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Research Briefs

POWER PROCESSING UNLV researchers will soon have access to one of the world's fastest supercomputers.

Switch SUPERNAP, Intel Partner with UNLV to Boost Scientific Research and Economic Development

ONE OF THE WORLD'S MOST POWERFUL computers is coming to Las Vegas, a development that promises to significantly power up UNLV research and discovery.

Las Vegas-based Switch SUPERNAP and tech giant Intel recently announced that UNLV has been awarded the use of the Intel "Cherry Creek" supercomputer, which ranks among the world's fastest supercomputers for its combination of speed, power, and energy efficiency.

The supercomputer will be housed in Switch's Las Vegas SUPERNAP data center and will be made available to UNLV researchers through the data center's unique connectivity network. It will give the university and its research partners access to world-class computing power and will act as a catalyst for scientific discovery, the modernization of applications, and regional economic development efforts.

Complicated analyses that once took years can now be completed in days, advancing fields such as genomics and bioinformatics, medical and climate research, molecular modeling, and data analytics. Thanks to its placement at Switch SUPERNAP, Cherry Creek will allow UNLV researchers to share data with collaborators across the globe.

"Supercomputers have become an indispensable part of almost every industry. For university researchers, they've increased the speed of analysis and discovery exponentially," says UNLV President Donald D. Snyder. "Working together with Intel and Switch, UNLV has a tremendous opportunity not only to keep pace with but to play a leading role in big data research and economic development partnerships that require high-performance computing."

The companies will also encourage public-private interactions to accelerate innovation and advance regional economic development. Private companies need access to the high-level computing power of supercomputers and the expertise of the UNLV team that uses them, so a portion of the computer's space will be reserved for private-sector investment in university research through partnerships.

"Cherry Creek was the first 'Top-500-Class' supercomputer featured at a supercomputing event, showcasing the efforts by Intel and our partners in driving unprecedented efficiency gains and accessibility that were not previously possible," says Hugo Saleh, director of Marketing and Industry Development, Intel Technical Computing Group.

In addition to research and private collaborations, Intel experts will provide guest lectures and academic programming for UNLV students in IT-related fields — activities that will help UNLV graduates compete for jobs in the evolving tech industry.

"The SUPERNAP executive team is pleased to be donating the services to UNLV for this effort. We understand how important this scientific research will be for economic development in the region," says Rob Roy, CEO and founder of Switch SUPERNAP. "The SUPERNAP ecosystem will accelerate the development of new technology and provide the necessary industry relationships to advance UNLV's efforts."

UNLV officials say the Cherry Creek computer will be a welcome addition to the strong computing arsenal of UNLV's National Supercomputing Center for Energy and

SWITCH: COURTESY SWITCH SUPERNAP; ASTRONAUT: SHUTTERSTOCK

the Environment (NSCEE), a facility founded in 1991 that supports researchers on campus and across the nation. UNLV staff will maintain and optimize Cherry Creek, will schedule time and use for UNLV and its research partners, and will work closely with technical experts from Intel and Switch SUPERNAP to update the supercomputer as new technology becomes available.

"Having access to this technology will enhance and expand UNLV's current research programs and will act as a catalyst for new emerging research interests such as big data analytics," says Joseph Lombardo, executive director of NSCEE. "Additionally, having this special resource will enhance the educational experience for a diverse set of top-quality graduate and undergraduate students while playing an important role in faculty recruitment."

HOW LONG IS IT SAFE TO STAY IN SPACE?

HERE ON PLANET EARTH, ALL LIVING things are protected from cosmic radiation by a thick layer of "shielding" — a barrier of nitrogen, oxygen and water vapor — provided by the atmosphere. Radiation does get through to the surface of the planet, but at significantly lower levels than on planets lacking our atmospheric buffer.

For those who spend time in space, however, cosmic radiation can be a serious problem. One estimate is that a single day in space exposes astronauts to the equivalent of a year's worth of natural radiation on Earth. And the effect is cumulative; it doesn't dissipate when they return home.

Frank Cucinotta, a professor of health physics and diagnostic sciences at UNLV, studies the biological risks of such exposures, evaluating for NASA and other agencies just how long it is safe to stay in space.

"To provide the level of protection we all receive from Earth's atmosphere would require surrounding astronauts in hundreds of centimeters of material, which is impractical," Cucinotta says. "Ships and suits typically have 10 to 20 centimeters of protection. To better protect these men and women, we have to accurately determine the risks of radiation exposure when they are in space. This will lead to methods for identifying individuals who have lower risks and to the discovery of approaches that can protect them."

To calculate the exposure risks, or the chance that a person will be diagnosed with cancer, Cucinotta and others studying cosmic radiation examine and develop theoretical models. Tests are then conducted on human cells and mice to validate their hypotheses.

Cosmic radiation increases the risks for cancers and seems to produce more lethal tumors than other types of radiation. It also seems to increase the risks for heart disease and cognitive conditions, such as loss of memory and dementia. The current acceptable risk for fatal cancer among astronauts on the space station is no more than a 3 percent probability of death. The maximum duration of space missions to stay within this limit is about 18 months. However, the trend toward longer missions, coupled with greater exposure, could reduce the length and number of missions in which an astronaut can participate.

And then there's Mars. While conducting research at NASA, Cucinotta and his team explored the potential for a manned mission to Mars. The cosmic radiation exposure during a voyage to the Red Planet is much higher than that on the space station. The estimated fatal risks for cancer and other diseases during that mission could be as high as 20 percent.

"A trip to Mars will take approximately 1,000 days using current technology," Cucinotta says. "Based on theoretical models, the cosmic radiation during that mission could also impact the crew's cognitive abilities or cause them not to remember the journey after they safely returned to Earth. And once back on Earth, the types of cancers, according to studies conducted on mice, will be more aggressive and likely to occur at much younger ages, compared to the cancers found on our planet."

As Cucinotta continues to uncover the actual risks of cosmic radiation and the means for protecting astronauts, his work also determines safe limits for manmade radiation, especially from medical equipment like computed tomography (CT) scans.

"Most people don't understand radiation," he says. "My colleagues and I are working to teach them about it and protect them from it."

"EXQUISITELY PRESERVED" FOSSIL FIND SHEDS LIGHT ON A DISTANT ERA

ROCKS DATING FROM THE PRECAMBRIAN typically don't contain fossils, as the sediments that formed them were deposited thousands of years before multicellular organisms were abundant.

Among the animals that did thrive during the period, few had the type of hard shells that aids in preservation. So when UNLV paleontologists working in a remote region of Nevada announced last year that they had discovered an assemblage of exquisitely preserved Precambrian fossils, the world took notice.

In a paper appearing in the March 2014 issue of the *Journal of Paleontology*, UNLV paleontologist Steve Rowland and recent graduate Margarita Rodriguez describe a new species of alga, the first from these newly discovered fossils to be formally described and named. The fossil is just a millimeter wide — the thickness of a dime — with segmented branches that are each about the diameter of a human hair.

The 560 million-year-old fossils occur in strata of the Ediacaran Period near the town of Gold Point, in Esmeralda County. The Ediacaran interval of geologic time immediately predates the Cambrian Period — the time of the so-called Cambrian explosion of multicellular life.

"This discovery of soft-tissue preservation in Ediacaran fossils is a big deal because there are no such sites of this age anywhere else in North America and very few anywhere in the world," Rowland says.

Because the Ediacaran is a poorly understood, yet critical time in the history of life, paleontologists are intensely interested in finds from the period.

Evidence of soft tissues open a window into the biology of the organism, Rowland says, but is rarely preserved in the fossil record. In Rowland and Rodriguez's find, however, the cellular structure of the alga is visible in the fossils. The researchers say they don't yet understand what set of circumstances permitted their preservation.

Rowland added that researchers typically find only the "hard parts" of animals and plants preserved — teeth and bones, for example — but these Ediacaran organisms did not have any hard parts.

Rowland and Rodriguez named their fossil alga *Elainabella deepspringensis*. "Elainabella" honors Elaine Hatch Sawyer of Fredonia, Ariz., whom Rodriguez identifies as an important person in her life. "Deepspringensis" indicates the fossils were unearthed in the Deep Spring Formation rock layer.

The type specimen, or scientific name-bearing representative of the new fossil species, will be permanently housed in the research collection of the Nevada State Museum in Las Vegas, where it will be accessible for study by other researchers.

FOSSIL FIND UNLV geoscience professor Steve Rowland and his team recently discovered an assemblage of exquisitely preserved Precambrian fossils in Nevada.

GRADUATE PROGRAMS EARN HIGH MARKS FROM U.S. NEWS

ELEVEN UNLV GRADUATE OR GRADUATE specialty programs ranked among the nation's top 100 in 2014.

Each year *U.S. News and World Report* evaluates more than 1,300 of the nation's graduate and specialty programs by discipline or specialty. Each is scored on the standardized test results of newly enrolled students, opinions from experts on each program's quality, acceptance rates, and other criteria.

Of the 11 ranked programs, those in two UNLV schools scored particularly well: Boyd Law School and the School of Nursing.

Boyd Law School's Lawyering Process Program ranked third for its legal writing programs. The dispute resolution program at Boyd's Saltman Center for Conflict Resolution, which includes advanced study of the nature of conflict and the methods to resolve it, ranked ninth. Among part-time law programs, Boyd ranked 20 out of 83 accredited law schools.

The School of Nursing online graduate program ranked 10th in a report originally released online in January and included in the 2015 guidebook. The school offers two master's tracks — family nurse practitioner and nurse educator — to prepare advanced

ROWLAND: AARON MAYES; DRONE: SHUTTERSTOCK

clinicians and educators to serve the health needs of the community and educate future nursing care providers.

Graduate programs, particularly doctoral programs, typically contain a strong research component.

Other UNLV graduate programs ranked in the top 100: No. 88 in Earth Sciences, No. 93 in Fine Arts, No. 94 in Sociology, No. 94 in the part-time MBA program, and No. 99 in both Civil Engineering and Nursing.

SOUTHWEST FOUND TO BE AMONG THE MOST "CLIMATE-CHALLENGED" REGIONS IN THE NATION

THE SOUTHWEST FACES A MULTITUDE of ill effects associated with climate change, including rising annual temperature averages, a decline in water reserves, diminished agricultural yields, and an increase in wildfires, according to Thomas Piechota, the lead author of the Southwest Section of the 2014 National Climate Assessment.

The 2014 National Climate Assessment explores what each of the eight regions in the U.S. faces in the coming decades as a result of climate change.

Piechota, who is a sustainability expert as well as UNLV's vice president for Research and Economic Development, noted that overwhelming heat and lack of rainfall are among the top reasons the Southwest is one of the most "climate-challenged" regions in the United States.

"Snowpack and stream flow amounts are projected to decline in the region, decreasing water supplies for cities and affecting agriculture and ecosystems," Piechota says. "The Southwest produces more than half the nation's high-value specialty crops, which are irrigation-dependent and particularly vulnerable to extremes of moisture, cold, and heat. We can expect reduced yields from increased temperatures and increasing competition for scarce water supplies that will displace jobs in some rural communities."

The Southwest region, which includes the states of Arizona, California, Colorado, Nevada, New Mexico, and Utah, may encounter other byproducts of climate change, such as insect problems and coastal flooding.

The assessment presents choices on how the Southwest can adapt to climate change. For example, continued development and use of geothermal, wind, and solar power resources could reduce water withdrawals needed to cool thermal power plants, which use about 40 percent of surface water withdrawn in the United States, according to the assessment.

The National Climate Assessment contains input from more than 300 experts and was overseen by a 60-member Federal Advisory Committee. The 840-page report outlines current climate status and projected climate changes for each of the eight designated regions of the United States.

PUBLIC WEIGHS IN ON PROS AND CONS OF UNMANNED AERIAL SYSTEMS

PUBLIC AMBIVALENCE CONCERNING THE domestic use of unmanned aerial systems, commonly known as "drones," remains strong, according to two national web surveys conducted by UNLV's Center for Crime and Justice Policy. The surveys are part of a series designed to measure public attitudes on emerging technology.

Tabulated last summer with responses from hundreds of U.S. adults, results showed that attitudes toward these "eyes in the sky" are highly dependent on how and where they are used, and who is using them.

Unmanned aerial systems, or UAS, usage continues to climb in Nevada and across the country. In January, the Federal Aviation Administration designated Nevada as one of six locations for UAS testing and development.

"UAS use will be widespread in the near future, so it is critical to develop well-conceived policy and laws to govern the use of this technology," says Joel Lieberman, professor and chair of the UNLV criminal justice department and co-author on the reports. "We are conducting this work to provide a strong foundation grounded in social science research to create relevant laws and policy decisions that will lead to a more effective implementation of UAS into society."

According to the surveys, there is general support for UAS use in search and rescue operations, military operations, and climate/geological mapping, but strong opposition to UAS for monitoring citizens, especially around their homes and at their workplaces.

"The use and proposed applications of aerial drone technology in a variety of public and private settings is at the center of ongoing public policy debates about the issues of public safety, personal privacy, and the acceptable balance between them," the report's authors say. "Based on the findings from this national survey of Internet users, public acceptance of aerial drone usage is highly contextual, depending upon the specific area of its application."

UNLV criminal justice professors Terance Miethe, Joel Lieberman, and Emily Troshynski, along with graduate students Mari Sakiyama and Milia Heen, conducted the surveys. They expect to release a Nevada-specific survey on UAS use later this year.

HISTORICAL NEVADA NEWSPAPERS TO BE DIGITIZED THROUGH NEH GRANT

THE UNLV UNIVERSITY LIBRARIES HAVE been awarded a large, multi-year grant from the National Endowment for the Humanities.

The two-year $311,000 grant was awarded for the National Digital Newspaper Program, a partnership between the National Endowment for the Humanities and the Library of Congress.

The grant will allow the University Libraries to digitize and make public selected historical Nevada newspapers. The digitized content will be hosted and freely available on the Library of Congress' Chronicling America Website (*http://chroniclingamerica.loc.gov/*).

This grant represents a statewide collaboration. The UNLV University Libraries will serve as the lead institution and will partner with the Nevada State Library and Archives and the University of Nevada, Reno Knowledge Center. A diverse panel of experts and scholars from around the state will serve on a Newspaper Selection Advisory Board, providing guidance for newspaper titles to be digitized.

"Newspapers represent a priceless trove of information, documenting the people, places, and events that have collectively woven the rich tapestry of Nevada history," says Patricia Iannuzzi, dean of University Libraries. "Historical newspapers are very popular with both the research community as well as lifelong learners curious about the state's history. Nevada's history, as told through its newspapers, deserves to be preserved, but doing so requires leadership and commitment from many partners across the state. The coordination required to complete this project is a testament to the passion we share for Nevada history."

She adds that the digital collections experts at the UNLV Libraries will lead the project, which involves digitizing and publishing tens of thousands of pages of historical Nevada newspapers. More information on the University Libraries is available at https://www.library.unlv.edu/.

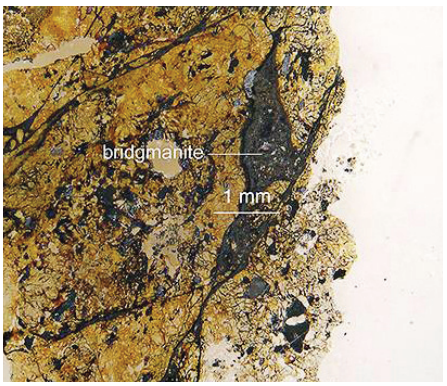
EARTH'S MOST PLENTIFUL MINERAL FINALLY MAKES AN APPEARANCE

SINCE 1979, SCIENTISTS HAVE BEEN searching for a piece of the Earth's most abundant mineral. Because the mineral is located more than 400 miles deep in our planet's lower mantle, the quest to discover a specimen has seemed, at best, a long shot.

No longer. After five years of work, Oliver Tschauner, a mineral physicist in UNLV's department of geoscience, and Chi Ma, a mineralogist from the California Institute of Technology, have located their elusive quarry.

Not surprisingly, the prize didn't emerge from deep digging. It instead had been hiding in plain sight, part of a 4.5-billion-year-old meteorite that landed near the Tenham station in Australia more than a century ago.

The pair named the mineral "bridgmanite" in honor of Percy Bridgman, a physicist who won the 1946 Nobel Prize for pioneering research on solids under high pressure. For decades, scientists have



simply known the mineral by its chemical components and crystal structure — silicate perovskite.

Officially identifying and naming a mineral involves knowing its chemical composition and crystal structure. Synthetic examples had been studied, but until Tschauner and Ma's discovery, no naturally occurring samples of the mineral had ever been found.

The mineral in the meteorite was created through a "shock event" that occurred approximately 470 million years ago.

"Before its fall, the Tenham meteorite was part of a larger asteroid that collided with another asteroid and broke into many pieces," Tschauner says. "It exhibits signs of strong shock-induced transformations, meaning it endured high temperatures and pressures as the result of this collision. These high-pressure conditions, similar to what we see in the Earth's mantle, are why bridgmanite could form in this meteorite, and why we don't see it at the surface of Earth."

According to Tschauner, people had previously suspected bridgmanite was located in so-called shocked meteorites. Grains of shock-generated high-pressure minerals are known to be tiny (micrometer scale), so scientists used electron diffraction — using a blast of electrons to reveal a solid's crystalline structure — to search for bridgmanite. However, the electron beam destroys this mineral, transforming it into glass.

Tschauner and Ma instead used a micro-focused high energy X-ray beam to collect diffraction signals from the Tenham meteorite. The project required development of new analytical methods and was dependent

NEWSPAPERS: COURTESY UNLV SPECIAL COLLECTIONS. BRIDGMANITE: CHI MA/CALTECH; VAN BREUKELEN: R. MARSH STARKS

on a new generation of ultra-fast X-ray detectors, which only became available two years ago. These new detectors permitted a fine-grid mapping for fishing out the tiny grains of bridgmanite, Tschauner says.

"Bridgmanite makes up approximately 70 percent of the volume of the lower mantle and approximately 38 percent volume of solid Earth in total," says Tschauner. "Its physical, chemical, and rheological properties are key in understanding the lower mantle.

"Because the mineral didn't have an official name, there was a problematic terminological vagueness in the literature about the lower mantle, 'MgSi-perovskite,' 'silicate perovskite,' or plainly wrong 'perovskite.' This vagueness is now removed," he says.

$1.4 MILLION GRANT TO EXPAND CLINICAL SOCIAL WORK EDUCATION & RESEARCH

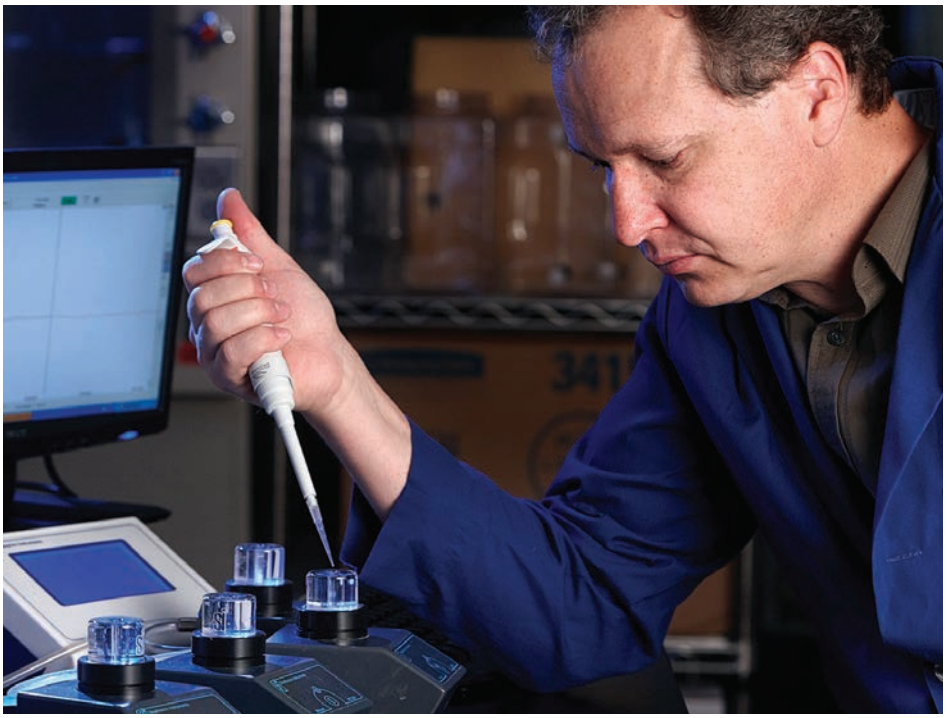
UNLV SCHOOL OF SOCIAL WORK PROfessors Ramona Denby-Brinson and Joanne Thompson and their team of collaborators have been awarded a $1.4 million Behavioral Health Workforce Education and Training for Professionals grant.

The award is from the U.S. Department of Health and Human Services, Health Resources and Services Administration (HRSA).

The purpose of the three-year project is to work with local and state public and behavioral health partners to develop and expand clinical social work education with the goal of producing 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 developed behavioral health disorders.

The project has a strong research component and will utilize multiple innovative 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.

"We truly consider this to be good news for all of the children, youth, and families in our community that struggle daily with mental health challenges," says Denby-Brinson. "We are excited to be able to prepare additional, advanced-level social workers who will have the skills and specialized training necessary to intervene on behalf of this vulnerable group."



FLOW FACTOR UNLV's Frank van Breukelen, pictured above in his laboratory, and Biswajit "BJ" Das have ingeniously employed Bluetooth wireless technology to drive a next-generation blood-flow sensor.

RESEARCHERS EMPLOY BLUETOOTH TECHNOLOGY IN BLOOD-FLOW SENSOR

STROKE, ALONG WITH HEART DISEASE, is one of the two leading causes of death in America. Strokes afflict nearly 800,000 Americans each year, resulting in some 145,000 fatalities and an estimated $40.9 billion in patient-care costs. Despite this tremendous human and financial toll, researchers have yet to develop a definitive therapy for their prevention and treatment.

Impaired blood flow is a factor in the majority of strokes, explains School of Life Sciences professor Frank van Breukelen, adding that the limitations of current blood flow sensors have hampered therapeutic developments. Van Breukelen is collaborating with electrical engineering professor Biswajit "BJ" Das on a better blood-flow sensor — one that employs inexpensive Bluetooth technology to enhance researchers' ability to detect stroke and heart disease risks.

Part of the problem, the scientists say, is that current blood flow sensors rely on power-consuming systems, thus hindering wireless telemeter use. Das and van Breukelen's Bluetooth sensor would measure blood flow rates without such limitations.

This sensor will be readily adaptable to wireless telemetric solutions. It also will allow long-term measurement of blood flow when testing with social animals, such as rats. Previous measurement methods suffered because they required that lab animals be physically restrained, given anesthesia, or in some other way having their mobility limited.

The researchers are using the College of Sciences' Research Fund for Innovation and Development (RFID) money to develop a prototype Bluetooth-enabled blood flow sensor. No similar digital telemeters are yet on the market. The RFID funds helped pay for undergraduate researchers to build and test the system.