A QUEST FOR OUR ORIGINS
An Extraordinary Fossil Find Alters the Record of Humanity’s Emergence

UNLV’s Brian Villmoare and LD 350-1
The Power of Partnership in Research

It’s my distinct pleasure to invite you to read this issue of UNLV Innovation, the university’s research magazine. I’m delighted at the prospect of our many friends and supporters learning more about the exceptional research and scholarship at UNLV. Since arriving here last year, I’ve had the opportunity to meet many of the distinguished scientists and scholars on our campus, and I can tell you that the research expertise at UNLV is absolutely outstanding.

While I am consistently awed by the innovation envisioned and implemented through research, I am also amazed at how well the UNLV research community understands the value of collaboration. Just in the last few months, we have announced several important partnerships that demonstrate the potential for our research to impact our community, state, and beyond.

For example, one of our research teams recently joined with the Cleveland Clinic Lou Ruvo Center for Brain Health to obtain an $11.1 million grant from the National Institutes of Health for advanced study of both Parkinson’s and Alzheimer’s Diseases. Another UNLV-led team involving researchers from South Korea and Japan recently received a $3.8 million grant from the National Science Foundation to create advanced artificial muscles for use in robotics. We also recently welcomed Nevada Governor Brian Sandoval to our campus to help announce a $1 million research partnership between UNLV and Tesla Motors. Additionally, our wonderful collaboration with Switch/Intel/Cisco has provided the university with access to staggering computational and research networking capacity that will place UNLV among the ranks of the nation’s top universities.

All of these partnerships demonstrate how research expands the reach of our university beyond the boundaries of our campus. It is critical that we continue to build an appreciation of the research endeavor among all of our constituent groups, from alumni and donors to parents and legislators. We hope that they gain a better understanding of how research advances the reputation of our university, improves our state’s economy, better educates our students, and enhances our quality of life.

These benefits are top of mind on our campus as we pursue the goal of becoming a top tier research university. Our strategic planning process is providing us with a path to achieve this status by growing our faculty, increasing our grant funding, enhancing resources and infrastructure for research, and supporting faculty scholarship that improves our reputation. An integral part of this plan also calls for an increased focus on partnering with our community, state, and private-sector partners to enhance our capacity for performing more sophisticated research. The synergy from these partnerships will benefit all involved, including our students, and we value the commitment and support these partners bring to our institution. They share our vision that we are just beginning to realize the vast potential of our university, and that it will produce remarkable benefits for all.

Dr. Len Jessup
UNLV President

Welcome to UNLV Innovation!

Welcome to UNLV Innovation! We produce our research magazine to share a sampling of the last year’s best news, articles, and photography depicting our research activity. The subjects in this issue are far reaching in scope: We tell the story of a UNLV anthropologist who recently made international headlines with the discovery of a 2.8 million-year-old fossilized jawbone that changes the timeline of human origins. We also introduce our readers to visionary robotics expert Paul Oh who shows us the face of the future. In our Research Report, we share the great news that UNLV patent applications have tripled in the last two years, and three start-up companies have emerged from our research.

It’s an exciting time for research and economic development at UNLV, and we hope you enjoy learning more about why we are so proud of UNLV research.

Dr. Thomas Piechota
Vice President for Research and Economic Development
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Invasive Flora: Unwelcome Visitors in Desert Parklands

NEW DATA FROM UNLV SCIENTISTS show that uncontrolled growth of invasive plants in Southern Nevada, California, and Arizona is threatening wildlife, degrading visitor experiences, and ratcheting up wildfire risks in some of the nation’s most important federally protected lands.

In Mojave National Park, Death Valley National Park, and the Lake Mead National Recreation Area, the researchers found, foreign plants and grasses are crowding out native vegetation and harming the animals that eat it. When the plant invaders reach the end of the life cycles, they die, dry out, and become fuel for wildfires.

The research area examined by the scientists spanned nearly 6 million acres, some 23 percent of national parkland in the contiguous United States. Eighty-two percent of plots were found to harbor at least one invasive species.

“Many non-native plants were introduced to the United States over 100 years ago,” says UNLV ecologist Scott Abella, the study’s lead author. “Some plants were intentionally introduced for purposes such as feeding livestock. Other plants were inadvertently introduced, like ‘stowaways’ in seeds of agricultural crops. Some of the non-native plants in the national parks we studied may have even been introduced by Spanish missionaries in the 1500s.”

Red brome, a.k.a. *Bromus rubens*, is a Mediterranean import that has become a particular problem in desert parks. This is chiefly because the tufted, bunch-grass species has been shown to alter wildfire patterns by increasing flames’ spread and intensity. The UNLV study indicated that Red brome, which can leave dead stalks standing upright for as long as two years, infested some 60 percent of the research plots examined.

“Several of the wildfires in the past 10 years around Las Vegas, including in Red Rock Canyon National Conservation Area, were partly fueled by [such] dead non-native plants,” says Abella.

Beyond purely practical considerations, Abella adds, everyone who treasures national parks has a stake in controlling rogue plants.

“National parks occupy only 1.3 percent of the lower 48 states,” he says. “In this small fraction of the United States, nature is supposed to be authentic — places where natural processes and native species predominate. Invasion by non-native species threatens the very ideal of national parks.”

The study, published in June by the journal *Nature Conservation*, suggests park administrators can combat the problem by helping visitors understand the risk of inadvertently introducing invasive plant species, by streamlining ways for park visitors and staff to report infestations, and by dedicating more resources in general to the fight against invasive plant species.
GRANT FUNDS NEW PUSH TO FIGHT PARKINSON’S, ALZHEIMER’S DISEASES

THE CLEVELAND CLINIC’S LOU RUVO Center for Brain Health and UNLV were recently awarded an $11.1 million grant from the National Institutes of Health and National Institute of General Medical Sciences to fund a Center of Biomedical Research Excellence (COBRE).

The five-year award marks the first-ever COBRE grant in Southern Nevada. The new center will fund resources and research related to Parkinson’s and Alzheimer’s diseases.

“We are thrilled to be forming Southern Nevada’s first Center of Biomedical Research Excellence in partnership with UNLV,” says Dr. Jeffrey Cummings, Director of the Cleveland Clinic Lou Ruvo Center for Brain Health and principal investigator for the grant. “To be awarded such a competitive federal grant to tackle the medical mysteries behind such horrific diseases as Alzheimer’s and Parkinson’s is a testament to the caliber of the area’s medical capability and collaborative efforts with UNLV.”

Three research initiatives will benefit from the grant funding. The first, led by UNLV psychology professor Jefferson Kinney, will assess novel models of Alzheimer’s with particular attention to the role of the immune system. The second project, led by Cleveland Clinic Lou Ruvo Center for Brain Health’s Dr. Ryan Walsh, will use neuroimaging and neuropsychology to advance understanding of Parkinson’s, specifically cognitive impairment associated with the disease. The final project, led by Cleveland Clinic Lou Ruvo Center for Brain Health’s Dr. Sarah Banks, will use neuropsychology, combined with cutting-edge imaging techniques, to understand commonalities between Alzheimer’s and Parkinson’s.

A clinical core to provide patients for the projects will be led by Cleveland Clinic Lou Ruvo Center for Brain Health’s Dr. Kate Zhong. UNLV’s Supercomputing Center, directed by Joseph Lombardo, will provide database and statistical support.

This COBRE grant is slated for five years, with approximately $2 million to be awarded each year. The grant demonstrates the strong partnership between the center and UNLV, illustrating their mission to grow the scientific and medical landscape of Southern Nevada.

“This award cements UNLV’s longtime research collaboration with the Cleveland Clinic Lou Ruvo Center for Brain Health and advances our shared mission to find answers to complex health issues affecting so many in our community and around the world,” says Thomas Piechota, UNLV vice president for research and economic development.

UNLV, TESLA MOTORS FORM RESEARCH PARTNERSHIP

UNLV AND TESLA MOTORS HAVE FORMED a research partnership that will draw on the expertise of university faculty to pursue advanced topics in battery manufacturing.

Nevada Gov. Brian Sandoval and officials from UNLV and Tesla formally announced the partnership during an Oct. 7 ceremony in UNLV’s Science & Engineering Building.

“This is an exciting example of how public-private partnerships can benefit both the commercial and academic communities,” says UNLV President Len Jessup, who spoke at the event. “Our faculty are performing high-caliber research and are enthusiastic about collaborating with a leader in the electrical vehicle manufacturing industry.”

The initial phase of the five-year agreement between Tesla and the university includes two projects led by UNLV engineers and scientists to enhance manufacturing processes at Tesla’s Northern Nevada Gigafactory.

A team of UNLV engineering researchers will focus on water recycling and treatment, and a separate team of chemists will work to improve recycling of metals from lithium ion batteries.

Plans for Tesla’s Northern Nevada facility were first announced last fall. The collaboration, which could total $1 million in funded projects over the next five years, provides opportunities for additional research as the partnership evolves.
UNLV RESEARCHERS PUBLISH FINDINGS ON POTENTIAL HIV CURE

Researchers at UNLV’s Nevada Institute of Personalized Medicine (NIPM) have engineered a new protein that they believe could lead to an HIV cure.

Published in the May issue of the peer-reviewed journal PLoS ONE, the researchers have discovered a protein that uses a newly developed gene-editing technique to rid the body’s cells of the immunodeficiency virus before it has a chance to multiply and develop into AIDS.

A patent application has also been filed on the researchers’ process, and testing on the protein, called HT-TALENs (short for HIV-targeted transcription activator-like effector nucleases), continues.

Humans infected with HIV have 1 million to 10 million cells harboring copies of HIV DNA. When HIV infects an individual, the virus inserts itself into DNA in cells and becomes part of those cells’ permanent blueprint.

“Current drugs slow the virus from being produced, but they don’t rid the body of the HIV DNA,” says NIPM executive director and UNLV life sciences professor Martin Schiller. “You’ve got to get rid of or damage the harmful DNA to truly prevent the cells from creating the virus.”

By altering a commonly used plant pathogen protein, Schiller’s lab engineered the new HT-TALENs variation. The plan will be to introduce the protein into the body through a common cold virus injection, and the protein will adhere to the specific portions of HIV DNA and cut or damage it without touching any of the non-infected DNA around it. When the cell repairs the damage, the new copy won’t contain functional HIV.

“This is a way we’re getting at the root cause of AIDS, not going after a downstream event, but going after the actual DNA copy,” Schiller says. “We are hopeful this will stop the virus replication in its tracks. We think it has the potential to be a cure.”

So far, the researchers have produced results only in the laboratory. They are awaiting patent approval and have started on the next phase of testing through a partnership with Brigham Young University. If that is successful, the scientists will move on to human trials.

“It’s going to take a number of years to develop, but I’m hopeful this approach should work. Our goal is to lead the way,” he says.

The protein treatment’s success would be a boon emotionally and financially for patients undergoing current HIV drug regimens, which can top $15,000 a year.

Human tests would pair the new gene-editing protein therapy with current treatments. Similar proteins might also be useful in curing other illnesses, such as bird flu.

This project, one of several that Schiller’s lab is currently pursuing, began about three years ago after a weekly meeting of his team focused on current research articles. One of them discussed the TALEN protein, derived from a wheat pathogen already widely used in the agriculture industry to genetically modify plants. Schiller and his team realized that it might be viable for use in HIV therapy with some modifications.

NIPM was established with a grant from the State of Nevada Knowledge Fund.

STUDY LINKS FULL-DAY KINDERGARTEN TO HEALTH, TEST SCORE BENEFITS

FULL-DAY KINDERGARTEN PROVIDES opportunities for numerous health benefits to Nevada’s youngest elementary school students, including improved nutrition education, physical activity, and access to school meals.

But, for students with certain qualities, full-day kindergarten is also a vehicle to improve elementary school math and reading test scores.

These results are from a recent health impact assessment (HIA) conducted by UNLV’s School of Community Health Sciences and its partners. It was compiled with community input and utilized publicly available data, as well as information obtained from school districts across Nevada and existing literature.

The study offers recommendations to decision-makers and the community regarding the benefits of full-day kindergarten. They include the importance of implementing evidence-informed, school-based nutrition education and physical activity requirements early on, which is shown to influence positive eating habits and health into adolescence.
According to Max Gakh, an HIA team member and an assistant professor in UNLV’s School of Community Health Sciences, participation in full-day kindergarten is connected to healthy behaviors and health-promoting opportunities that may have long-term impacts.

“As Nevada considers its K-12 education system, it’s important to think how health fits into the picture,” says Gakh. “Decisions made about full-day kindergarten may have health effects, too.”

Researchers found evidence that, particularly in the short term, certain children in full-day kindergarten tend to achieve higher math and reading test scores than those in half-day programs. This appears especially true among African-American, Latino, low-income, and English-language learning students. In addition, in many cases, full-day students have greater access to regular meals, which is also associated with positive academic performance.

For close to a decade, Nevada has offered full-day kindergarten at some of its schools through a mix of free and tuition-based programs. At the time of the study, about 87 percent of Nevada public school students enrolled in kindergarten were estimated to have access to either publicly funded or tuition-based full-day programs. Nevada lawmakers voted in the recent legislative session to fund the expansion of full-day kindergarten offerings statewide.

HIAs are gaining in popularity nationally and around the world as a way for public health researchers and practitioners to connect with other sectors and communities to explore the health impacts of public policy decisions. A webinar on the Nevada full-day kindergarten HIA is available at www.youtube.com/watch?v=teui7sNAEAg&feature=youtu.be.

The HIA was made possible by a grant from the Health Impact Project, a collaboration of the Robert Wood Johnson Foundation and The Pew Charitable Trusts, dedicated to promoting the use of health impact assessments in the U.S.

More information and a searchable map of HIA activity in the United States are available at www.healthimpactproject.org.

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UNLV ESTABLISHES LICENSING AGREEMENT WITH ABEL THERAPEUTICS

UNLV HAS REACHED A LICENSING agreement with Abel Therapeutics, a start-up company that seeks to commercialize the discoveries of biochemistry professor Ernesto Abel-Santos. The company is researching, developing, and commercializing a novel compound designed to prevent Clostridium difficile (C. diff) infections.

This serious, sometimes fatal infection is often contracted in hospitals, surgery centers, and other health-care facilities. It is considered one of the fastest-growing epidemics in the U.S. Abel-Santos, who is a company co-founder, is currently conducting additional research on the team’s findings. He and his team recently received a five-year, $3.25 million award from the National Institutes of Health to develop a more potent and stable drug to prevent C. diff infections. The grant is an R01, or Research Project Grant, which is considered one of the agency’s most competitive awards.

C. diff is a bacterium that forms spores that can stay in the environment or body for extended periods. Under the right conditions, these spores can germinate in patients’ gastrointestinal tract, producing toxins that cause severe abdominal pain and uncontrollable diarrhea. Abel-Santos’ compound is designed to prevent the spores from germinating.

“The university has pursued a patent for this discovery through the U.S. Patent and Trademark Office, and we are very enthusiastic about this start-up company,” said Zachary Miles, associate vice president for economic development.

He noted that Abel-Santos worked with the College of Business’ entrepreneurship students, who developed a business plan for his company. The team recently won second place at the Southern Nevada Business Plan Competition.

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UNLV-LED TEAM RECEIVES GRANT TO DEVELOP ‘MUSCLES’ IN ROBOTS

A UNLV-LED RESEARCH TEAM HAS received a $3.8 million grant from the National Science Foundation to create advanced artificial muscles for use in soft robotics that could one day help millions of people with disabilities.

Soft robotics is an emerging field in which the components of a robot are made of pliable materials. UNLV engineering professor Kwang Kim and partner researchers from UNLV, Korea, and Japan are developing new polymer-metal composites to improve the function and lower the cost of artificial muscles.

If successful, the artificial muscles developed will advance the robotics industry and could also be used in medical diagnostics and
RESEARCH BRIEFS

HEAVY LIFTING UNLV researcher Kwang Kim and his team have received a grant to study artificial muscles in robots.

Kim, a pioneer in artificial muscle research, will work closely with UNLV engineering colleague and renowned robotics expert Paul Oh.

“The development of artificial muscles will benefit understanding of methods and functions that mimic biology and could be applied in many fields of engineering and science in connection with soft robotics,” Kim says.

Students will also benefit from the grant through these partnerships with international collaborators, who will provide them with sophisticated skills in cutting-edge soft robotics technologies, Kim adds.

The grant was awarded through the National Science Foundation’s “Partnerships for International Research and Education” (PIRE) program, designed to strengthen scientific collaboration between U.S. and international researchers. The UNLV project is one of 17 funded through PIRE’s latest round of awards.

“By linking together researchers from around the world, PIRE allows us to leverage U.S. dollars and improve scientific outcomes,” says Rebecca Keisler of NSF’s Office of International Science and Engineering. “These rich partnerships will tackle some of today’s most pressing research questions.”

International collaborators on the UNLV-led project include researchers from South Korea (Il-Kwon Oh, of the Korea Advanced Institute of Science and Technology) and Japan (Kinji Asaka, of the National Institute of Advanced Industrial Science and Technology). Other U.S. collaborators include Kam Leang, of the University of Utah; Chulsung Bae, of the Rensselaer Polytechnic Institute; and Maurizio Porfiri, of the Polytechnic Institute of New York University.

SURVEY SHOWS MIXED OPINIONS ON POLICE BODY CAMERAS

REQUIRING POLICE TO USE “ON-OFFICER video recording systems,” or body cameras, would likely improve transparency and public trust, but granting media access to the cameras’ video footage could infringe on privacy rights, according to a new UNLV study.

The study reports results of an online national survey, conducted in May 2015 by a research team in UNLV’s department of criminal justice. A total of 635 people age 18 or older across the U.S. responded. The respondents were primarily male, white, and over 30 years old.

Overall support for police body cameras was very high, but opinions varied on how body cameras might affect relationships between the police and the community. Also, support for the technology varied based on the type of activity that police perform.

Respondents were less optimistic that cameras would improve relationships between police and citizens — particularly relationships between police and minority citizens.

William Sousa, director of the Center for Crime and Justice Policy at UNLV’s Greenspun College of Urban Affairs, says the survey was conducted within a year of several controversial cases involving police and citizen interactions that resulted in death. A heightened awareness of current events and a federal push for body cameras provide context to the public’s opinion in the report.

“The relationship between police and citizens – and police and minority citizens – is far more complex than can be solved by a particular type of technology,” Sousa says. “For the most part, people are more skeptical of the technology’s ability to improve relationships, even though much of the federal push has stemmed from racial tensions resulting from recent cases involving police and citizens.”

While the results showed respondents generally agreed that cameras would result in more police respect toward citizens, fewer incidents of police misconduct, and more effective information gathering by police, some 40 percent worried that victims of crimes and witnesses might be apprehensive about cooperating with police knowing their statement would be recorded. Only 36 percent of respondents told researchers they believed body cameras would help reduce racial tension between police and citizens.

Sousa says more research is needed to help city, county, and state governments develop policies and procedures and consider privacy implications.

“The survey points to the idea that a lot of people are not aware of the consequences...
related to privacy or trust between officers and citizens,” Sousa says.

“For example, will people be more reluctant to talk with officers knowing their conversations will always be recorded? Would police officers and public safety officials agree to turn off cameras upon a citizen’s request?”

Sousa says the public perceives that police officers are involved in more high-profile incidents, but responding to serious crime is a small part of what they do, and using force is an even smaller part of managing serious crime. Cameras may be relevant for those cases.

“If a citizen truly believes the officer did not do his or her job properly, there’s a way to challenge the issue,” Sousa says. “It could protect citizens from misconduct and excessive force, and it could protect officers from false complaints made by citizens. It has the potential to protect officers and citizens and encourage transparency.”

Collaborating with Sousa on the study were criminal justice professor Terance Mitche and public affairs doctoral student Mari Sakiyama. The team is conducting more advanced statistical analyses in preparation for a presentation to the Western Society of Criminology; they will incorporate the analyses and feedback from the presentation into a scholarly journal submission.

UNLV DOCTORAL STUDENT ATTENDS MEETING OF NOBEL LAUREATES

EARLIER THIS YEAR, ENVIRONMENTAL engineering doctoral student Erica Marti was one of 55 students from the United States selected to attend the annual Lindau Nobel Laureate Meeting in Germany.

During the week-long event, she engaged with some of the world’s greatest minds in medicine, physics, and chemistry.

“We are so proud of Erica’s accomplishments and the prestige she has brought to our college,” says Rama Venkat, dean of UNLV’s Howard R. Hughes College of Engineering. “We are thrilled to have one of our students learn from the world’s most compelling scholars and scientists.”

Marti was asked to attend the event after successfully navigating a competitive national and international selection process. About 200 academies of science, universities, foundations, and research institutions from more than 50 countries played an active part in vetting the young scholars. Oak Ridge Associated Universities, a Tennessee-based consortium of major doctoral-granting academic institutions, sponsored Marti’s application. Some 650 graduate and post-graduate students worldwide were chosen to attend.

In addition to the standard program at the meeting, Marti was selected to participate in a master class, “A 21st Century Career in Research,” with Brian Schmidt, a physicist who received the Nobel Prize in 2011 for findings related to the accelerating expansion of the universe.

“It was a real honor to attend and meet scientists from all over the world,” Marti says. “The Nobel laureates were friendly and generous with their time. They shared their inspiring stories about achieving groundbreaking discoveries despite failures along the way, which is a testament to persistence in research and a vital lesson for all young scientists to learn.”

Since 1951, Nobel laureates have convened each year in Lindau to have open and informal meetings with students and young researchers. During the event, laureates and students exchange ideas, discuss projects and build international networks. Student participants hail from 88 countries. This year’s meeting was held from June 28 to July 3.

Marti’s doctoral work at UNLV involves water and wastewater treatment with an emphasis on chemicals used to disinfect drinking water. Such treatments are often used to kill pathogens in water but can create byproducts that are harmful to humans. Marti is investigating methods for preventing the formation of these harmful byproducts as well as ways to safely remove them.

The journey to Lindau wasn’t Marti’s only recent trip abroad. With a grant from the National Science Foundation, Marti spent a summer in Australia examining disinfection byproducts. She is also the recipient of a $25,000 UNLV Presidential Research Scholarship, the most prestigious award given to graduate students.
Marti, a former Las Vegas high school chemistry teacher with a master’s degree in education, is currently an intern at the Southern Nevada Water Authority. Her doctoral advisor, Jacimaria Batista, is an engineering professor and noted expert in wastewater treatment.

**ENDANGERED FISH SPECIES ESCHEWS OXYGEN**

THE DESERT PUPFISH, AN ENDANGERED aquatic species found only in the desert Southwest, often swim for exceptionally long stretches without oxygen – even when oxygen is readily available, two UNLV life scientists have found.

Frank van Breukelen, an associate professor of life sciences, and Stanley Hillyard, a professor of biomedical sciences, made the discovery after undertaking a more general investigation of the fishes’ energy needs. They admit the result surprised them, especially since there didn’t appear to be any compelling environmental reason for the pupfish to forego oxygen.

“The pupfish’s extended time not consuming oxygen made no sense since oxygen is so much more efficient, and these pupfish live in an incredibly energy-deprived environment,” says van Breukelen. “Some of the pupfish were able to go without breathing oxygen for up to five hours with only a couple of brief interruptions of oxygen use.”

Hillyard and van Breukelen describe this behavior as “paradoxical anaerobism,” that is, oxygen deprivation for no apparent reason. The longest totally oxygen-free period the scientists observed was an astounding 149 minutes, says van Breukelen. The feat is all the more perplexing given that when the pupfishes’ gills did get back into action, there was no sign of heavy breathing.

“What we didn’t see is compensatory oxygen consumption. The fish aren’t simply holding their breath; instead they are producing some ethanol, and we think that ethanol closes down a channel in the mitochondria, where they use oxygen.”

Why do these two-inch fish, found only in warm springs and spring outflows near Death Valley, go for such long stretches of time without consuming oxygen?

To better understand, researchers looked at the historical climate conditions of the area. Some 10,000 years ago, they say, the desert Southwest was not a desert. There were numerous lakes in the region, and Death Valley was filled with cool (68 degrees Fahrenheit) water close to 300 feet deep. As the lakes dried out, the pupfish ended up in the area’s warm springs, which can be up to 95 degrees.

“The question is whether the pupfish adapted to live in those warm springs because, after all, they spent all of their previous evolutionary history in cooler waters and there hasn’t been much time to evolve,” says van Breukelen.

Ventilation in fish is driven by oxygen levels. When the oxygen level is high and fish produce ethanol, it closes off the mitochondria, the structures often described as the “powerhouse of the cell.” Since the cells are not consuming

**NEW OFFICE TO SUPPORT UNDERGRADUATE RESEARCH**

Few undergraduate experiences are more rewarding for students, both personally and professionally, than those working side by side with faculty members engaged in groundbreaking scientific and scholarly investigations. To help more students gain such hands-on experience in real-world research — along with the mentoring relationships that result from these experiences — UNLV has established an Office of Undergraduate Research and Scholarship, designed to coordinate and stimulate undergraduate participation in research, scholarship, and creative activities at UNLV.

The office aims to accomplish a variety of goals, officials say. Among these will be centralizing data gathering and communication on undergraduate research initiatives; using undergraduate research to boost recruitment of high-caliber high-school students; forming partnerships with NSHE institutions; and developing appropriate undergraduate-related research infrastructure.

The office will also coordinate efforts to train faculty mentors; will raise and manage funds; will work to attract a diverse cross-section of students; will coordinate efforts for long-term student career preparation (including graduate student recruitment) and, finally, will organize university-wide undergraduate research symposia to showcase findings related to undergraduate researchers’ findings. For more information email our@unlv.edu.
the oxygen coming in, there is little need to increase ventilation; hence, anaerobism occurs.

Unfortunately for the fish, going without oxygen is not without side effects. Researchers discovered damage to some of the pupfish that was similar to the effects of chronic alcoholism.

“There is a protein that is normally expressed in smooth muscle called alpha actin,” says van Breukelen. “Much like what we’d find in an alcoholic’s liver, we find this smooth muscle actin being expressed in the fish’s liver.”

This can negatively affect lifespan, he adds. The desert pupfish typically lives only six to nine months. Related species in cooler environments, on the other hand, often survive a couple of years.

Van Breukelen and Hillyard’s study was published in the April 15 issue of *Journal of the Federation of American Societies for Experimental Biology*.

**$500,000 IN FACULTY OPPORTUNITY AWARDS PROVIDE SEED FUNDING**

Research Projects from 20 UNLV faculty members have been selected to receive approximately $500,000 in Faculty Opportunity Awards, university officials announced earlier this year.

The Faculty Opportunity Awards program, inaugurated in 2012, is designed to support faculty research that shows potential for continued external funding. It also aims to provide the financial support investigators need to complete significant scholarly and creative works.

This year, faculty scientists and scholars submitted 44 proposals in three categories: Individual Investigator Awards, Collaborative Interdisciplinary Research Awards, and the Innovation Technology Award. Faculty-led panels reviewed the proposals and made funding recommendations, while a selection panel that included members of the CoRE Council and the Research Council offered additional input.

Thomas Piechota, vice president for research and economic development, then made final award recommendations to UNLV President Len Jessup.

Of the proposals selected, 12 were Individual Investigator Awards, a category that included awards for such faculty members as Jaeyun Moon, an assistant professor of mechanical engineering who specializes in advanced materials for energy applications; Arya Udry, an assistant professor of geosciences who is exploring volcanic activity on distant planets; and Jennifer Grim, a celebrated flute soloist and assistant professor of music who is exploring how flutes were played in Baroque-period performances.

Seven awardees were named in the Collaborative Interdisciplinary Research – Emerging Areas Seed Grants area. Among the groups selected was one including faculty members David Hatchett, Clemens Heske, Paul Forster, Balakrishnan Naduvalath, and Laszlo Nemeth, all from UNLV’s department of chemistry and biochemistry. The team is developing electrochemical processes that could advance efforts to convert CO2 into liquid fuels, a quest with energy generation and carbon-reduction implications that was recently called “one of the most important contemporary energy and environmental challenges.”

Jun Yong Kang, an assistant professor of organic chemistry, received the Innovation Technology Award funding. His work involves synthesizing a chemical compound, Gamma-aminophosphonate, that has shown promise as a therapeutic agent.

The Collaborative Interdisciplinary Research Awards – Center Of Excellence Challenge Grant went to Kwang Kim and Paul Oh in the Department of Mechanical Engineering for their “Center for Excellence in Consumer Robotics.”

**CENTER FOR GAMING REGULATION ESTABLISHED AT UNLV**

UNLV HAS ESTABLISHED A NEW International Center for Gaming Regulation, a state-supported partnership between UNLV’s International Gaming Institute (IGI) and the university’s William S. Boyd School of Law.

The center is poised to fill the gaps in understanding of global gaming regulation.

The center will be a research and teaching “point of convergence” for governments seeking to implement best practices, says UNLV’s Bo Berhard, IGI’s executive director. Research fellows at the center will target inefficiencies and inconsistencies in gaming law and regulation, while advocating, when appropriate, for policy changes using center-developed education programs.

Earlier this year, Nevada Gov. Brian Sandoval signed an appropriations bill committing an annual allocation of $500,000 to the center. Corporate sponsors from the global gaming industry have also offered support, pledging more than $1 million in donations.

Bernhard says that the center has been given a charge to become a global leader in the area of gaming regulation. “This center will answer that call, and the state’s financial commitment is a resounding endorsement of our efforts,” he says.

Dan Hamilton, dean of UNLV’s Boyd School of Law, adds that combining the resources and expertise of the law school, IGI, and government and industry partners will result in the development of best practices “to help those navigating the complex landscape of gaming regulation.”

Mark Lipparelli, a Nevada state senator and former Nevada Gaming Control Board chairman, and Anthony Cabiot, one of the world’s foremost experts in gaming law and policy, will serve as special advisors to the center.

The IGI is one of a growing number of UNLV centers of research excellence, according to Thomas Piechota, vice president for research and economic development.
Despair interrupted

Vulnerable youth have a friend in Ramona Denby-Brinson, the 2015 Harry Reid Silver State Research Award winner.

By AfsHa Bawany
She was a 21-year-old single mom who grew up in the foster care system, and she already had four children. Minutes into their first interview, UNLV's Ramona Denby-Brinson was able to tease out the depressingly familiar arc of her life story: absent parents, broken relationships, and grief and loss disguised as anger.

The young woman said she began having babies to prove that she could be a better mom than her own had been, that she would actually care for her children, and that, in return, she herself would be loved. Denby-Brinson nodded empathetically, but knew more complicated issues were at work.

“This situation is much too common for foster youth who become parents at an early age,” Denby-Brinson says. “We find that despite declining national rates of teen pregnancy over the past decade, the rates remain high for foster youth.”

Beginning early in her career as a social worker, Denby-Brinson wanted to shed more light on this aspect of foster care, especially given the fact that foster youth are three times more likely than their counterparts to maltreat their own children and subsequently have them removed from their care.

Denby-Brinson is a professor of social work in the Greenspun College of Urban Affairs and a senior resident scholar of social services at UNLV's Lincy Institute. In her 17-year academic and professional career — both as a scholar and a social worker — she has become deeply familiar with the realities of situations like that of the mother of four. She has also gained national recognition for developing programs aimed at assisting youth as they struggle, typically with little or no professional support, to overcome the attachment disruptions, physical and emotional traumas, personal losses, and, perhaps most tellingly, the profound grief that arises from the difficult hand fate has dealt them.

Throughout her career, Denby-Brinson has been changing conversations about child welfare (including foster care), children's mental health, cultural competency, and social policy. Her goal? To help Nevada’s most vulnerable citizens get a shot at a better life.

This work has earned her the Harry Reid Silver State Research Award, one of UNLV's most prestigious accolades. Named for the U.S. senator who has been a longtime supporter of UNLV, the award recognizes faculty researchers who exemplify a commitment to advancing understanding of issues that address the changing needs of the community, state, and nation. It includes a $10,000 cash prize funded by the UNLV Foundation. Denby-Brinson is the first female to win the award.

“It’s humbling to be part of a group of such accomplished people who have received the award,” she says. “I don’t see it as an award for me as much as I see it as recognition of the host of social science researchers across campus. Social science researchers pose tough questions, tackle seemingly insurmountable problems, and often pursue lines of inquiry that don’t have easy answers. The university is recognizing the value of social science research and our ability to change the landscape of the community with the type of research we do.”

Denby-Brinson is a Las Vegas native and licensed social worker. She earned a master's degree in social work from UNLV in 1990 and a doctorate from The Ohio State University several years later. After three years as an assistant professor at the University of Tennessee, Denby-Brinson returned home to join the UNLV faculty in 1998.

Since then she has been awarded more than $12 million in competitive research grants from some of the nation’s most important funding agencies, including the National Institutes of Health, the U.S. Department of Health and Human Services, and the Lois and Samuel Silberman Foundation.

“Ramona has used her research to advance the public good and to effect change on behalf of Nevada’s most vulnerable citizens,” says Stan Smith, associate vice president for research at UNLV. “She is highly deserving of this prestigious award.”

Smith notes that funding agencies tend to reward researchers who get results, and Denby-Brinson has done so by translating research into action. Her development of the Kinship Liaison Program, a mentoring project aimed at supporting foster families who care for the children of relatives, is one notable example.

Statistics indicate that maltreatment recurrence rates — the continued abuse or neglect of foster children who enter the system after experiencing mistreatment at home — for kids fostered by relatives can be high. Denby-Brinson’s research has shown that care by relatives is a preferred form of placement given its potential to increase overall well-being for children. However, when relative caregivers are not
supported or trained, or do not have adequate resources, maltreatment can persist. Many relative caregivers struggle financially and can feel overwhelmed by their new responsibilities. Some are unprepared to care for children who, due to previous traumatic experiences, may need help adjusting to their new homes.

The Kinship Liaison Program, overseen by Denby-Brinson and officials working with the Clark County Department of Family Services, aimed to reduce maltreatment recurrence, increase home stability and permanence for children, and improve their overall well-being. Relative caregivers were paired with well-trained mentors, or “kinship liaisons,” men and women whose similar experiences and support helped ameliorate the conditions that can lead to abuse and neglect. It’s working, she says. Maltreatment recurrence rates have been cut in half and children are improving academically and emotionally.

The program’s achievements have been lauded by the U.S. Department of Health and Human Services, and it has since become a model adopted in one form or another by several U.S. cities. Its success has also led to ongoing funding by Clark County, and it has been described as a model family engagement and system-of-care approach and is cataloged in the Child Welfare Information Gateway description of exemplary programs.

“Ramona Denby-Brinson develops research questions that produce solutions for Las Vegas and the nation,” says Robert Ulmer, dean of UNLV’s Greenspun College of Urban Affairs. “Her research is so important because the innovative solutions she develops protect and make the lives of children better. As a faculty member in the Greenspun College of Urban Affairs, she conducts research that captures the value of creating urban solutions for the most pressing needs in our communities.”

For her part, Denby-Brinson says she is motivated by the “change in conversation” that happens when programs like the Kinship Liaison Program are successful. “Now policymakers want to invest in the kids and invest in supporting caregivers and families,” she says. “That’s the neat part: when you can use your research for advocacy. We use our research to change policies and to create programs that, in the real world, make a difference for families.”

In another project, Denby-Brinson is seeking to better understand why young women in foster care — such as the aforementioned 21-year-old mother of four — so often end up in difficult circumstances. Mindful of the tremendous risks that foster youth face, she created the Determined, Responsible, and Empowered Adolescents Mentoring Relationships (DREAMR) project in 2012. DREAMR is a randomized experimental-control group study situated in Clark County and funded by the U.S. Department of Health & Human Services Children’s Bureau. Young women are eligible for participation in the DREAMR project if they are between the ages of 12-21 and are currently or were formerly in the foster care system. A team of public and private providers administer an array of services. Denby-Brinson is partnering with several community stakeholders to conceptualize and implement the intervention, and she and her research team have been studying the effects of the intervention for the past five years. Her early research findings indicate that these women typically aren’t making spontaneous or irrational decisions. They are instead consciously choosing preg-
Denby-Brinson also finds that a significant number of her foster-child cohort struggle to envision a better future for themselves. Parenthood, by providing a sense of purpose, worth, and meaning, thus becomes a satisfying stand-in for the significant and meaningful relationships that are otherwise missing in their lives.

“This research provides social work professionals with greater understanding of the psychology behind early pregnancy — particularly intentional pregnancies — in foster care youth,” she says. “It allows professionals to appropriately and more effectively intervene. Such interventions can potentially stop the cycle of generational maltreatment and bring about more positive financial, educational, and psychological outcomes for young adults.”

Denby-Brinson seeks to address social problems in a fashion typical of her professional values and philosophy: She cultivates relationships, galvanizes community interests, and brings together community partners and stakeholder groups. The DREAMR project involves active and long-standing partnerships with a number of organizations, including the Clark County Department of Family Services, Big Brothers and Big Sisters, the Southern Nevada Health District, and the Nevada Institute for Children’s Research and Policy. She also partners with local nonprofit groups serving foster families and at-risk children, such as Olive Crest and SAFY (Specialized Alternatives for Family), to create various intervention programs.

In the DREAMR program and others, Denby-Brinson credits the dozens of graduate students who have assisted her over the years. Currently, senior research associate Efren Gomez, whose academic background is economics, manages the DREAMR project and supervises a group of graduate research assistants who are studying social work and marriage and family therapy.

“We conceptualize the interventions and related research components, and then we teach graduate students how to collect, manage, store, and analyze data,” she says. “Graduate students are a vital part of our work, and we could not run longitudinal, multifaceted, large projects without them. In fact, the graduate students become so skilled and they get so invested that they can decipher things that sometimes we miss. It’s truly a case of the students becoming the teachers.”

In addition to graduate students the DREAMR study actively involves technical advisors — young adults who were once in the foster care system and now help others by sharing their insights and experiences. “Our technical advisors assist in every aspect of the project. They help us to collect data but most importantly, they help us to understand and translate our research findings,” she says.

In the DREAMR study Denby-Brinson and her team are developing a variety of activities used to help foster youth reconcile feelings of separation and the trauma that they have experienced in the past. In order to more rigorously assess the interventions’ effectiveness, Denby-Brinson uses a control group, a tool that is fairly unique in social science research. Particularly in child welfare research, the use of control groups is not always welcomed; this is because public child welfare administrators and other leaders seek to deliver services to all children.

In this case, however, Denby-Brinson convinced her community partners to use a randomized control group design, hoping to provide a clear indication of whether the variables introduced affect outcomes. The subjects were randomly selected to participate in either the control group or the intervention-receiving DREAMR group.

Final results are expected early next year, but preliminary findings indicate decreasing depression and anxiety rates for the DREAMR group participants. Pregnancy rates among them have also dropped. The program is expected to end in 2016 but may continue if grant funding is available.

Denby-Brinson has used her empirical research findings to create a new project that organizes the efforts of local and state public and behavioral health partners to develop and expand clinical social work education. The three-year project, titled “Meeting Behavioral Health Workforce Needs Project,” was funded by a $1.4 million grant funded by the U.S. Department of Health and Human Services. Its goal is to produce more than 100 highly competent practitioners who can intervene on behalf of children, adolescents, and transitional-age youths who are at risk of (or who have already developed) mental and/or behavioral health disorders.

The project’s research component involves multiple methods, including geodemographic recruitment, youth- and family-informed teaching models, mentoring groups, field site environmental scans, and clinical, cultural, and linguistic self-assessments/self-efficacy measures.

Led by project coordinator Natasha Mosby, the initial cohort of trainees have started their specialized training, which includes a series of courses and field education to prepare them to intervene with children and youth using evidence-based mental health treatment models. Denby-Brinson says faculty will emphasize the importance of connecting with the families and parents of children, as they need support just as much as the children do and must be valued as equal partners in helping children succeed.

In addition to courses taught by UNLV faculty, the social work mental health trainees will take a course that will be co-taught by adolescents who have been diagnosed with mental health difficulties and their parents or a family representative. Denby-Brinson says the idea is to help students to hear first-hand how families live with mental health issues.

She says this new method of delivering the course material should help students overcome their biases and stereotypes about children who live with mental health disorders.

Involving family members will also help students understand that treatment of mental health disorders is a team effort — a partnership among patients’ families, doctors, nurses, school officials, counselors, social workers, and other mental health professionals.

“One of the rewarding aspects of my work is being able to use research discoveries to change the lives of children, youth, and families who have been overlooked and counted out,” Denby-Brinson says. “It’s amazing to see how even a minimal level of support and investment can help children thrive and grow up to live normal, productive, and fulfilled lives.”

The Harry Reid Silver State Research Award is funded by the UNLV Foundation.
UNLV patent applications have tripled in the last two years, and three startup companies have been formed, demonstrating the university’s revitalized commitment to bringing its research to the marketplace. Learn about three innovative discoveries that are contributing to the remarkable growth in commercialization of UNLV research.
M O R E  T H A N  4 0  P E R C E N T  O F  T H E American honeybee population died prematurely in 2014, a sharp rise over 2013’s already distressing total. Both in the U.S. and around the world, the honeybee’s devastating decline continues to alarm both environmentalists and farmers, who rely on commercial beekeepers to pollinate nearly a third of all crops on the planet.

“These numbers are unsustainable,” says Amy, a UNLV life sciences researcher who is on the front lines in the war against honeybee pathogens. Her primary target is American foulbrood disease, a bacterial infection responsible for millions of bee deaths each year.

The weapons of choice for Amy and her research team are specific bacteriophages (or “phages” for short) that can be used as a natural way of preventing American foulbrood infestation and hive destruction. A bacteriophage is a virus that infects and replicates within a bacterium.

“We found that if we treated honeybee larvae with these phages they survive almost as if they were never exposed,” she says.

Her research also has spawned Colony Shield, a startup company based in...
Henderson, Nevada, that has entered into an exclusive licensing partnership with UNLV. The company aims to expeditiously bring products derived from her lab’s discoveries to beekeepers anxious to find a way to save their hives. The stakes are high. Honeybees support nearly $15 billion worth of agricultural industry in the U.S. alone.

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AMERICAN FOULBROOD DISEASE, OR AFB, wreaks havoc when the _Paenibacillus larvae_ bacterium finds its way into the gut of a bee in the larval stage. The deadly microbe eats the developing larva from the inside out until it eventually dies, leaving behind a gooey mess filled with contagious spores. Nurse bees then spread the spores to additional larvae. Eventually, the entire colony collapses.

Current environmental regulations require infected hives to either undergo a costly remediation process or for beekeepers to destroy the hives, bees, and associated equipment by fire. Preventative treatments with antibiotics have shown short-term promise but also leave behind environmentally questionable chemical residues in honey. Such treatment methods have also been shown to produce _Paenibacillus_ strains that quickly developed resistance to the antibiotics, making the treatment ineffective and the bacteria potentially more dangerous in the long term.

Amy’s solution is a natural process that, when administered properly, is showing great success in preventing AFB infection and some success in treating hives that have already been infected. It is also completely safe for bees and humans.

Amy and her research team presented their latest results in June to the American Society for Microbiologists. The society awarded its 2015 undergraduate research fellowship to one of Amy’s students, Lucy LeBlanc, for her work identifying and isolating an enzyme that helps facilitate phage therapy by protecting larvae that are already under attack.

While Amy’s lab is doing fundamental research and establishing UNLV’s expertise in the study of phages, UNLV’s startup partner Colony Shield is helping transfer these theoretical insights into a deliverable technology. Currently, Colony Shield is producing freeze-dried phages that beekeepers can add to sugary syrup for nurse bees to distribute around the hive.

“I am a scientist, and I understand the need to let the basic science and applied science inform each other without obscuring the other,” says Amy. “I love biotechnology, and I’m always thinking about real-world applications for this science.”

Her primary goal, she says, is to stop the ravaging effects of the disease. But Amy also hopes to help the beekeeping industry.

“We hope that those who keep bees will find this a successful prevention method to avoid devastation from American Foulbrood,” she says, adding that the economic impact of preventing AFB would be tremendous. “Every hive costs several hundred dollars to set up, and each one not lost to disease means cost savings.”

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IN ADDITION TO LEADING THE UNLV research that has led to a successful startup, Amy has provided 14 students with valuable research opportunities. The research has led to many theses, dissertations, and publications in leading journals — most recently in the July 2015 _Journal of Insect Science_. Several students’ names also appear on two patent applications.

Amy’s students have also visited several Clark County elementary, middle, and high schools to teach young children about bees’ significance in maintaining a sustainable food supply. One recent presentation to third graders at Tartan Elementary in North Las Vegas included a demonstration of the “phage dance,” created by LeBlanc to inspire the next generation of microbiologists.

Amy says she’s gratified to see the benefits the research has produced, from student successes to community outreach to the startup launch.

“I’m extremely grateful that both UNLV and Colony Shield have seen the value in supporting a treatment that promises to prevent some of the devastating loss of honeybees in the United States and worldwide.”

— Penny Amy
“See, it just looks like a pile of sand,” says post-doctoral researcher John Howard, pointing to the dirty-white chalk-like powder.

But this is no ordinary pile of sand. It came from a mix of ingredients that, when heated to 300 degrees Celsius, forms a new kind of material that, Howard says, could represent the next big leap in battery technology.

Howard is part of a team of UNLV researchers led by Yusheng Zhao, head of the university’s new energy materials lab. Fueled by $2.9 million in grant funding from the U.S. Department of Energy, Zhao, Howard, and their team are making advances in fundamental research about energy storage and transfer that could change what’s inside the batteries that power our personal gadgets and electric vehicles.

“We want battery-powered vehicles that go faster, go farther, and are safer,” Zhao says.
Their current focus involves development of a substance called lithium-rich antiperovskite, or LiRAP for short. (LiRAP is an electronically inverted form of “perovskite,” a crystal structure that’s abundant deep in the Earth’s mantle.) When synthesized in UNLV’s labs, LiRAP forms the basis of a new battery material Zhao and his team are working to develop. If their effort succeeds, it would lead to a new generation of batteries that could compete with current technology at a fraction of the cost while also providing added safety benefits.

To facilitate the ion transfer that generates energy, all batteries consist of three parts — a cathode, an anode, and an electrolyte in between. Zhao explains that current lithium-ion batteries contain a liquid electrolyte that is toxic, flammable, and leak-prone. For vehicles that rely on lithium-ion batteries, including airplanes and electric cars, leakage and combustion can be serious issues. Boeing’s highly touted new 787, for example, was initially plagued by batteries that could overheat and catch fire; similarly, electric vehicle manufacturers have faced concerns over fires resulting from routine car accidents.

Zhao’s battery material — the sand-like substance produced in his lab — creates a solid electrolyte that is impact-resistant and non-flammable, making it less dangerous and more environmentally friendly. Such innovations, Zhao says, are key to his lab’s success.

Recently, his team found a way to replace a typical carbon anode (the battery part indicated by a minus sign) with one made of lithium. The change increased the battery’s energy density, which could lead to more compact batteries able to provide more energy.

“This kind of discovery is why we do what we do,” Zhao says. “The unexpected is what makes research exciting.”

If the team’s work continues to go well, the resulting technology could lead to a new generation of batteries constructed as singular solid-state cells — cells that could safely and efficiently power devices ranging from phones and laptops to wearable electronics and electric cars.

Initial funding for Zhao’s battery lab came from the Advanced Research Projects Agency-Energy (ARPA-E), a federal initiative supporting important applied research related to energy. Competition for ARPA-E grants is intense, with about 1 percent of proposals receiving funds. Zhao’s $2.9 million grant, awarded in 2013, funds the lab at UNLV for three years and also facilitates collaboration with researchers at University of Texas and Los Alamos National Laboratory, where Zhao worked prior to joining the UNLV faculty.

Zhao credits his work at Los Alamos for laying the foundation for his current research at UNLV. He came to the university in 2010 to lead the High Pressure Science and Engineering Center. That work led to the research now being conducted at UNLV’s new energy materials laboratory, he says.

Zhao says research exploring materials to serve as solid-state electrolytes in batteries has been conducted for decades, but only recently was his team able to secure the resources necessary to take significant next steps.

“We are not just working on one battery component,” Zhao explains. “We are considering the battery as a whole. Our experiments serve as a bridge between fundamental science and practical applications.”

He cautions, however, that there is still much to explore. The team is currently working on crystal-structure manipulation, for example, to increase ionic conductivity and power capacity. They also are investigating the LiRAP electrolyte’s compatibility with different electrode materials, as well as exploring the LiRAP material’s functionality as a cathode (the plus-sign part of a battery).

“Dr. Zhao is conducting cutting-edge research in battery and battery-related technologies,” says Zachary Miles, associate vice president of economic development at UNLV. “The collaboration with ARPA-E has created some innovative opportunities for energy research with commercial promise, and we are enthusiastic about the future of this team’s work.”

— DAN MICHALSKI
Cleaner Rare Earths

Our high-tech marvels demand rare earth metals and oxides. UNLV researchers are working to make extracting them less toxic and more efficient.

There are 118 elements on the periodic table. The familiar ones include hydrogen (1), oxygen (8), as well as the noble gases helium (2) and neon (10). But there is a subset of the periodic table that includes less familiar elements. Count among them atomic numbers 57 through 71 — a group of metallic chemicals collectively referred to as "lanthanides," or rare earth metals.

Found in the Earth’s crust, these rare earth metals are valued for their unique magnetic, optical, and catalyst properties. Many of the items we take for granted in modern life — consumer electronics, computers, clean energy, health care technology — depend on lanthanides to perform with the efficiency, speed, and durability to which we’ve grown accustomed.

China currently controls approximately 97 percent of the world supply of rare earth metals and oxides, says David Hatchett, a chemistry professor at UNLV. For the rest of the world this, obviously, is a source of some consternation.

"China is reducing exports and increasing prices to foreign consumers," says Hatchett, who has been developing a more efficient way to separate rare earth metals from mineral deposits for six years. "The global impact of these restrictions is greatest in countries with large high-tech manufacturing sectors such as the USA, Japan, and Germany."

Lanthanides are typically found in mineral deposits that require laborious and costly processing and refinement. They are difficult to extract — a characteristic that defines them as much as their silver color, sensitivity to contamination, and sometimes high levels of reactivity.

Like most processors, the Chinese typically rely on an "acid-leach" process — essentially exposing material containing rare earths to a chemical bath — to extract the desired elements. Contaminated water left over is then consigned to waste pits. Unfortunately, these pits are seldom effective in keeping acids and other contaminants from leaking into groundwater. In China, where regulation is lax and there are few environmental protections, local residents are left to live with the environmental fallout.

Hatchett and his research team believe there is a better way. They are the principal investigators on a patent protecting their process of electrochemically recovering and separating a variety of rare earth metals. It is a process that would decrease the cost of processing high purity metals. The new separation technology, Hatchett says, enables more rapid, flexible, efficient, and environmentally friendly extraction and separations of individual lanthanides from mixtures.

"We discovered a way to electrochemically reclaim these rare earth metals and possibly separate them," he says. "The refining process produces a mixture of rare earth metals, but if you can separate out the one you want and leave the other stuff behind, it is a beneficial process.

"It is an electrochemical approach rather than a chemical approach, meaning we are not using leach pits and taking the extract out to neutralize," he adds. "We actually dissolve the materials directly into an ionic liquid, and we then electrochemically recover one in the presence of others. We use an electrode to collect the one species we want."

In terms of materials, rare earth metals are the hardest to reduce, Hatchett explains. They are extremely electropositive, meaning they don't want to be reduced to metal. They are not found in nature as a metal.

The electrochemistry of the ionic liquid is the key. The ionic solution is a salt — not in the more familiar crystallized form, but a liquid.

"The materials we use are nonvolatile, environmentally stable, and they provide high electrochemical reduction potentials," he says. "The process allows us to reuse the materials because the solvent or ionic liquid doesn't degrade."

Hatchett says the next question is to determine if this process is cost effective.

This method isn’t just for mining rare earth metals from the Earth; it could also be used for consumer-based recycling. Rare earth metals are present in many materials that are discarded, such as fluorescent light bulbs. Hatchett notes that there might be a time when it will be financially feasible to reclaim these materials. His team’s process could conceivably be used for reclaiming rare earth materials found in discarded electronics.

The process may also be useful in recovering rare earth metals from spent nuclear fuel or from manufacturing byproducts, as well as in the mining industry, according to Zach Miles, associate vice president of economic development.

"The prospect of introducing a less toxic, more efficient process for recovering or separating these materials would be a tremendous opportunity for a number of industries," he says. "The research opens the possibilities for new types of industry as well."

Miles added that the process is represented in two published patents and is available for licensing by the university.

— Shane Bevell
A Quest for Our Earliest Ancestors

WHERE THE FOSSILS ARE
A camel caravan winds its way through the sun-blasted hills of Ethiopia’s Ledi-Geraru region.
A Quest for Our Earliest Ancestors

BY CHARLES E. REINEKE

By illuminating a dark period in human evolutionary history, a UNLV scientist gets his turn in the spotlight.
For Villmoare, a charismatic but low-key assistant professor at UNLV, the media onslaught was something of a whirlwind. “Especially the first two weeks after the Science article was released, I was really overwhelmed,” Villmoare says. “I had just gotten back from Ethiopia a couple of days before, so I was still on Ethiopian time. I was doing interviews at five in the morning, 1 a.m., noon. I never got any sleep; I was just in a haze the whole time.”

Sleep deprivation and the occasional over-the-top antics of television news crews notwithstanding, Villmoare didn’t begrudge reporters their interest. He had, after all, spent years working alongside Kaye Reed, William Kimbel, and other prominent researchers from Arizona State University’s Institute of Human Origins (IHO) to unearth exactly this sort of fossil. When the breakthrough finally happened — on a late January morning two years ago in Ethiopia’s sun-blasted Ledi-Geraru region — everyone on hand knew they had accomplished something special.

It took a while, but soon enough the whole world would know too. A headline in the online edition of the journal Nature was typical of the breathless international coverage: “Ethiopian jawbone may mark dawn of humankind,” it read.

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**SITE AND STRATA**

The desolate site of “humankind’s dawn” hadn’t been chosen by accident. Ledi-Geraru is located less than 20 miles northeast of Hadar, the fossil-hunting ground made famous by Donald Johanson’s 1974 discovery of “Lucy,” the famous 3.2 million-year-old skeleton of *Australopithecus afarensis*. The Hadar region has produced many other important finds, but all older than the 3-million-year horizon predating the appearance of our genus, *Homo*.

Ledi-Geraru, on the other hand, showed great potential for yielding up very old fossils of *Homo*. Adding to the site’s luster were data provided from radiometric dating, a technology that allowed geologists to peg fossilized flora and fauna from the area at 2- to 3-million-years-old. This period is a critical time in human evolutionary history, one that had previously yielded precious few finds shedding light on *Homo’s* origins.

Discovering early human fossils within this million-year gap had always been the team’s chief objective. The availability of radiometric dating, Villmoare says, was crucial to making it happen. For millions of years, he explains, the Ledi-Geraru region has been rife with volcanic activity. During eruptions, lava and huge clouds of ash coat the landscape with crystals containing small amounts of naturally occurring radiation. As it cools, this igneous material hardens into layers of ash and rock, trapping its radioactive crystals inside. Because these decay at a predictable rate, geologists can use radiometrics to pinpoint when these layers, or stratigraphic...
sections, were formed.

Fossils are seldom found in the igneous strata formed by these volcanoes but are common in the sedimentary deposits that slowly built up between eruptions. It’s thus a relatively straightforward exercise to date fossils found sandwiched in sediments between igneous layers; scientists simply “bracket” them from stratigraphic section to section. “The idea is that you have a geologist who can say, ‘Ok, it looks like this time frame is between x and y,’” says Villmoare.

Finding the right strata, however, can be more of a challenge.

“The problem is that the [2- to 3-million-year-old] sediments don’t preserve very frequently in eastern Africa. It took us a long time to find the right ones,” he says. “This, incidentally, is why you have to do this sort of thing in a desert environment like Ledi-Geraru. There can’t be a lot of foliage on the ground because you have to be able to see all the stratigraphy.”

Ledi-Geraru is named for two rivers, often dry, that define the research area. It’s good for dating fossils but difficult in other ways. It’s hot. It’s remote. Mounting a field camp for 50 to 60 researchers, students, drivers, kitchen staff, and others is a major logistical headache.

“Yes, it’s quite a production getting the whole thing organized,” Villmoare says. “In the early days we would just put all the gear on the top of a couple of Land Cruisers. But now we rely on a big, military-style six-wheel truck to come out and drop it off.”

BUILDING A CAREER

Villmoare, a self-described “late bloomer,” says he took a circuitous route to anthropology. But it’s a path that has left him with the breadth of skills necessary to deal with pretty much any situation that might arise in the desert.

He was raised in Baltimore, the son of lawyers. As a kid, oddly enough, he had only a passing interest in fossils, dinosaurs, and other things paleontological.

“I grew up wanting to be a novelist, actually,” says Villmoare. “I didn’t take a single hard science course as an undergrad [at the University of Virginia]. I had always had a problem with the math. I had a couple of bad math teachers, and I grew to dread it. It’s kind
of ironic because much of my work is highly quantitative, and now I teach statistics to graduate students.”

After graduating from UVA with bachelor degrees in English literature and philosophy, Villmoare, like a lot of liberal-arts majors, set aside his literary ambitions in favor of a more practical path to prosperity — in his case, work in the building trades.

“I really wanted to learn how to build a house from start to finish,” Villmoare recalls. “So I found work in construction. Every six months I would switch trades: framing, sheetrock, trim, tile … all these different skills.”

Success followed, and he eventually headed up his own historic renovation firm in Phoenix, where he’d moved to be with his wife, Amy, who was training to become a chef. Villmoare’s firm prospered, earning contracts to work on some of Phoenix’s most prized historical properties, among them the city’s iconic Luhrs Building, its old Grace Court School, and many of the houses on Phoenix’s famed Heritage Square.

But even as he built his business, Villmoare found himself yearning for something more than “just working.” In part because he recalled enjoying family camping trips near Anasazi ruins, he signed up for a couple of anthropology courses at nearby Arizona State University. “It was just on a lark,” Villmoare says. “But a couple of the professors liked my work enough to recommend me for admission to the anthropology program. I got in at the same time that the Institute of Human Origins arrived.”

He had found his calling. “I’m not one of these people who was driven, someone who knew what he wanted and pursued it from day one. I almost just fell into it. IHO didn’t have to appear at ASU at the same time that I did. But when it did, I could see that this was an amazing opportunity, and that paleontology was something I could see spending my life doing. Needless to say, I pursued it vigorously from that point.”

Villmoare kept the construction firm going, using proceeds from the business to help sustain his family — he has two daughters, Margo, born in 2003, and Ava, born in 2004 — while he pursued a master’s, then a doctoral degree. His academic work focused on the evolution of the human and primate skulls. After graduation, his first faculty position took him and his family to University College in London.

Villmoare says he and his wife loved London, and he was eventually offered tenure at University College. But making ends meet in England’s capital was tough.

Nearly all of his salary was going to pay rent on a modest home 45 minutes from the college, while his wife’s income had to pay for everything else. “It was just too stressful financially,” says Villmoare.

England’s loss was America’s gain. Villmoare returned to the U.S. in 2011, becoming a research professor at George Washington University’s prestigious human paleontology program. He joined the UNLV faculty in 2014 and, with the university’s blessing, soon found himself again collaborating with his former Institute of Human Origins colleagues, this time on one of the institute’s most prominent projects: the hunt for 2- to 3-million-year-old remains at Ledi-Geraru.

**EVOLUTIONARY UNCERTAINTY**

In their *Science* article, Villmoare and his co-authors begin by describing why finding a jawbone and teeth from the period was so exciting. The origin of *Homo* remains clouded, they wrote, an “uncertainty [that] stems in large part from a limited fossil record between 2 and 3 million years ago, especially in eastern Africa.” Their specimen, they continue, “securely dated to 2.80 to 2.75 million years ago, combines derived morphology observed in later *Homo* with primitive traits seen in early *Australopithecus*. The discovery has implications for hypotheses concerning the timing and place of *Homo* origins.”

Villmoare, by way of analogy, likes to describe what all this means in terms of an evolutionary “tunnel.” Roughly three million years ago, he says, our early ancestors entered a million-year-long passageway. They emerged very different animals.

“At 3 million years we were essentially ape-like creatures,” Villmoare says. “We lived in wooded environments eating fruits the way apes do. And even though we were walking on two legs, we were still long armed and still...”

“It’s quite a production getting the whole thing organized. In the early days we would just put all the gear on the top of a couple of Land Cruisers. But now we rely on a big, military-style six-wheel truck to come out and drop it off.”
Bare bulbs illuminate Institute for Human Origins researchers at their Ledi-Geraru command center.
adapted to living in trees, at least occasionally.

“At 2 million years, on the other side of the tunnel, we appear with larger brains, using stone tools, and starting to eat meat. We also have acquired more modern body proportions: longer legs and relatively shorter arms. It was a huge, huge adaptive transition.”

Determining how and why this happened depends, in large part, on expanding the fossil record, that is, systematically searching through period-appropriate strata to find bits of fossilized plants and animals that might provide a fuller account of our ancestor’s evolutionary environment. Enter the Ledi-Geraru jawbone.

Villmoare vividly recalls its discovery.

“We were all on this hill that produces a lot of fossils — a place where we found a lot of non-human stuff as well — circling around it,” he says. “Chalachew Seyoum, an ASU graduate student who is from Ethiopia, was working his way toward the top, and he saw the thing poking out of the sand.”

As soon as he realized the “thing” was a mandible, Seyoum excitedly summoned Kaye Reed, an expert in mammalian fossils who, with Villmoare, co-directs the Ledi-Geraru project. Reed took one look and whooped with joy. Villmoare arrived moments later. He and Reed quickly confirmed that the fossil belonged to a hominin, a member of that evolutionary line leading to Homo sapiens.

SINGULAR SPECIMEN LD 350-1’s distinctive features, among them the size and shape of its molars and premolar teeth and the relative narrowness of the rear part of the jaw, helped establish that the creature it came from was a representative of the evolutionary line leading to Homo sapiens.

Skilled museum staff helped reassemble the jaw and teeth. They also created detailed casts of the fossil to aid in further investigations.

At a laboratory in the museum, Villmoare teamed up with Kimbel, director of the Institute of Human Origins, to begin the painstaking analysis that would lead to the Science publication more than two years later.

“Bill and I met in Addis, and we spent eight or nine days just comparing the fossil to every specimen that they have at the museum,” Villmoare says. They started with Australopithecus afarensis, the hominin species that lived in Ethiopia’s Afar region between 3.8 and 2.95 million years ago.

“We compared it to every single one of those to make sure that it was truly different,” Villmoare says. They then moved on to other specimens, working their “way outward from there,” he adds, “toward other species of Australopithecus and early Homo.”

This process of finding LD 350’s evolutionary fit — an investigation conducted both at the Addis Ababa museum and with the fossil’s cast at Arizona State — was anything but straightforward, recalls Kimbel. “You sit with a jaw and make these observations — lists, measurements, comparative annotations — to develop a sense of the jaw’s affinities: what lineage it is most likely affiliated with, what species it differs from, et cetera. The hard part comes in trying to sort out the alternatives.”

Kimbel and Villmoare knew right away that the jaw did not belong to Lucy’s species, A. afarensis. This is because its bone structure and teeth were more “derived” than Lucy’s; in other words, they had evolved to reflect the specialized needs of a hominin from a later period. But because all hominins following A. afarensis show at least some of these changes, the determination did little to settle whether LD 350 was, in fact, part of the early Homo lineage.

“The degree of difference between the LD 350 jaw and other species in Southern and Eastern Africa that are younger than 3 million years old is less obvious than the differences between LD 350 and its putative ancestor, Lucy. So, as you refine your hypotheses as to where it might fit on the evolutionary tree, the distinctions, potentially, become subtler. And when you have half a jaw with five teeth, well, you know” — here Kimbel pauses and laughs — “it gets a little touch-and-go sometimes.”

“I, for one, was a little more skeptical at the outset as to where this thing was going to fit on the tree” he says. “I knew instantly that it was not going to fit with afarensis. That was easy. The question was, ‘If not there, then where?’

“Brian and I haggled back and forth; we looked and thought. Ultimately, I asked myself … ‘What would we expect the jaw of one of the earliest representatives of our lineage to look like?’

**An Evolutionary Road: A Timeline**

<table>
<thead>
<tr>
<th>H. sapiens</th>
<th>200 kbp</th>
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<tbody>
<tr>
<td>H. rudolfensis</td>
<td>2 mya</td>
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<tr>
<td>H. erectus</td>
<td>2 mya</td>
</tr>
<tr>
<td>H. habilis</td>
<td>1.8 mya</td>
</tr>
<tr>
<td>AL 666-1 jawbone</td>
<td>2.3 mya</td>
</tr>
<tr>
<td>Australopithecus afarensis (Lucy)</td>
<td>4-5 mya</td>
</tr>
<tr>
<td>LD 350-1 jawbone</td>
<td>2.8 mya</td>
</tr>
<tr>
<td>robust australopithecines</td>
<td>2.6 - 14 mya</td>
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| 4 million years ago |
| 3 million years ago |
| 2 million years ago |
| 1 million years ago |
| Present time |
like if it were, in fact, on the line leading to later *Homo?* When I turned the question that way — thinking about its teeth, bone structure, *et cetera* — it began to bubble up to me that the representative jaw I was imagining was there on the table in front of us.

“That’s hypothesis testing, and that’s what we do. Paleoanthropologists sometimes project — though not consciously — that identifying these fossils is the outcome of some mystical process: We find them in the ground, we pull them out, and then, ‘Voilà!’ — like they have labels attached to them. In fact, just as in any other science, what we do involves a long, scholarly process of testing, questioning, forming hypothesis statements, and so on. And, frankly, this is the most interesting part.”

In this case, of course, the consensus opinion pointed to LD 350-1 as the oldest *Homo* specimen ever unearthed. Villmoare adds the essential evolutionary context.

“In your mind picture a capital ‘Y,’ he says. “The stem of the ‘Y’ is *Australopithecus.* Then you have this split: the right branch goes to what is called the robust group, or *Paranthropus,* and the left branch goes toward us.”

The LD 350-1 mandible, he continues, has some features that it shares with the *Australopithecine* stem — it is primitive in some respects, especially in the front, around the chin. “But it also has a lot of other features that you don’t see until you are fairly far up the *Homo* branch of the ‘Y.’ In other words, they are not features that could be misidentified or misaligned with another group.”

Among these are the size and shape of those molars and premolar teeth, along with the relative narrowness of the rear part of the jaw. These and other defining characteristics of the Ledi-Geraru mandible, he says, are still with us humans today.

“The fact that those features are present at 2.8 million years means that it’s at that point on the ‘Y’ that’s right above the split, on the base of the line leading to modern humans.”

**MORE TO EXPLORE**

All fossil finds, no matter how consequential, tend to raise as many questions as they answer. LD 350-1 is no exception. How did regional climate change affect this hominin’s living conditions? What about physical and behavioral development? How did it move? Was the creature capable of using tools? And, perhaps most critically, did the jaw’s owner have a brain size approaching that of modern humans?

**MAN AND MANDIBLE** Brian Villmoare poses with LD 350-1, the fossilized jaw that pushed back the timeline on human origins.

Answers will depend on more research and further discoveries.

“Did we want to find more? Yeah, most definitely,” Villmoare says. “A lot of the hypotheses that relate to early *Homo* center around brain expansion. And so one of the big questions is whether our specimen had a bigger brain than *Australopithecus.* The only way to know if it has a larger brain is, obviously, to find a piece of brain case. So next year we’re going to go back over that hill.”

The Ledi-Geraru Project is supported by funding from the National Science Foundation and the Institute of Human Origins. Villmoare says he’s also impressed by UNLV’s support, which goes beyond just providing a nice laboratory in Las Vegas.

“I’m a research guy, and so the fact that the university takes research seriously really does matter to me. The fact that UNLV has stepped up its game and is intent on supporting research going forward makes this place a great fit for me.”
The creations of Paul Oh, technologist and visionary, are in the vanguard of a robotics revolution.

BY MEGAN DOWNS
PHOTOGRAPHY AARON MAYES

He calls it “Roboland,” his vision of an automated systems paradise meant to inspire the inner engineer in us all. “It will be educational, like the Smithsonian. It will have some rides, like Universal Studios, so families can get their kids excited about science and engineering. And it will be the place to unveil robotics technology, like Las Vegas’ famed Consumer Electronics Show, where people come from all over the world to see tomorrow’s electronics. We can do the same for robotics.”

Welcome to the restless and creative mind of Paul Oh, robot-builder extraordinaire and the recently named Lincy Professor for Unmanned Aerial Systems at UNLV. Oh says he came to Las Vegas because Nevada is poised to become the nation’s premier destination for all manner of “unmanned systems”—robotic machines that have potential to become stronger and faster than their human creators.

But don’t book your Roboland vacation just yet. Though Oh contends that it would be a perfect fit for Las Vegas, he acknowledges that at this point it’s just a dream. In the meantime, however, opportunities to build Nevada’s robotic future abound, he says.

For example, he cites Nevada’s designation as one of six states with Federal Aviation Administration authorization to test unmanned aerial devices for the commercial market. And earlier this year, a UNLV team led by Oh scored a top-10 finish in the Defense Advanced Research Projects Agency (DARPA) Robotics Challenge Finals, the world’s premier showcase for state-of-the-art robots. Among the participants were the international engineering heavyweights Carnegie Mellon, MIT, and NASA.

Oh arrived at UNLV last July by way of Drexel University in Philadelphia, bringing with him more than $1 million in federally
funded research grants. Previous to that, he served as a program director for robotics at the National Science Foundation, where he managed a portfolio that supported almost all nonmilitary university robotics research in the U.S. He has also served as a fellow for Boeing, the Office of Naval Research, and the NASA’s Jet Propulsion Lab at CalTech.

Among Oh’s first tasks at UNLV was to establish the Drones and Autonomous Systems Lab (DASL), where he and his team fine-tuned the robot “Metal Rebel” that would participate in the DARPA Robotics Challenge (DRC) Finals.

The DRC was designed to catalyze human-robot systems development with the goal of helping emergency personnel respond to natural and man-made disasters. According to the DRC website, “teams from some of the most advanced robotics research and development organizations in the world are designing hardware, software, sensors, and human-machine control interfaces to be tested in a series of tasks selected by DARPA for their broad relevance to disaster response operations.”

Oh brought two talented roboticists with him from Drexel, postdoctoral researchers Kiwon Sohn and Youngbum Jun, both of whom took lead roles in the DARPA challenge and have served as co-authors on the numerous research publications that have emerged from it. Graduate student Paresh Brahmbatt, another Drexel transplant who serves as the DASL lab manager, also played a key role. Other team members include graduate and undergraduate students from UNLV, along with a professor and a handful of students from Kookmin University in Seoul, South Korea.

The DARPA challenge, Oh says, was about more than just helping a robot lumber around an obstacle course. The goal was to use the challenge to motivate lab team members to conduct research and to develop projects in an unconventional way, eschewing typical procedures in pursuit of more radical ideas. Oh believes it’s a great way to fuel excitement in the laboratory.

“Over the next two to five years, I want our robotics lab to dazzle,” he says. “Whether it’s with drones, vehicles, or legged robots, we feel we could really make an impact by partnering with business. It’s part of putting Southern Nevada on the map in the robotics world.”

The team has already published 24 papers emanating from their findings during the DARPA challenge preparations, more than any other participating team.

Many of these published findings focus on how to program and control robots in an environment with “degraded” communications, the type of situation that might ensue following a natural or man-made catastrophe. At the DARPA challenge, robots in such environments are tasked with driving a car, opening a door, turning a valve, removing debris, and climbing stairs. The team’s eighth-place finish was a testament to the research heft of the team, Oh says, but he is interested in pushing the team harder.

“It’s nice to say that we are in the top eight in the world, but sometimes it’s about getting the job done,” Oh says. “The bottom line is that we are developing ideas for companies that are looking for practical, real-world solutions. The important thing now is communicating the results to potential end-users in industry.”

One sign of real-world success was that Metal Rebel emerged as the DARPA challenge’s fastest motorist, completing the driving task in less than one minute. The result was particularly impressive given that many of the 24 teams’ robots didn’t even attempt to drive.

This accomplishment has led Oh to believe that he and his team now have a leg up on the competition when it comes to researching the capabilities of robots behind the wheel. He credits his team’s superior results to their unique approach to the “robots driving” problem. Many
of the participants approached the driving task by deploying techniques developed for driverless cars: scanning the environment, building a computer model, then deploying an algorithm to instruct the robot.

Oh’s approach, on the other hand, sought to emulate how a human drives, i.e., by having the robot observe objects as they appear and then reacting to them. Metal Rebel’s triumph indicates that this approach can work, and that, with sufficient refinements, it’s possible similar robots could one day be programmed to drive nearly any non-robotic vehicle. Long-haul trucks, ocean-going ships, rockets into space, you name the conveyance, and Oh can envision a robot at the helm.

Oh also has big plans for a world where unmanned aerial systems will develop limbs, or dexterous manipulators, that can actively interact with objects. The idea is that such creations could assist with all sorts of tasks that are difficult or dangerous for human workers, such as bridge repairs on busy highways or maintenance projects on skyscrapers.

In research funded by the National Science Foundation, Oh and his team are not only building such useful limbs but also working to discover how to utilize them effectively in aircraft. They are conducting research on stabilizing the aircraft while these appendages are at work. Most current research in this area involves systems with wheels or those confined to a clearly defined track. Using limbs on aerial vehicles, Oh says, is “uncharted territory.”

In his typical outside-the-box thinking, he’s looking to the biological world for inspiration. What, he asks, can we learn from the way a monkey uses its tail as a third limb to perch or balance? How does a bird use its beak to build a nest?

“This is cutting-edge work, pioneered by our group and gaining traction all over the world,” Oh says. “It’s a real paradigm shift because most of today’s drones are passive, only taking videos or photos.”

To his colleague, UNLV engineering professor Kwang Kim, this is the type of innovative thinking that sets Oh apart: He possesses the rare combination of both vision and expertise that produces amazing results.

“He has engaged in remarkable research in robotically advanced capabilities,” Kim says. “Paul’s research is forward-looking, and he has been consistently funded by a number of government agencies, including the National Science Foundation and the Department of Defense. He is always thinking of the next innovation in robotics and encouraging his students to think creatively. He is a real asset to UNLV.”

Oh is also exploring subjects particularly relevant in Southern Nevada. He wants to explore problems involving water consumption in desert climates, such as creating unmanned aerial vehicles that “rain” on demand, and he’s intrigued by how robotic systems might be better used in cutting water consumption in urban environments.

Another area that has piqued his interest is the service industry, where robots might enhance hospitality at casinos, resorts, or trade shows. Such machines, he says, could allow for more client privacy and a better, high-tech entertainment experience.

And, he muses, they’ll be a ready-made workforce to staff Roboland when the time comes.

Charles E. Reineke contributed to this story.
An unidentified woman works the wheel at the Hotel Apache and Casino in downtown Las Vegas, circa 1940.
In Changing the Game: Women at Work in Las Vegas, 1940-1990, UNLV history professor Joanne Goodwin deftly deploys oral history to chronicle how — during a period when workplaces remained deeply divided by race and gender — the rules of the employment game gradually shifted from discrimination to greater, if not equal, opportunity.

The book, Goodwin’s second, details the lives of 11 women who defied the odds to succeed in the Las Vegas hotel/casino industry during a pivotal time in the evolution of Southern Nevada. Among her subjects were casino owners, dancers and dance company managers, hotel administrators, dice dealers, and housekeepers.

Today, we might be tempted to celebrate such pioneering figures as feminist icons. Central to Goodwin’s work, however, is the context of historical possibilities during the decades after World War II.

“Women needed to work around and within the constraints of a workplace that hired women and men, blacks and whites, for different jobs,” Goodwin said. “Historians have focused on activists who struggled to open doors yet missed the significance of non-politicized women, who, by their presence, pushed boundaries and sought greater opportunities once the doors were opened.”

Through Goodwin’s interviews, readers will meet Hattie Canty and Lucille Bryant, two African-American “back-of-the-house” workers who became active in the Las Vegas Culinary Workers Union Local 226. Canty became Local 226’s president in 1990, eventually leading 550 Frontier Hotel culinary workers in a six-and-a-half year strike — one of the longest labor actions in U.S. history.

“Bryant and Canty’s stories describe women who are wage-earners in a traditional position for the time — housekeeping,” Goodwin says. “Both were part of the migration of workers from the Deep South to the West during and after World War II. Neither had an advanced education, which was true for many workers who came to the area during these years.”

Even with little formal schooling, however, both women implicitly understood what it took to get ahead, says Goodwin. “Rather than employing an individual strategy, they used collective action through the culinary union for employment security. Hattie Canty was pleased to be

### Changing the Game: Women at Work in Las Vegas, 1940-1990

Joanne Goodwin
University of Nevada Press

Faculty authors examine Las Vegas women at work, the status of global patents, racialized schools, and advances in the understanding and treatment of substance use disorders. **BY COREY LEVITAN**
“They started with specialized knowledge, utilized relationships, wove around sexism — whether blatant or subdued — and advocated for themselves.”

Goodwin also profiles casino owners Sarann Preddy and Claudine Williams. Preddy was a civil-rights activist best known for her efforts to revive the Moulin Rouge, the valley’s first interracial hotel, which closed a few months after opening in 1955. Williams ran the Silver Slipper and then the Holiday Casino (which became Harrah’s), at first in a partnership with her husband, then by herself when his health failed.

“Claudine and Sarann had a number of similarities,” Goodwin notes, “yet their outcomes were remarkably different because of the era and one’s ability to finance a casino. They both had a marvelous way with words and were pretty honest about the ups and downs of the business. For these businesswomen in the years before equity protections, they each cultivated networks and adopted styles that enabled them to advance in their chosen fields.”

Fluff LeCoque and Bernice Jaeger also proved adept at advancing in discriminatory workplace environments, as each moved up the chain of command at a time when women were rarely promoted. LeCoque was particularly successful, progressing from dancer to production director.

“The skills they used are prototypical of contemporary women in business,” Goodwin says. “They started with specialized knowledge, utilized relationships, wove around sexism — whether blatant or subdued — and advocated for themselves.”

Goodwin says the book owes its origins to two of her graduate students, both employed in hotel-casino jobs, who approached her with the idea of collecting life stories from women in the gaming industry. Goodwin encouraged them to pursue the idea. Other students joined and when they completed their degrees and moved on, Goodwin was left with the foundation of what became the Las Vegas Women Oral History Project. The project has since encouraged nearly 100 community members “to share their life stories, thereby enriching the teaching of Las Vegas history,” she says.

“This type of research could not have been done without extensive interviews or oral histories,” Goodwin says. “The texture of a person’s daily life, her choices, her trials, her dreams are not available to the historian in any other documentary source.”

The women’s stories in Changing the Game, she adds, aim to add to historians’ understanding of an economic and cultural moment that transcended Las Vegas’s gambling industry.

“These women were joined by thousands of others across the country,” she says. “Their presence in the workforce by the ’70s created a watershed moment, not because of the majority’s activism, but because there were so many women who were not going to ignore opportunities any longer.”

Goodwin, who also leads UNLV’s Women’s Research Institute of Nevada, is currently on sabbatical conducting research for her next project on the implementation of equal opportunity policies in the West.

Global Patents: Limits of Transnational Enforcement
Marketa Trimble
Oxford University Press

If you have a great idea for a new product, says Marketa Trimble, be aware that somebody, somewhere in the world, could steal it.

Patents provide a way of protecting inventions but, as Trimble points out, there’s never been a way to obtain patent protection worldwide.

“Inventors must obtain patents in every individual country if they want to protect their inventions globally,” she says. “And, if you’re not a millionaire, that’s unrealistic.”

Trimble, a professor at UNLV’s William S. Boyd School of Law, has crystallized decades of international patent law research and experience into her first book, Global Patents: Limits of Transnational Enforcement, published by Oxford University Press.

“The book provides lawyers and business people who have international dealings with a good overview of the international patent system and its possibilities and limitations,” Trimble says, noting that the book has been well received by academics and practitioners from around the world seeking insight into transnational enforcement of intellectual property rights.

Since the 1880s, she says, countries have sought to make it easier for applicants to obtain patents in multiple nations. Although there has been progress, the world has yet to codify what some argue is a necessary next step: a global patent.

“The creation of a single global patent would require countries to agree on a single set of conditions of patentability,” Trimble says. “Not only would such an agreement be difficult to achieve, it might not even be desirable. Countries at different stages in their development and with different socioeconomic conditions have understandably different views on what should be protected by a patent and how. The different views are apparent even now, at a time when most countries of the world adhere to several international patent treaties that set the basic rules of patentability and provide for the streamlining of the patent application process in multiple countries.”

Historically, the lack of a global patent has been only a mild headache to inventors, chiefly because physical and logistical barriers helped thwart thefts of intellectual property. In order to see an actual patent in the past, one would have had to travel to each country’s patent office to view and copy the actual patent. The internet has changed that, of course. Computers can now display every major country’s patents for free — a boon to scofflaws looking to steal ideas. And they do.

“Many companies do business on a global scale, but they typically forfeit patent protection in many countries because of the high costs of patenting in multiple countries. Even when companies do file for patents in multiple countries, they might not obtain patent protection in some countries because of differences in standards of patentability,” she says.
“The creation of a single global patent would require countries to agree on a single set of conditions of patentability. Not only would such an agreement be difficult to achieve, it might not even be desirable.”

Trimble, a native of Prague, Czech Republic, says her initial interest in patent law was stoked by trips that she took with her father. “My father was a technology reporter who covered issues of intellectual property protection. As a child I was fortunate to be able to travel with him to several factories in Czechoslovakia where he covered their technology and innovation. It was an interesting and very educational experience because Czechoslovakia was a communist country before 1989, so the economy and innovation were skewed in numerous ways, highlighting the need for effective intellectual property protection.”

After graduating from law school, Trimble worked in the government of the Czech Republic, including the Ministry of Justice. As a Czech official, she represented the country in European Union bodies and on assignment at the European Commission in Luxembourg. She went on to obtain two additional degrees at the Law School of Charles University in Prague, then moved to the U.S. in 2004 where she obtained a master’s and doctoral degree in juridical science from Stanford Law School. She joined the faculty of UNLV’s Boyd School of Law in 2010.

Trimble is now a recognized expert on intellectual property law. She serves, for example, on the International Law Association’s Committee on Intellectual Property and Private International Law, and is the co-author of a highly regarded casebook on international intellectual property law. Her work on transnational disputes, including disputes arising from activities on the internet, is credited with assisting a wide range of parties and bodies operating in the international arena.

Trimble says her recent book aims to fill a unique niche. “Publications on international intellectual property law..."
“There have been so many new developments increasing our understanding of substance abuse from a brain perspective.”

usually focus on the aspects of public international law — the making of international treaties and the enforcing of countries’ obligations to follow these treaties — and not on the aspects of private international law,” she says. Private international law concerns cross-border disputes among private litigants, such as between a patent owner and an alleged infringer, or a patent owner-licensor and its licensee.

Global Patents covers patent laws and litigation worldwide but focuses on the U.S. and Germany, providing a side-by-side comparison of patent enforcement in two of the busiest patent litigation countries in the world.

“The expertise of their courts is highly regarded in other countries,” says Trimble. “Patent experts follow the developments in these two countries, and courts in other countries refer to decisions from them.”

The book not only explains the limitations of international patenting, both legal and practical, but also reveals workarounds for expanding a small inventor’s patent protection. One involves using the litigation of a single-country patent to extend protection outside that country.

“Enforcement is most cost-effective when a business can use the patent of a single country to solve its worldwide disputes relating to the invention covered by that patent,” Trimble says. “The Apple v. Samsung saga is instructive. After battling in dozens of lawsuits in multiple countries, the two companies decided to shape the outcome of all their disputes worldwide according to the decisions of the U.S. courts on the contested U.S. patents.”

Another solution is to maintain disputes over multiple countries’ patents but to concentrate the litigation of the patents in only one forum; this means that one country’s decision determines the fate of patents granted in several countries for the same invention.

“This sometimes occurs in arbitration,” Trimble says. “However, as opposed to arbitration tribunals, courts have been reluctant to take cases involving multiple countries’ patents. Nevertheless, we have seen litigation, for example in the United Kingdom, in which a court decided the non-infringements of several countries’ patents.”

Of course, it is extremely costly to litigate patent matters, which is why the costs can become unbearable for many patent holders when multiple countries are involved. In addition, some nations’ courts will not accept cases involving multiple countries’ patents at all, so centralizing them in a single court may not be an option.

Despite the problems it would solve, global patent protection won’t be available anytime soon, according to Trimble.

“This is a prerogative that countries are unlikely to delegate,” she says, adding that uniform enforcement would be the next difficult issue to address if a single global patent were created.

“For a global system to be consistent, it needs to be accompanied by global agencies and courts that decide on the validity of patents with global effect,” she says. “The current developments surrounding the introduction of a regional unitary patent in the European Union show how difficult this process is, even among countries that are relatively close to each other economically, geographically, and culturally.”

Neuropsychological Aspects of Substance Use Disorders: Evidence-Based Perspective

Daniel Allen and Steven Paul Woods
Oxford University Press

According to the National Institute on Drug Abuse, approximately 570,000 people die each year due to drug use, along with more than $700 billion in increased health-care expenditures, lost productivity, and costs associated with drug-related criminal activity.

Behind these sobering statistics lie countless lives ruined and hearts broken. But for both addicts and their families, argues UNLV’s Daniel Allen in a new book, recent research offers promise for treating this troubling — and enduring — problem.

Co-edited with Steven Paul Woods of the University of California, San Diego, Allen’s Neuropsychological Aspects of Substance Use Disorders: Evidence-Based Perspective includes work by some of the world’s most distinguished addiction researchers.

“Our hope is that our book will help address some of the obstacles to understanding and treating substance use disorders by bringing together the most current information from the brain science literature with application to specific substances of abuse and special populations,” says Allen, UNLV’s Lincy Professor of Psychology and a former president of the National Academy of Neuropsychology.

The project sprang from what Allen and Woods say was an “obvious gap in the literature on neuropsychology and substance abuse.”

“There have been so many new developments increasing our understanding of substance abuse from a brain perspective,” says Allen. “There was a real need for a book where the most up-to-date information is assembled.”

After identifying the need, Allen and Woods recruited an international dream team of brain science leaders to contribute chapters. Authors include such nationally recognized experts as Warren Bikell, director of the Addictions Recovery Research Center at Virginia Tech; John Crabbe, director of the Portland Alcohol Research Center at the Oregon Health & Science University; and Igor Grant, director of the HIV Neurobehavioral Research Program at the University of California, San Diego.

“As I was editing some of the chapters that came in, I found myself learning much in areas that are not a central part of my own research program,” Allen says. “There are so many new developments with the knowledge base increasing each day; having an opportunity to read about the most current findings was rewarding. And it was also rewarding to have the opportunity to interact with some of the brilliant scientists doing the research.”

Substantial progress has been made, he adds, from the days when alcoholism and substance use problems were viewed as moral failings. Today’s researchers instead view them as clinical challenges, disorders demanding empirical investigations aimed at discovering successful psychological and pharmacological treatments.

Allen is upbeat about what’s been accomplished so far,
but says much work remains to be done.

"In particular, interventions for substance use disorders are not as effective as we would like, and understanding the interactions between treatment effectiveness and individual variables such as ethnicity, comorbid mental and physical illnesses, and cognitive disorders continues to present challenges to researchers and clinicians," he says. ("Comorbid" is a term that describes patients who have two chronic diseases or conditions simultaneously.)

Allen adds that the interplay between environmental and genetic contributions to the development and continuation of substance use disorders requires more study, as does identification of those who are at the greatest risk of developing problematic patterns of substance use.

The book is grouped into three sections. The first focuses on new developments in the fundamental science, such as genetic influences and neural substrates of addiction. The second addresses recent research from each of the major categories of substances typically abused. The third deals with special patient populations and topics, including patients whose substance-use disorders occur with comorbidities, such as infectious disease, traumatic brain injury, and, especially, mental illness.

"Serious mental illness and substance abuse comorbidity continues to be a significant challenge to the treatment community," he says. "Unfortunately, those with mental illness and comorbid substance abuse probably make up the majority of individuals who have schizophrenia and bipolar disorder, but we know less about them than we do about those without substance abuse disorders."

Allen gravitated toward addiction treatment while specializing in the neuropsychology of mental illness at a Veteran’s Administration hospital in Pittsburgh, where he worked before joining the UNLV faculty in 1999.

"The biggest problem I saw among vets I worked with by far was substance use disorders, particularly alcoholism and cocaine use," he says. "I found it hard to provide adequate treatment for them because, at the time, little information was available in the empirical and clinical literature that specifically addressed the unique needs of individuals with both a mental illness and a substance use disorder."

Allen’s hope for the book is that it might help clinicians, researchers, and graduate students overcome barriers to understanding the complex set of neurological factors at play in substance use disorders.

"Ideally, it’s a book that can be a reference tool for those who want to review a summary of recent literature from a group of nationally respected experts," he says. "I hope that clinicians and the academic community find it useful and can turn to it when they seek the most up-to-date research in this area of study."
More than 60 years has passed since the U.S. Supreme Court ordered an end to segregation in America’s public schools, but inequality and racial prejudice have not disappeared from our classrooms. In fact, argue the authors of *Racialized Schools: Understanding and Addressing Racism in Schools*, racism in education is today an even more pernicious problem, since it operates on a largely unconscious level.

To one of the book’s authors, UNLV’s Jesse Brinson, racism is so embedded in the human mindset that some people don’t even recognize its presence. Some scholars, he notes, even go as far as to assert that admitting one’s racism is indistinguishable from acknowledging one’s humanity.

“So the question is not whether an individual is racist,” says Brinson, a professor of educational and clinical studies. “The real question is whether an individual is mildly, moderately, or severely racist.”

For educational authorities, then, such acknowledgments are just a starting point: They must also be cognizant of how racist policies and practices play out in their schools. In other words, they must ask, “To what extent are school policies and procedures intentionally or unintentionally racist in development and implementation?” says Shannon Smith, Brinson’s co-author.

Unfortunately, says Smith, previous studies suggest policy makers and administrators are ill equipped to do much about the deeply entrenched racial biases manifested in schools.
“Racism is particularly important to address in schools, where creating a level playing field among kids of different ethnic backgrounds is critical to achieving positive educational outcomes,” says Smith, who is also a professor of educational and clinical studies.

The best administrators, the authors agree, are those who commit themselves to hiring staff who are less likely to perpetuate racist thinking and behavior.

Sadly, some school staff will undoubtedly bring their racial baggage to work with them; some will suffer from forms of bigotry that will rank them in the “severe racist” category. The authors say their new book will help school personnel identify and confront these educators in a direct and yet professional manner. When done correctly, they add, the process can be cathartic.

“For individuals who are challenged to identify their racism, if you are able to show them how their thinking is erroneous, many will tend to change their way of thinking,” Brinson says.

Racialized Schools supports its recommendations with data from various empirical models, including the authors’ own research involving online surveys distributed to some 3,000 U.S. education professionals, including school mental health personnel, teachers, administrators, and school board members. The results of their study almost immediately yielded insights into the scope of the problem.

“One of our first findings was how deeply embedded racism is as a societal taboo,” Smith says. “We received a number of contacts from teachers who were not willing to answer the survey because they were afraid that their principal could access the survey and discover how they really feel.”

Another telling discovery was the heavy price racism exacts in “opportunity costs” — that is, the way racial prejudice can turn the economic potential of millions of young people into a long-term financial burden.

“The school-to-prison pipeline alone is enough to warrant a radical new way of thinking about education,” Brinson says.

Brinson and Smith write that, “Certain kids, because of the way they’re perceived by teachers, are likely to be funneled into low-ability curriculum tracks and identified as being difficult to teach. As a result, they are stigmatized for their entire academic careers and rarely attend college.

“If they even graduate from high school, they will be identified as marginal and less likely to find meaningful employment. And, if they decide not to go into the service sectors because the wages are so low, many could turn to less legitimate ways to spend their lives attempting to earn a living.”

The authors suggest a number of ways we can do better for such children. In addition to curriculum guides, they present “interpretive acts” – short vignettes involving potentially racist encounters or situations.

The intent of the interpretive acts section is to enable readers to uncover their hidden racism, they say. They also hope some readers will be challenged to explore their own thought patterns and beliefs. Particularly when the vignettes they’re reading aren’t to them, readily identifiable as offensive.

Racialized Schools is also intended as a practical learning resource, one that provides in-class curriculum guides. The guides, tested using focus groups, were designed to reduce race-based bullying and foster more effective interaction among different ethnic groups.

Curricula notwithstanding, success in school is strongly influenced by the student-teacher relationship. In societies where racism is prevalent, students become adept at identifying adults that they perceive as harboring a racial bias towards them.

“If teachers don’t find themselves able to have meaningful relationships with students of color, their ability to be effective teachers is extremely compromised,” says Brinson. “American teachers are 80 percent white, and many are not comfortable communicating with underprivileged students on an emotional level, nor are they adept at impressing upon them the importance of learning.”

Brinson, who is African-American, met Smith, who is white, at a program merger created by the College of Education’s Counselor Education Program. Brinson had a research interest in multicultural counseling issues. Smith focused on social justice and advocacy. It wasn’t long before they found themselves talking about issues that appeared to overlap between their respective research areas.

But it was only after Brinson began to discuss his experiences in academia that he and Smith shifted the discussion to racism in education. Both scholars acknowledged that Smith had a slight, but still unfair, advantage as a white male.

“We’re both equally qualified in our field,” Smith says, “and yet [in meetings] I would be called on more and would have the ability to address certain topics that Jesse wouldn’t. There were multiple examples of where I would have privilege in the academic environment. Even the simpler things, such as the seating arrangement, often reflected who had the most sociopolitical capital due to racism.”

After such meetings the two discussed these inequities, talks that led them to conclude they should team up to tackle a study related to racism in higher education. But soon Brinson and Smith determined that racism at the elementary and secondary levels would be a better place to start given that there was a greater need for empirical research in this area.

“In particular, we wanted to be able to produce a project that could potentially have public policy implications,” says Brinson, “one that would expose this problem to individuals within our state government. We felt that a book would have the greatest potential impact. Our society may never overcome racism, but the children in our schools do not have to be victims to individuals who may be unaware of their racist tendencies.”

Smith concurs. “If racist ideologies are to be dismantled from the American fabric, it must begin in our nation’s schools, and it must begin with our teachers and school administrators examining their own racism.”
UNLV sponsored programs expenditures have increased approximately 15 percent since 2012; in the same period, research expenditures increased nearly 17 percent. This year alone, the university performed research, public service, and instruction activities associated with externally funded grants and contracts valued at nearly $50 million.

The College of Sciences received more than $13.2 million in award funding in FY15, the largest amount among the colleges. The Greenspun College of Urban Affairs posted the largest percentage gain in award funding in FY15 with a 665 percent increase (from $203,544 in FY14 to approximately $1.6 million in FY15). The Colleges of Education, Business, and Fine Arts also showed significant percentage increases. Award funding from the private sector and foundations also increased by 86 percent to more than $2.8 million.

Patent applications emerging from university research, primarily in the disciplines of science, engineering, and gaming innovation, have tripled in the last two years, and three startup companies have also been formed. UNLV’s metrics in these areas are now comparable to those of several peer institutions.

“The incredible growth in patent and startup activity is evidence of the university’s commitment to the economic development of the State of Nevada,” said Thomas Piechota, vice president for research and economic development. “UNLV is an integral partner in the diversification and growth of our state’s economy, as well as in building the quality of life in our community. We are proud of UNLV’s research and economic development endeavors and remain dedicated to their success.”

Disclosures of faculty research with commercialization potential have increased 89 percent since FY13, and revenue from licensing agreements increased significantly in the last three years.

Another measure of university research activity is the number of doctoral degrees conferred, as doctoral programs require a strong research component culminating in the doctoral dissertation. UNLV doctoral conferrals increased 19 percent in FY15.
SPONSORED PROGRAM ACTIVITY

EXPENDITURES

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<tr>
<th>Year</th>
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<th>Research</th>
<th>NSF Reported R&amp;D</th>
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* Sponsored programs expenditures include research, instruction/training, and other sponsored activity (i.e., public service, student services, etc.).

** NSF Reported R&D expenditure data will be available February 2016.

AWARDS

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* Sponsored programs funding includes awards for research, instruction/training and other sponsored activity (i.e., public service, student services, etc.).

PROPOSALS

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UNLV AWARD DATA | FY15

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*Financial aid funds (e.g., Pell grants and Millennium Scholarships) are no longer included in these amounts.

SPONSORED PROGRAM FUNDING BY SOURCE | FY15

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Federal: 62%

State: 5%

Industry/Foundations: 6%

Local: 1%

Federal Passthrough: 26%

DOCTORAL DEGREES CONFERRED | AYO9/10 - 14/15

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**RESEARCH DISCLOSURES, PATENT ACTIVITY & STARTUPS**

**NUMBER OF RESEARCH DISCLOSURES SUBMITTED VS. PATENT APPLICATIONS FILED, FY09-15**

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**AGREEMENTS AND LICENSING REVENUE**

**NUMBER OF AGREEMENTS EXECUTED, FY09-15**

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**INSTITUTIONAL REVIEW BOARD APPROVALS**

**NUMBER OF INSTITUTIONAL REVIEW BOARD APPROVALS, FY09-15**

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Clinical psychology fellows Jeremy Gallas and Jared Grant aren’t playing around — they’re creating healthier outcomes for children and families through their post-doctoral work at The PRACTICE. Their fellowships are funded by a gift from the Eleanor Kagi Foundation, a Lynn M. Bennett Legacy.