before."



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There's No Place Like Home

As New Mexico is increasingly becoming a second home for Hollywood, with a large number of film and television productions making their way here, opportunities for involvement abound. Additionally, new technology markets within the state provide exciting prospects for a tech-savvy workforce.

The Interdisciplinary Film and Digital Media program and ARTS Lab combine to provide UNM students with top-notch training and experience for media industry careers such as animation, filmmaking and production, game development and technology, image processing, scientific visualization, and more.

The IFDM program will expand in the Fall of 2011 to include a production and educational facility for upper-level students at Mesa del Sol, a new development on Albuquerque's south side. The facility, near Albuquerque Studios and other industry facilities, will contain a

production and dubbing stage, where students can gain valuable professional experience without leaving the state.

The Special Education Program prepares teachers and educational professionals to support the learning of all students, and to ensure access to the education necessary for success.

by Steve Carr

The year was 1975 when Federal legislation was enacted that called for equal treatment of special needs children in public schools across the United States. It was titled the 'Education for All Handicapped Children Act.' It required that all students with disabilities receive an appropriate education. It's been a long time since then, and while the name of the act has changed somewhat over the years, its mission and purpose remain the same.

Over the years, much has been learned in regard to developing methods to improve the education of special needs children. At the University of New Mexico, the Special Education Program has developed into one of the best in the country, and is at the forefront of a paradigm shift in special education, driven, in part, by the Individuals with Disabilities Education Act and No Child Left Behind.

The new approach to special education centers on the belief that children of all learning abilities--including those with physical and mental differences--should learn together, have equal access to the general education curriculum, and have the support they need to lead fulfilling lives. Through the various programs and research conducted in the department, it would indeed appear that UNM is succeeding in that mission.

"UNM realized that for special education teacher preparation to be successful, there is a need for public school collaboration on the UNM special education curriculum," says Ruth Luckasson, chair in the Department of Educational Specialties where Special Education program has evolved over the years. A Distinguished Professor at UNM and a world-renowned expert on mental disabilities, Luckasson has been chair of the department since 2004. She is a national leader regarding legal reform with regards to intellectual disability.

"We are committed to preparing outstanding teacher leaders to educate children with exceptionalities and support their families," she says.

One of the program's ideas that clearly touches on the mission is the preparation of teachers by developing the skills, understanding, and dispositions to support the learning of all students. Additionally, teachers are encouraged to work with students, families, and communities to assure personally satisfying lives and access to the education necessary to succeed as an adult.

Other key program ideals include working with a diversity of people and perspective; developing relationships of service, accountability, collaboration and advocacy; discussing and disseminating ideas; as well as developing innovation in teaching, technology, and leadership.

"One of our most important programs in the Special Education department is a partnership with Albuquerque Public Schools," says Luckasson. "The APS/UNM Partnership Program in Mental Retardation and Severe Disabilities is a nationally recognized teacher preparation program."

The program, now in its seventh year,was co-created by UNM and APS Special Education andhas 20 new students every year. The program is designed to support teachers entering the field of special education who do not hold a special education license and may or may not have previous experience in the field of education. It supports individuals who have completed an undergraduate degree in any field who want to teach children with disabilities.

Participants receive up to 45 credit hours of tuition to complete licensure and Master's in Special Education in the Mental Retardation and Severe Disabilities within a two-year period; a stipend for their first year of teaching and full teacher salary and benefits for their second year of teaching; direct support in the classroom for two years; and access to APS new teacher support and staff development opportunities.

They are also supported toward becoming teacher leaders who implement and model research-based best practices. In turn, participants agree to teach in APS for two years after the completion of licensure requirements.

Some of the research programs designed to help special education children include Literacy: All Children Empowered or LACE, which is driven by Associate Professors Susan Copeland and Liz Keefe.

This program is designed around a working group of general and special educators working with Pre-K children through adulthood, developing literacy instruction for individuals with severe disabilities. One of their current projects is developing a conceptual framework for literacy

instruction, creating access to literature by adapting books and working on a definition of literacy that could include everyone.

Working with teachers from public schools and community agencies in Albuquerque, Moriarty, and Rio Rancho, the group meets regularly and is working together to brainstorm and disseminate information and by putting the elements they come up with into themes.

"This keeps us informed of what's going on in the schools and also in the community, says Keefe. "The number one goal is to do a better job of teaching children with all disabilities. We are going beyond the classroom and putting into action a project on adapting books so they are accessible to children with all disabilities."

"Through research, we are learning and understanding that everyone is involved in literacy," adds Copeland. "The research coming out of this is changing the practice to support teachers. We're excited about it."

Copeland and Keefe have also written a book as part of their efforts titled, "Effective Literacy Instruction for Students with Moderate or Severe Disabilities." In the book they advocate the development of literacy skills as a critical component of successful education, communication, employment, and community participation.

"We strongly believe that access to high quality literacy instruction is an essential right for all people that will increase their participation in their schools and wider communities," says Keefe.

Another research endeavor involves Associate Professor Cathy Huaqing Qi and a four-year grant that examines longitudinal relationships among language delays, social skills, and behavioral problems among low income pre-school children. Her goal is to establish a strong and stable extramurally funded research program in the area of early language and behavioral assessment for young children from culturally and linguistically diverse background (CLD), and early language and social skills intervention for children with autism spectrum disorders (ASD).

The Autism Society of America says that one in 150 children in the United States has ASD. In fact, they're one of the fastest growing groups of the roughly 15 percent of students who receive special education services in New Mexico. UNM recently began to offer a graduate certificate called the "ISLB Graduate Certificate: Instruction for Students with Intensive Social, Language, and Behavioral Needs," that gives students intensive instruction working with ASD children.

"I have developed three main lines of primary research, which are related in that they all address the issue of language delays, behavioral problems, and social skills," says Qi. "My goal is to gain a better understanding of the critical role of early language skills in children's social skills and behavioral functioning later in life."

"The faculty here at UNM are doing so many things to help families with student disabilities," says Luckasson.

"The Special Education program is one of the best programs in the college, University, and region because of the excellent faculty and its leadership," says College of Education Dean Richard Howell. "The program exemplifies the finest in University education by maintaining high productivity in all areas of research, teaching and service."

"They do this in a balanced fashion that brings them in contact with parents, teachers, and students in a variety of settings. They are sought out by school districts throughout New Mexico, the nation, and world and serve as expert consultants on a variety of areas for children with special needs."