LSU RESEARCH

The Constant Pursuit of Discovery › › › › › › › › › › › Office of Research & Economic Development › › › › › › › › › Fall 2014

SOWING THE FUTURE THROUGH RESEARCH

From the Vice Chancellor

One year ago, I took over as the Vice Chancellor of Research & Economic Development. During this time, we have accomplished a great deal, and I am proud of the research activities of our faculty, staff, and students that are being highlighted in this magazine.

Because we are the flagship public university in Louisiana, and because we are a land-grant, sea-grant, and space-grant institution, we have as our mission to serve the interests of the entire state and the nation. Over the past year, we have made considerable strides in investing in the focal areas identified in our strategic plan and encouraging faculty and staff to move toward implementing that plan. Our faculty have garnered several large grants and are conducting exciting research in these areas. In these pages, you will read examples of our groundbreaking research and creative endeavors that keep LSU at the forefront of innovation and discovery.

Approximately $70 billion in new investments are being contemplated within Louisiana. We have placed a major emphasis on economic development in support of the state's objectives in encouraging industrial development. To this end, we have new leadership in place to refocus our technology transfer and commercialization activities. Additionally, because the federal funding scenario is not as bright as we had hoped, we are reaching out to our industrial partners to diversify our portfolio of research. I am glad to report that these efforts are starting to bear fruit.

I hope that you will enjoy reading the stories and articles about our research and will visit our website (research.lsu.edu) for more details.

Kalliat T. Valsaraj

Vice Chancellor, Research & Economic Development
Charles and Hilda Roddey Distinguished Professor in Chemical Engineering and
Ike East Professorship in Chemical Engineering

LSU RESEARCH

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Send correspondence to Office of Research & Economic Development, to the address above, or email to research@lsu.edu. Phone: 225-578-5833. Visit us on the Web at: research.lsu.edu.

Louisiana State University and Office of Research & Economic Development Administration

F. King Alexander, President & Chancellor

Stuart Bell, Executive Vice Chancellor & Provost, Academic Affairs

Kalliat T. Valsaraj, Vice Chancellor, Research & Economic Development

Matthew R. Lee, Senior Associate Vice Chancellor, Research & Economic Development

K. Gus Kousoulas, Associate Vice Chancellor, Research & Economic Development

LSU Research

Publisher and Executive Editor: Matthew R. Lee

Editor: Ashley Berthelot

Assistant Editor: Brenda Macon

Coordinator: Holly Carruth

Contributing writers: Paige Brown, Kelly Hotard, Jenny Linscott, Aaron Looney, Brenda Macon

Design: Steve Radcliffe/LSU Office of Communications & University Relations

Photographers: Eddy Perez and Jim Zietz

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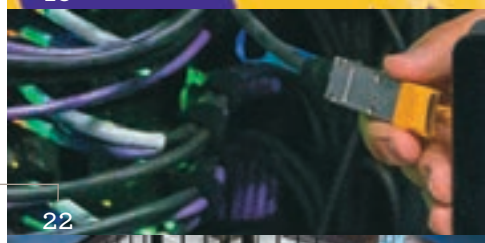
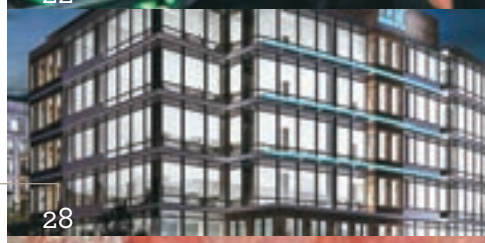




At LSU, several programs currently in place allow undergraduates to work with faculty mentors to produce research results that have significant impact in their fields: the Alumni Scholars program; ASPIRE, which is supported through the College of Humanities & Social Sciences; and the Chancellor's Future Leaders in Research are just a sampling of these programs.

Undergraduate Research Comes Into Focus at LSU

Undergraduates study chemical reactions that occur on the surface of nanoparticles in Assistant Professor Louis Haber's chemistry laser lab, which contains the fastest and most powerful pulsed laser system in the Gulf South.

With the recently announced Quality Enhancement Plan (QEP) that LSU has established as part of its reaccreditation package, the number of hands-on research opportunities for undergraduates will increase exponentially. The QEP, which launched in fall 2014, embraces the idea that undergraduates should be actively involved in learning, creating, researching, and developing ideas as part of the natural discovery process and represents a commitment by the university to provide our students with the very best educational experiences possible.

Titled "LSU Discover," the QEP expands opportunities for all LSU students to participate in projects that will give them a better understanding of their fields and a leg up on their careers after they graduate. Additionally, the proposed program is intended to give every student the opportunity to engage in research experiences that will not only enhance the student's future career, but that also have the potential to change the world for the better.

One reason for the university's selection of undergraduate research as an area for special focus is the overwhelming evidence that formal research opportunities for these students consistently correlate with enhanced student learning and creativity, improved retention and graduation rates, and successful high-level employment. For example, according to a study conducted at UCLA and led by Sylvia Hurtado, which was reported in the journal *Research in Higher Education* (Vol. 49.2, March 2008), institutionally provided, structured opportunities for research, especially biomedical research, were key predictors for the success of all early students, but particularly for African American students. Another study, conducted at the University of Colorado Boulder by a team led by Heather Thiry and reported in the *Journal of Higher Education* (Vol. 82.4, July/August 2011), of these types of experiences for students in STEM (Science, Technology, Engineering, and Mathematics) fields also found that undergraduate participation in authentic research is an "effective way to socialize novices into the scientific research community" and help them "develop mastery, knowledge, skills, and behaviors necessary to become scientists."

Other studies revealed that an undergraduate research experience or other creative activity can enhance personal growth beyond specific research skills. Studies also have shown that participation in undergraduate research helps students define career goals and solidify the choice of a college major. Studies also indicated that research experiences for students in their sophomore year appear to be particularly effective, and earlier and longer involvement increases the positive effects of this experience. Students who participate in multiple semesters of undergraduate research increase their grade point averages in comparison to those who do not.

Encouraged by all of this evidence pointing to the importance of getting students actively involved in their fields of study early on, the university set about developing a plan for involving students as early as possible in these types of experiences. The first step was to create a functional definition for LSU's undergraduate research experience, which became "LSU Discover."

At LSU, undergraduate research involves inquiries or investigations, conducted by undergraduate students, under faculty guidance, that solve problems, make original intellectual contributions, or make creative contributions to a discipline or practice.

This definition guided the team in its next steps, which were to identify faculty mentors and undergraduate researchers who were already actively involved in this type of activity. By learning from existing programs, such as those mentioned previously and others, like LSU's collaboration with the Howard Hughes Medical Institute (HHMI), the LSU Discover team began to develop a comprehensive plan for expanding these

types of opportunities to include any student who wishes to participate.

Currently, top students at LSU have the chance to engage in real research projects that have the possibility of making significant advances in their chosen fields. Faculty mentors work with these undergraduates on projects at or beyond graduate-level research, and students receive more than just their diplomas when they graduate. They leave LSU with real research experience that translates to enhanced assistantships at LSU and other prestigious graduate schools worldwide.

Jori Erdman, a professor and program director in the School of Architecture at LSU, has been working with undergraduates on research projects for five years. She has found each experience to be unique and special.

"Architecture students don't often see themselves as 'researchers,'" Erdman commented. "I appreciate working with undergraduate researchers because I can show our students how design and research can work together in making the built environment better. It also gives me a chance to work one-on-one with students on projects they really care about."

Jessica Wasiloski, a mentee of Erdman's, was recently selected as an "LSU Discover Scholar," one of twelve students who represent the eleven senior colleges, the School of Veterinary Medicine, and the Honors College. Wasiloski's research project illustrates the interrelationship between design and research that leads to environmentally responsible structures.

Wasiloski, who graduated summa cum laude in May 2013 from the College of Art & Design, completed a multi-semester research project with Erdman, the staff of the LSU Coastal Sustainability Studio, and the director of facilities at Port Fourchon, Louisiana. Her research centered on designing temporary housing facilities for port workers in Port Fourchon, which


Jonathan Lambert

has lost 87 percent of its habitable land in the last decade. She recognized the need to create a building that represents the ever-changing environment of the area, selecting materials and designing the facility "to move, grow, and reflect change" over time. Her Honors thesis title references this experience: "Temporal Hotel: Architectural Response to a Fluid Landscape."

"The biggest advantage to doing research is that you get to do something you're interested in," Wasiloski explained recently. "I didn't have to pursue a second semester of research, but I did because I preferred to work on something I was passionate about. And you can have ownership of your senior year."

Another LSU Discover Scholar who is representative of the student researchers that the team found as they conducted their assessment of undergraduate research at LSU is Jonathan Lambert. In May 2014, Lambert received a double degree in coastal environmental science with a marine concentration in the School of the Coast & Environment and biological sciences in the College of Science. As an undergraduate, he has participated in notable research experiences, including at the NOAA National Marine Fisheries Service, at the LSU Southern Regional Climate Center, and at NASA Goddard Space Flight Center—Biospheric Science Lab. When he was a junior in spring 2013, Lambert received the prestigious Udall Scholarship, becoming only the third person from LSU to win this award. He credits his research experiences for his selection.

"My involvement in undergraduate research provided me with a closer relationship with my college, professors, and peers than I could have gotten through just taking classes or joining student organizations," Lambert explained. Of LSU Discover, he added, "Spotlighting undergraduate research is a great way to promote this experience so that other students will see its great joys and benefits."

Through LSU Discover, opportunities like those Wasiloski and Lambert have had will be extended to any LSU student who expresses an interest in research. Of course, each student who participates in LSU Discover will also be expected to commit to the quality of work required to develop an acumen for research. According to the LSU Discover report, courses and training geared toward LSU Discover will include enhanced instruction in basic research principles. Combining technological literacy, investigation methods, professional ethics, critical thinking, and communication skills into this plan will ensure that students learn more than simply how to conduct an experiment or develop a survey. These skills have been deliberately chosen to help students become better professionals regardless of their future careers and of whether they continue into graduate school or not.

Additionally, LSU Discover plans include creating events—such as the recent Research Day at which students presented their work to a campus-wide audience—that will provide undergraduate researchers a venue for sharing their ideas, presenting their work, and networking with others. While this year's event took place on a single day, plans are in the works to spread activities over a Research Week in coming years. As the program continues to grow, other events, such as an undergraduate research conference, are also possible.

LSU's Office of Undergraduate Research, headed by Professor Randy Duran, who is also one of the authors of the LSU Discover plan, is leading this effort to teach more students how to conduct professional and responsible research projects.

"LSU Discover will dramatically enhance the number and quality of opportunities for research, innovation, and creativity for all students," Duran explained recently.

Vice Chancellor of Research & Economic Development Kalliat T. Valsaraj added, "Exposing undergraduates to the excitement of research is a wonderful way to increase the pipeline of students to graduate school and professional opportunities."

Corby Martin, currently an associate professor and director of behavioral science and epidemiology research at Pennington Biomedical Research Center, is also a mentor to undergraduates. "Undergraduate researchers are tomorrow's research leaders," he offered in explanation for his reason for working with students. "It is critical that we provide undergraduate researchers with the opportunity to demonstrate their creativity and to obtain the research experience they need in today's competitive environment."

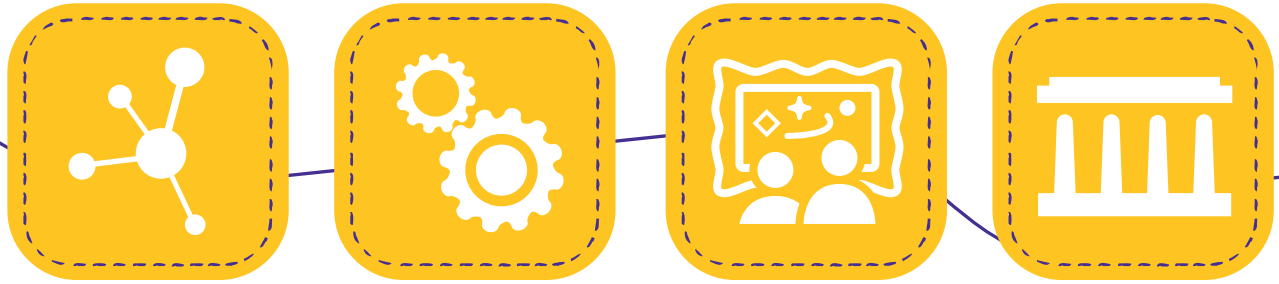
LSU Discover is an opportunity to do just that.

Working Toward a Creative LSU

As a comprehensive research institution, LSU embraces not just the science and engineering disciplines, but the arts, humanities, social and behavioral sciences, business, and other professional disciplines as well. A common thread running through all of these disciplines at LSU is the need for creativity. Long thought to be only the realm of the arts, contemporary analysts now recognize that creativity is a central component of all scholarly and learned work and is a critical fluency to develop in students preparing to enter the labor force. Indeed, a recent IBM survey of 1,500 CEOs showed creativity to be the most important competency for leaders, learners, and workers in the 21st Century.

Recognizing the importance of fostering creativity at LSU, the Office of Research & Economic Development (ORED), under the leadership of Vice Chancellor Kalliat T. Valsaraj and Senior Associate Vice Chancellor Matthew Lee, has set forth an ambitious strategic plan to foster multidisciplinary research and academic programs; forge new partnerships with industry, state agencies, and other community stakeholders; and start building the infrastructure to support creativity and innovation across campus. The strategic plan also calls for LSU faculty to pursue scholarly work that can reinvigorate the Louisiana economy and be applied to address the region's most pressing problems.

During the summer of 2013, Dr. Laurence Kaptain was appointed LSU's first director of creative initiatives in ORED. He spent the first year working closely with ORED to develop new, transdisciplinary, and "non-routine" ideas designed to elevate creativity among students and faculty across the university and support new kinds of engagement projects both within LSU and between LSU and the broader Baton Rouge community.



Baton Rouge is a city with a rich, textured history and an array of human, economic, and geophysical assets. It is also a city facing multiple compelling challenges related to water, jobs, education, poverty, and land use, among other issues. Similarly, LSU is a great educational institution with remarkable assets that faces significant challenges as a result of recent funding cuts and rapid changes in the higher education system, in and outside of Louisiana.

Frances Lawrence (foreground), a professor in the Department of Finance and the director the Certified Financial Planner program, has served on the Creative Initiatives Task Force since its inception.

Kaptain began by developing a multidisciplinary Creative Initiatives Task Force to support the strategic plan of ORED for the annual year 2013-14. During its initial year this group was tasked with:

- providing a definition of creativity that will support the strategic goals of ORED;
- bringing a broader appreciation for the creative contributions of all disciplines to the research plan of LSU;
- developing communication mechanisms to promote scholarship both internally and externally; and
- identifying funding sources that will support creative engagement and thinking, both in and beyond the arts areas at LSU.

The Creative Initiatives Task Force came up with the following definition that interfaces with LSU's and ORED's strategic goals:

- Creativity is a central element in the discovery and generation of novel concepts, research solutions, enhancement of student learning for the 21st century, and the broadening of faculty expertise and knowledge, while advancing cross-disciplinary collaborations.
- Creativity recognizes opportunity and embraces ambiguity as an essential element of intellectual and innovative advancement.
- Creativity enables problem solving that extends past idea generation, providing original solutions that address the distinctive needs and strengths of LSU, Louisiana, the United States, and the global community.

The Creative Initiatives Task Force established a website and blog that may be found at creativeinitiativesblog.com; hosted several Brown Bag lunches for faculty, students, and LSU leaders to bring people together who are interested in learning more about collaborative research and creative activity across disciplines; hosted creativity scholar Elizabeth Long Lingo for two days of leadership training; and brought to campus MacArthur Fellow Liz Lerman and Helicon Collaborative President Holly Sidford.

On the heels of a very successful inaugural first year of the Creative Initiatives project, Kaptain moved on to other opportunities. ORED will continue to build on the strong foundation of the Creative Initiatives project, developing funding sources to support the effort and fostering additional faculty and student participation in the project to ensure that an emphasis on creativity in all its forms remains a central component of the scholarly work conducted at LSU.

SCIENCE CAFÉ

There's a general misperception about the role of research at universities like LSU and the impact it actually has. Many people who are removed from the internal workings of university life see it as an "ivory tower" issue, stemming from the incorrect notion that science and scholarship generated by faculty reside in a silo, with little or no external benefits. This is particularly problematic in the case of public institutions such as LSU, where taxpayer dollars partially support the institution.

Enter Science Café. Based on Café Scientifique, a U.K.-based organization founded in 1998 with the goal of sharing science with the public, science cafés are grassroots movements to increase public knowledge, understanding, and enjoyment of science. LSU's Science Café has expanded that wide-ranging mission to include the social sciences, arts, and humanities in order to more fully foster public appreciation of all forms of university research and scholarship.

"We saw Science Café as an opportunity for LSU faculty members to take their research to the people in a fun, casual, yet informative way," said Ashley Berthelot-Arceneaux, former director of research communications at LSU and inaugural Science Café organizer. "Many of our researchers are extremely committed to the idea of sharing their work with the public, and this offers a comfortable, off-campus setting in which to exchange ideas and information."

LSU's Office of Research & Economic Development (ORED) saw potential in the idea and decided to move forward with it in January 2013. The success of the very first event, which was publicized both internally around campus and among various traditional and social media outlets as well, caught everyone off-guard, with more than 80 people showing up at local favorite Chelsea's Café.

"Where we would have been satisfied with a turnout of 30—and 50 was our dream goal—80 to 90 people came," said Zac Lemoine, research communications editor. "And they didn't just sit quietly. They engaged. They laughed and talked and asked questions."

"Approachability is key," said Berthelot-Arceneaux, "because so many people fear science and research, or consider it boring or too complex for them. The idea of sitting down to a scientific lecture isn't appealing to many people outside the gates of our campus. That's why speakers for the series are chosen carefully and collaborate with the research communications team to ensure a top-notch presentation that stays within a very short window of time."

Prosanta Chakrabarty, curator of ichthyology at LSU's Museum of Natural Science, served as the inaugural speaker for the event.

"I really enjoyed it. I wanted the crowd to interact with me, and I wanted to talk about how scientists need to be better communicators," said Chakrabarty. "I was told 10 to 15 minutes, and I timed to 12 minutes to make sure there was plenty of time for questions—and for people to refill their drinks."

Chakrabarty spoke about his work at the university's museum of natural science, where he studies taxonomy of fishes, but he used his fieldwork as a contextual frame to liven up the idea of being a scientist. He showed slides from expeditions from Taiwan to Madagascar and everywhere in between and discussed his recent discovery of several species of fish new to science.

"I think I reached my goal of giving an entertaining talk about science that makes it more approachable for the general public," said Chakrabarty. "I'm glad there are outlets to discuss science with the public like LSU Science Café."

At the second event, the topic turned to social sciences, with Senior Associate Vice Chancellor of Research & Economic Development and Professor of Sociology Matthew Lee, who presented "Hip Hop & Homicide," a rousing look at crime statistics over the last several decades paired with popular music trends. After another packed house and positive feedback, it was official: the Science Café was not only a success, but a welcomed event by both faculty and the community.

"Where else are you going to see a full professor blow bubbles from a kid's toy set to describe how binary star systems form?" said Greg Molchan, PhD and repeat café attendee. "LSU Science Cafe is not just about coming together as a community to learn something from the area's top scientific researchers and discuss the nature of the universe. It also makes science the fun and exciting learning experience it should be."

The event is now more than a year and a half old, and it shows no signs of losing popularity. In fact, the event has continued to attract an average of 85 attendees each month, with some topping out at more than 100.

"We were all surprised at the intense and immediate popularity of the event, but it proves that the public is hungry for information about the research going on at their university," said Lee. "It also proves that our faculty are equally as eager to interact and share information with the community."

For more information about the LSU Science Café, visit **lsu.edu/research**.

01 | 29 | 13
Prosanta Chakrabarty, curator of ichthyology at LSU's Museum of Natural Science and assistant professor of biology

02 | 26 | 13
Matthew Lee, professor of sociology and senior associate vice chancellor of research & economic development

03 | 26 | 13
Robert Twilley, director of the Louisiana Sea Grant Program

04 | 30 | 13
Ed Overton, professor emeritus of coastal and environmental sciences

05 | 28 | 13
Robb Mann, assistant professor of anthropology and southeastern regional archaeologist

06 | 25 | 13
Mari Kornhauser, professor of screenwriting

07 | 30 | 13
Suniti Karunatillake, assistant professor of geology and geophysics

08 | 27 | 13
Joel Tohline, former director of CCT and professor of physics and astronomy

09 | 24 | 13
Jeff Nunn, professor of geology and geophysics

10 | 29 | 13
Vince LiCata, professor of biological sciences, and **Bonnie McDonald**, PhD student in communication studies

11 | 26 | 13
Chris Austin, professor of biological sciences and curator of herpetology at LSU Museum of Natural Science

02 | 25 | 14
John Pojman, professor of chemistry

03 | 18 | 14
Jackie Stephens, professor of biological sciences

03 | 25 | 14
Kevin Macaluso, professor of pathobiological sciences at LSUVM

04 | 29 | 14
Wes Shrum, professor of sociology

05 | 27 | 14
Barry Keim, professor of geography and anthropology and Louisiana state climatologist

06 | 14 | 14
Brad Schaefer, professor of physics and astronomy

07 | 29 | 14
Rebecca Saunders, professor of geography and anthropology

08 | 26 | 14
Brian Wolshon, professor of civil and environmental engineering

09 | 30 | 14
Christopher Mores, professor of pathobiological sciences

Research universities are economic engines, driving innovation and technological advancements around the world. Their critical mass of expertise attracts industry and encourages entrepreneurship, stimulating small business development while attracting large corporations to locations that would otherwise be overlooked.

ECONOMI

While this reality might be understood intuitively by many, it's often difficult to put a number on. However, hard data is increasingly more important, especially in the age of tight budgets and federal sequestration. Recently, LSU researchers in the Division of Economic Development at the E. J. Ourso College of Business decided to do just that, and conducted a study to determine the university's statewide economic impact.

"Impact studies provide important details about an institution's relevance to a state or region's economic well-being," said Stephen Barnes, director of LSU's Division of Economic Development within the E. J. Ourso College of Business. "Because LSU has its flagship in the capital city but has campuses across the state, we thought it was especially important to underscore how far-reaching our influence truly is."

The study determined that LSU's economic impact on Louisiana totals an impressive $3.9 billion. This includes the impact of all nine LSU campuses—LSU, the LSU AgCenter, the Paul M. Hebert Law Center, Pennington Biomedical Research Center, LSU Alexandria, LSU Eunice, LSU Shreveport, and the LSU Health Sciences Centers in Shreveport and New Orleans—at both the state level and on their particular region within the state.

"These numbers demonstrate how invaluable LSU is to our state from a variety of angles, whether it's through jobs created, sales generated, or drawing nonresidents to Louisiana," said Barnes. "LSU is most definitely a critical economic driver for the state of Louisiana."

State Breakdown

There's no doubt that almost $4 billion dollars is a significant sum of money. So, the natural follow up question is, how does LSU generate all that cash?

"While many people are familiar with the economics of college football, few realize the economic impact of having a Research I institution in your backyard," said Barnes. "Federal grants don't just drive innovation… they infuse local economies with much needed cash through salaries and supply purchases."

During the 2013 fiscal year, LSU provided a return of $5.08 for every operating and capital dollar provided by the state.

"It's no surprise that LSU has such an economic impact on Louisiana," said LSU President and Chancellor F. King Alexander. "With campuses, research stations, and extension offices in every corner of our state, we don't just make money for Louisiana—we attract new business and industry, provide solutions to the state's most pressing issues, and improve the overall quality of life for our citizens. We do this all with a keen eye toward value because we believe it's important to provide exceptional higher education opportunities without an inflated price tag and a lifetime of debt."

The total economic impact of local LSU institutions on the Baton Rouge MSA comes to $2.1 billion in sales, $764 million in earnings, and more than 21,400 jobs. The nine parish region, which includes Ascension, East and West Baton Rouge, East and West Feliciana, Iberville, Livingston, Pointe Coupee, and St. Helena Parish, houses more than 8,300, or 62.7 percent, of full-time LSU employees.

The same team of researchers is currently nearing the end of another economic impact study on LSU—this one focusing on the long-term benefits to a state housing a major research university.

The full report is available at lsu.edu/researchnews under Stories.

C IMPACT

Business Sense

In addition to direct economic impact, LSU's core of technical, scientific, and scholarly expertise has been a significant motivation behind critical public-private partnerships connecting industry and higher education. The most prominent examples are the university's highly successful work with industry giants IBM and EA Sports, which both have significant economic impact on the city and state while also positively impacting LSU's digital media and computer science offerings. As an added bonus, students at LSU have the opportunity to work and train with leading industry figures so that they acquire real-world experience in addition to a top-notch education.

Additionally, the university supports a truly entrepreneurial culture in the state's capital and around Louisiana. Its new research park—Innovation Park—was named emerging research park of the year in 2013 and combines scientific investigation and business enterprise under one umbrella. Innovation Park raised more than $12 million in investment capital over the last year. Designated by Louisiana Economic Development as a qualified research park and by the federal government as a HUB zone, its resident companies are eligible for numerous research and development tax incentives and credits, as well as other state incentive programs. Innovation Park's expert staff provides international trade assistance for companies who wish to export, with training, translation, international trade, marketing experts, and logistics experts.

Innovation Park is also home to LSU's business incubator, the Louisiana Business and Technology Center (LBTC), which houses more than 30 small businesses. In the last year alone, the center has supported more than 200 local entrepreneurs and more than 13 start-up companies assisting in the creation of nearly 70 jobs.

"For more than 25 years, LBTC has supported Louisiana's entrepreneurial spirit by assisting start-ups with business plans, identifying investment opportunities, providing technology transfer assistance, and so much more," said Charles F. D'Agostino, director of LBTC and Innovation Park.

LBTC was designated as one of only 25 Soft Landings International Incubators in the world in 2011. The National Business Incubation Association (NBIA) offers this designation to let foreign firms know these incubators have specialized programs and/or facilities for helping companies break into new markets.

LBTC also houses a student incubator (see story on page 14), which cultivates savvy business practices and entrepreneurial passions among young entrepreneurs, and attracts students from around the country to settle in Baton Rouge and attend LSU in order to make their dream of running their own business a reality.

Moving Forward

As strong as LSU's current economic impact is, there's always room for improvement. LSU's Office of Research & Economic Development (ORED) recently implemented a strategic plan identifying seven focal areas of research strength across the campus. One of the goals identified within the plan was to transition from a focus on single-PI grants to multi-million dollar, multi-institution Centers of Excellence. LSU has had some significant success with this approach in the past, claiming one of only 46 Department of Energy-

With campuses, research stations, and extension offices in every corner of our state, we don't just make money for Louisiana—we attract new business and industry, provide solutions to the state's most pressing issues, and improve the overall quality of life for our citizens.

— F. King Alexander
LSU President and Chancellor

Governor Bobby Jindal and LSU President and Chancellor F. King Alexander recently announced the creation of the **LSU Transformational Technology and Cyber Research Center (TTCRC)**, which will pursue major federal and commercial research projects in applied technology fields. Initially, the TTCRC will be funded in part by the State of Louisiana and LSU in a challenge grant configuration that provides $1 in state funding and $0.50 in LSU funding for each $10 in research funds the center attracts over the next three years.

Ultimately, the TTCRC will target raising $34.5 million over its initial three years, with $30 million coming from external federal and private sources and the remainder coming from the State of Louisiana ($3 million) and LSU ($1.5 million). Creation of the center, which will collaborate with the Stephenson Disaster Management Institute and other LSU research entities, is subject to a vote by the LSU Board of Supervisors.

The research center's first director, Jeff Moulton, comes to LSU from the Georgia Tech Research Institute, where he served as director of program development for a 1,700-person entity that attracts more than $300 million in annual research and development contracts. Moulton will be charged with attracting major research contracts to LSU by leveraging the university's unique strengths in such disciplines as supercomputing, cybersecurity, and nanotechnology.

"We live in a world of unprecedented challenges," Moulton said. "Nascent threats require innovative solutions. The Governor's Office through Louisiana Economic Development (LED) has done a tremendous job of attracting a world-class research capability in Louisiana. LSU had the vision to commission the TTCRC, and we'll leverage this capability to bring Louisiana's intellectual might to the fight. I'm excited to be a part of it."

Goals of the research partnership between the State of Louisiana and LSU are for the center to reach at least $10 million in research contracts by Jan. 1, 2016, and $30 million in research contracts by July 1, 2017.

designated Energy Research Frontier Centers funded at $12.5 million, and an $11 million Superfund Research Center supported by the National Institute of Environmental Health Sciences (NIEHS).

To enhance this strategic approach and ease researchers toward large-scale collaborations, ORED identified and provided several mechanisms of assistance, including technical and grant writing services, and streamlined sponsored programming processes.

Meanwhile, in an effort to corral the university's many assets into one focused approach, LSU's President Alexander assembled a committee on technology transfer, tasking the group of university experts with identifying and implementing ideas to streamline existing technology transfer practices while implementing new ideas for further efficiencies and new developments.

The new approach, based upon a new shared-services partnership with the LSU System Research and Technology Foundation, offers centralized administrative support functions enhancing both productivity and cost-savings while allowing each campus to manage its own operations. The budget for this partnership is expected to replace what the campuses currently spend on external legal fees each year, and will be shared according to a formula based upon each campus's relative proportion of LSU's total annual research expenditures.

This new approach will be strengthened by the launch of a new proof-of-concept funding program, the LSU LIFT2, or Leveraging Innovation for Technology Transfer, Fund. LIFT2 will provide support for commercialization of faculty intellectual property—support difficult to come by through traditional means. Providing a bridge over the critical gap between basic research and commercialization, LIFT2 will provide grants to faculty on a competitive basis twice a year, in amounts up to $50,000, to validate the market potential of their inventions. The new funding program is to be permanently sustained through an allocation of 5 percent of all future licensing income being routed directly back into the fund.

"Building a robust pipeline for bringing new technology to the marketplace is critical for creating an innovation economy. As a key component of that effort, Baton Rouge Area Chamber (BRAC) has long supported improving the process of technology transfer and commercialization at LSU," said BRAC President and CEO Adam Knapp. "The recommendation of the LIFT2 fund, in particular, illustrates LSU's commitment to supporting faculty inventors during the earliest phases of an idea. We applaud Dr. Alexander's leading change in this area, and look forward to further developments under his leadership to improve performance."

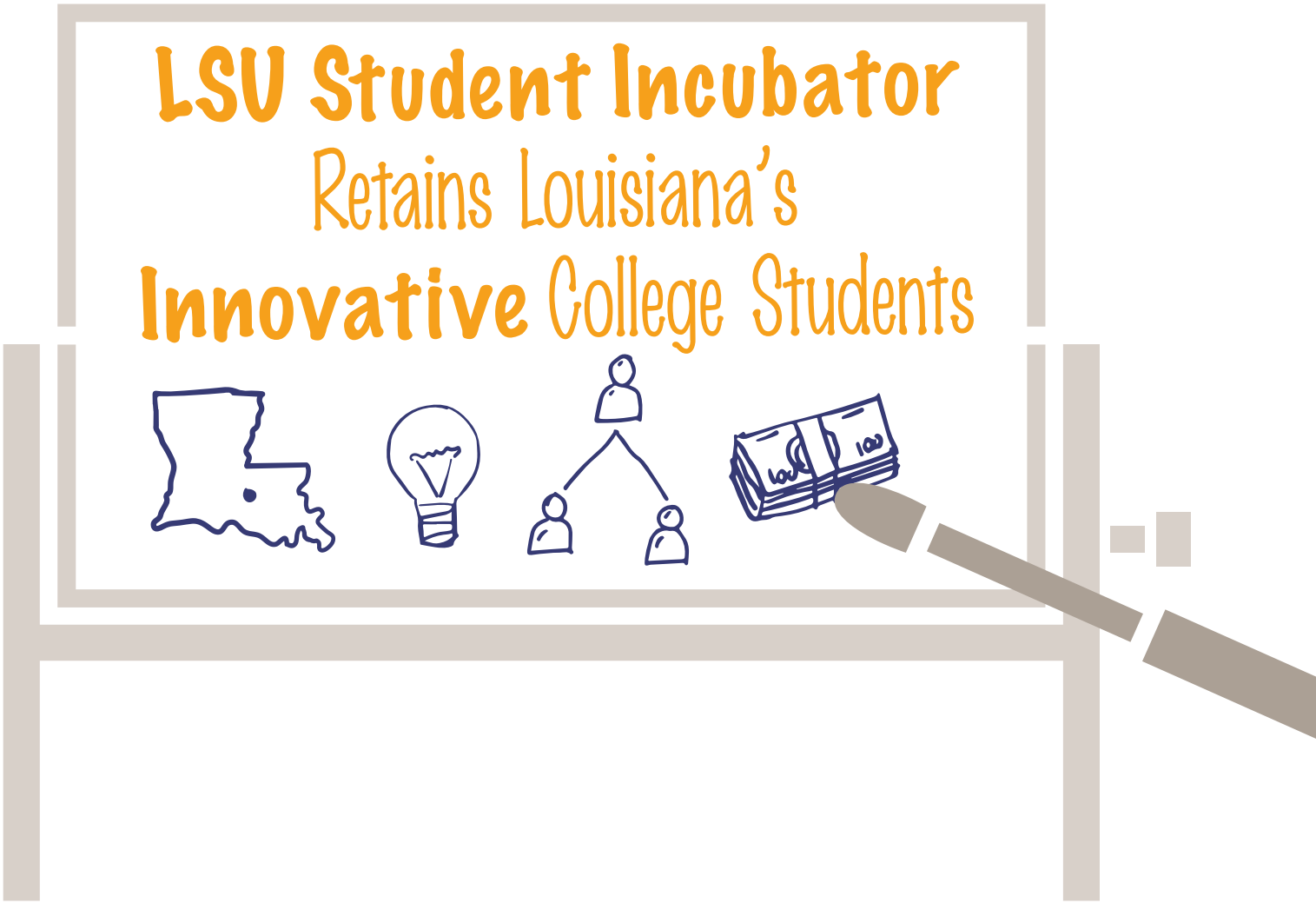
Could the LSU Student Incubator terminate Louisiana's brain drain of young professionals? The Louisiana Business and Technology Center (LBTC) recognized Louisiana's economic need to retain the state's college graduates and in 2010, launched the LSU Student Incubator program to identify and support motivated young entrepreneurs.

When LBTC began planning for the LSU Student Incubator, very few such programs existed across the country. LSU modeled its program after the nation's top student incubators, including Duke University, Massachusetts Institute of Technology, and Stanford University. However, the incubator program development at LSU also incorporated valuable resources from the LBTC. During the final planning stages, multiple student entrepreneurs were interviewed to ensure the program would meet student needs.

"Many students have great ideas but need help creating business models to determine how to properly operate their businesses," LSU Student Incubator Director Jennifer Fowler said. "We also have students who are experts in their field but who need assistance turning their expertise into a successful business. We are here to help these students with the business aspect of the startup."

The LSU Student Incubator was one of the first college programs that identified the nation's growing market of aspiring student entrepreneurs.

Since the incubator's launch in 2010, the program has gained international recognition as one of the leaders in the student incubation industry. The LSU Student Incubator has helped implement 15 new programs of its type worldwide and assisted an additional 15 programs with ideas for improvement. Because of the program's success, multiple universities including Texas State University, Southern Illinois University, and Sam Houston State University have modeled their incubators after the LSU Student Incubator.



Annually, the LSU Student Incubator supports over 50 student-run startups by providing individual business consultations, business planning software, accounting assistance, professional mentors, co-working space, and other valuable resources necessary for students to establish and develop their businesses. In the past three years, the program has supported 108 businesses composed of 127 LSU students, and the students' companies have raised more than $3.6 million in capital. Today, the program directly enhances Louisiana's economy through the 108 jobs created by the LSU Student Incubator startups currently in operation.

"We are helping Louisiana and LSU retain our graduates by keeping them in the state to operate their own businesses," LBTC Executive Director Charles F. D'Agostino said. "These student companies are improving economic development in the state by creating jobs, hiring Louisiana students and citizens, and locally spending payroll and supplies money." D'Agostino has spoken at four National Business Incubation Association International conferences on student incubation and has answered the inquiries of, and given tours to, many universities interested in replicating the LSU program.

During the early stages of the LSU Student Incubator, it became evident that students needed a small amount of capital to start and grow their businesses. The students struggled to obtain the startup capital, so the program staff saw an opportunity to create "Venture Challenge" to resolve the dilemma. Venture Challenge, a competition for LSU Student Incubator members, requires participants to create business plans and 10-minute investor pitches. The competition concludes with a grant of $25,000 in cash to four to six finalists' companies. The challenge benefits all participants by providing résumé building, networking opportunities, and the total business startup experience. The event allows the LSU Student Incubator to showcase the best and brightest members and reward those students for their hard work.

"The LSU Student Incubator is an amazing program," a 2014 Venture Challenge winner and cofounder of E T C H Studio Zoe Ganch said. "It has helped us financially with the Venture Challenge [grant], but more importantly, it has truly benefited our business by providing amazing mentors and resources that we wouldn't have otherwise. Being creative minds, the technical aspects of running a business are very new to us, and having those mentors has been essential for us to continue and expand E T C H studio!"

In addition to the Venture Challenge, the LSU Student Incubator offers multiple events to ensure student businesses are more likely to succeed. The incubator's Elevator Pitch Competition allows members to practice delivering business pitches in a competitive setting. The incubator also hosts seminars that are led by local entrepreneurs and business professionals on various business topics including strategic planning, legal issues, marketing, financing, accounting, and fund acquisition. Participants are able to apply the skills they learn to achieve success in the professional world. To date, the LSU Student Incubator has graduated 23 businesses that are in operation, and all but one of the graduates remain in Louisiana.

Some of the greatest successes from the LSU Student Incubator include graduate companies Yellow Jacket Case, LocalMed, Hitlights, Loupe Theory Studios, and Ties to the South. Yellow Jacket Case, a 2012 Venture Challenge winner, received national media attention for raising $1 million to launch the company's stun gun smartphone case and was voted the "Coolest iPhone Case of CES 2014." Another Venture Challenge winner, LocalMed, created 52 Baton Rouge jobs in 2012 and partnered with United Concordia Dental, the nation's largest dental insurer, in 2014. Graduate company Hitlights is currently a tenant at the LBTC and one of the leading LED lighting product suppliers in North America.

"The LSU Student Incubator is building a Baton Rouge necessity," graduate success and cofounder of Loupe Theory Studios Max Zoghbi said. "The incubator empowers a collective group of young entrepreneurs and directly enhances Baton Rouge's expanding economy."

Zoghbi founded Loupe Theory Studios to follow his love for video production. Today the company is flourishing in Baton Rouge's booming feature film industry. Zoghbi highly encourages students to take advantage of the student incubator to create careers that students are passionate about and to build the local community.

In just four short years, the LSU Student Incubator has largely enhanced Louisiana's economy and built a future for college graduates in Louisiana. The program strives to retain Louisiana's brightest college students and may be the economic secret weapon that Louisiana has needed all along.

For more information or a tour of the student incubator contact:

Charles F. D'Agostino, LBTC/LSU Innovation Park Executive Director
cdag@lsu.edu | 225-578-7555

Spring 2014 Member List

In the three years since the LSU Student Incubator opened, the program has assisted 108 student startups, composed of 127 students. Today, 27 of those startups are in business creating jobs for 108 people in the Baton Rouge area. The LSU Student Incubator currently serves these 27 startups:

Affordable Business Solutions

Founder: Robert Selders, Jr., LSU Agribusiness Class of 2015

Business: A business support company that specializes in website design, hosting, and web maintenance and offers graphic design and voice over IP solutions

Contact: rselders@creativewebspot.net, (225) 288-3024

Bazile's

Founder: Jovon Snyder, Business Administration, LSU Class of 2013

Business: An exclusive Louisiana cuisine franchise restaurant

Contact: jsnyd11@tigers.lsu.edu, (504) 644-7115

Campus Commodes

Founders: Derek Worstell, Business Management Entrepreneurship, LSU Class of 2015; Daniel Garza, Finance, LSU Class of 2015

Business: A smartphone application designed specifically for college students to quickly and easily find the best bathrooms on campus

Contact: dworst1@lsu.edu, (757) 784-6072

Charlie Mac's

Founder: Tyler Robertson, Biochemistry, LSU Class of 2014

Business: Proposed local restaurant and bar that features a menu composed of dishes that were created from recipes by former LSU head football coach Charles McClendon's family

Contact: trob1227@yahoo.com, (818) 689-0043

College Collab LLC

Founder: Kurt McCune, General Business Major, Class of 2015

Business: A website called CollegeCollab that will link students together by the specific classes they are taking

Contact: kmccun2@tigers.lsu.edu, (985) 210-2843

E T C H studio***

Founders: Zoe Ganch, Architecture, LSU Class of 2015; Mallory Estopinal, Architecture, LSU Class of 2015

Business: A small, co-owned, laser-cut jewelry business operated through the social media platform of Instagram

www.studentincubator.lsu.edu

Contact: contact.etch@gmail.com, (214) 514-2236, (281) 883-3517

Foundation Family Fitness*

Founder: Katheryn "Andrea" Sebastien-Roberts, Sport Management, LSU Class of 2013

Business: A high-quality, fun fitness experience for the whole family in a family-oriented environment with Christian values

Contact: andrea_sebastien@yahoo.com, (225) 252-2192

Free Fall View Productions

Founder: Javier Magdiel Fernández, Creative Writing, LSU Class of 2015

Business: An independent production company focused on making diverse types of professional video and photography with a cinematic look and with a primary focus on innovative and creative ways to approach client needs

Contact: magdielfernandez@gmail.com, Freefallviewproductions@gmail.com, (225) 933-7441

GameSpyre

Founders: Nicholas Salzer, Mechanical Engineering, LSU Class of 2017; Matthew Edwards, Mechanical Engineering, LSU Class of 2017

Business: Top-tier news coverage for all of the competitively played games in the eSports scene

Contact: nsalze1@tigers.lsu.edu, (225) 226-8279;

Medwa47@tigers.lsu.edu, (225) 993-4465

Grub Drop

Founder: Ayan Mehrotra, Masters of Science, Civil Engineering, LSU Class of 2014

Business: A delivery business that focuses on providing swift and economical deliveries from various restaurants around LSU's campus that currently do not offer their own delivery services

Contact: amehro1@lsu.edu, (225) 571-6798

Hynson Enterprises, dba RamentoWealthy.com

Founder: Michael Hynson, Economic Geography, LSU Class of 2014

Business: Business startup services

Contact: mhynso1@tigers.lsu.edu, (225) 573-3395

Iron Marketing

Founder: Ryan Primeaux, Sports Administration, LSU Class of 2014

Business: Offers professional web services for increasing online company growth, with services ranging from website development and social media consulting to logo and print design

Contact: contact@ryanprimeaux.com, (817) 205-9239

Magnolia Luxe

Founder: Taylor Kantt, Fashion Merchandising and Spanish-Secondary Education, LSU Class of 2015

Business: Custom, handmade jewelry and accessories at an affordable price

Contact: tknatt2@lsu.edu; (225) 405-6328

Mashball**

Founder: Todd Mashburn, Business Management, LSU Class of 2015; Timothy Mashburn

Business: A box game

Contact: tmashb1@lsu.edu, (504) 339-4555

Mehall Medical Logistics

Founder: John Mehall, Information Systems and Decision Sciences (ISDS), LSU Class of 2016

Business: An enterprise designed to help people find the health care coverage that fits their needs

Contact: johnmehall@gmail.com, (586) 859-8803

OURSTAR, INC.

Founders: Osama Amous, ISDS, LSU Class of 2016

Business: A liaison/consultant to bridge the economic gap between businesses in Louisiana and the Middle East

Contact: oamous1@tigers.lsu.edu, (225) 315-0460

Rise Above All

Founder: Isaiah Alexander, Business Management, LSU Class of 2016

Business: A brand of T-shirts, wrist bands, badges, and posters for young men

Contact: ialexa2@tigers.lsu.edu, (337) 377-8970

RockWater

Founders: Mark Moss, Flores MBA Program Class of 2013

Business: A company to market and sell a product called RockWater, the only medically formulated drink that aids in kidney stone prevention (sold in a powdered form for shipping)

Contact: mmoss7@tigers.lsu.edu, (318) 422-7771

Simply Fresh

Founder: Robert Smith, Petroleum Engineering, LSU Class of 2014

Business: A new organic fast food restaurant

Contact: fwdqb18@yahoo.com, (281) 229-9083

Southern Buoy

Founders: Dylan LeBlanc, Philosophy, LSU Class of 2015; Trey Killeen

Business: High-quality, local seafood delivery to nonnative markets

Contact: dlebl46@tigers.lsu.edu, (225) 788-1401

Supedup Auto

Founders: Gary Shuford, General Business, LSU Class of 2013; Jason Buise

Business: Mobile car maintenance company: main services include washing, detailing, and performing general automotive maintenance

Contact: supedupauto@gmail.com, (225) 242-9540, www.supedupauto.com

Sustainable Green

Founders: Austin Guidry, Chemical Engineering, LSU Class of 2015; Michael Guidry, Biology, LSU Class of 2013; TJ Tippit

Business: Company that uses hemp to develop food and possibly medicinal products and utilizes the composition of the plant's structure to make a cost effective and responsibly made fuel

Contact: aguid38@tigerts.lsu.edu, (225) 937-0695

Young Kings Society (YKS)

Founder: Travis Mamon, Accounting, LSU Class of 2016

Business: A design, product development, and marketing company geared toward a young, urban student population

Contact: tmamon1@lsu.edu, (404) 790-2748, www.yksociety.com

Name TBD

Founder: Eric Newberry, International Trade and Finance, LSU Class of 2014

Business: A carbon sequestration company restoring wetlands and selling carbon credits

Contact: enewbe1@lsu.edu, (281) 627-4362

Name TBD

Founder: Thomas Hamilton, Entrepreneurship, LSU Class of 2013

Business: Fabrication and installation of granite countertops in both residential and commercial real estate

Contact: thami11@tigers.lsu.edu, (318) 450-8307

Name TBD

Founder: Gustavo Chacon Rojas, Electrical Engineering PhD, LSU Class of 2014

Business: Technological consulting, including development and implementation

Contact: gchaco1@lsu.edu, (504) 578-3412

Name TBD

Founders: Lauren Rodgers, General Business, LSU Class of 2014; Cameron Mcnab, General Business, LSU Class of 2015

Business: A restaurant offering a milk-free cuisine with a unique dine-in experience

Contact: lauashley7@yahoo.com; (337) 354-6703;

cmcnab4@tigers.lsu.edu (813) 833-9536

* 2014 Venture Challenge winner
** 2014 Audience Choice winner
*** Winner of both Venture Challenge and Audience Choice awards

Q & A with Andrew Maas

LSU's new Director of Intellectual Property, Commercialization & Development

Q: Why did you choose to come to LSU?

A: I chose to come to LSU because I believe that Baton Rouge and the Capital region are ready to see an increase in technology-based economic development. In order to fully realize the potential of a region, a high caliber flagship research institution is critical. Linking the two together, I saw great potential and something that I wanted to help incubate and develop over the next three to five years. LSU is in a great position to grow due to the new, energetic, and visionary leadership of President F. King Alexander and Vice Chancellor of Research & Economic Development Kalliat T. Valsaraj.

Q: What is your background?

A: I am an engineer by training with a BS and MS in Civil Engineering from Brigham Young University and the University of Texas at Austin, respectively. I am a licensed professional engineer in the state of Texas where I worked for several years, including growing a startup engineering company from two individuals to 14 employees in 18 months. I also have a JD from the University of Akron School of Law as well as a master's degree in law (LLM) with a focus on intellectual property. My LLM research was "early stage patent valuation under the new patent regime." I have been published in the *Journal of the Patent & Trademark Office Society*, as well as in *Cement and Concrete Research*.

Q: What are your goals for LSU and the Office of Intellectual Property, Commercialization & Development (OIPCD)?

A: Here at LSU, I want to make sure that faculty, staff, and students know that OIPCD is here to help in the development and securing of rights for commercially viable technologies and developments with an eye toward commercializing these technologies for the benefit of the region and the university community. Often offices like OIPCD are considered to be a support program for the "inventive" STEM colleges. I believe that is far from reality. What many people do not realize is that it is not just patented "gadgets" that can be protected and commercialized. Intellectual property includes more than just patents—it also includes copyrights, trademarks, trade secrets, and several other obscure types of protections. Things like teaching methods; new curriculum and instructional content; literary, dramatic, and musical materials; art; and more are all protectable forms of intellectual property.

With that being said, LSU has thousands of full-time faculty that are engaged in the process of creating and inventing things that can be protected through the OIPCD for the commercial benefit of LSU and the faculty, staff, and student inventors.

Q: What are your proudest professional moments thus far?

A: I am most excited about the programs and projects that I have spearheaded recently that resulted in technology commercialization efforts at the university level. Specifically, I was instrumental in the following projects:

- A 2010 Department of Commerce, Economic Development Administration, i6 Challenge awarded jointly to University of Akron Research Foundation and Austen BioInnovation Institute in Akron (ABIA). This was a $2.2 million grant over two years to identify and support the nation's best ideas for technology commercialization and entrepreneurship. UARF and ABIA aimed to increase innovation and minimize the time from idea to commercialization of new technology by bringing together world-class scientists, physicians, engineers, researchers, and entrepreneurs in the biomedical and polymer science industries in Ohio, specifically focusing on medical device technologies from the University of Akron and three surrounding hospital systems.
- In 2012, the University of Akron, Innovation Practice Center created a university-wide proof-of-concept center similar to the LSU LIFT2 fund program, which was funded with $2 million over four years. I led the strategic planning and budgetary allocations required by the provost and vice president of research, including facilitating collaboration between five colleges and 15 faculty—$420,000 of continuing faculty and $705,000 of startup funding.
- I developed the full proposal for the 2013 National Science Foundation I-Corps Sites Program, which awarded $300,000 to UA to help faculty move technologies through critical early stage market analysis to determine market potential and market fit.

Many of the things that I learned while working on these projects I hope to implement here to help LSU become a powerhouse for technology commercialization in the region, the state, and the nation.

Maas would love the opportunity to meet faculty, staff, students, and others in the university community who might be interested in technology commercialization. He can be reached at andrewm@lsu.edu or 225-615-8936.

Schrödinger's Killer App: Quantum Technology at LSU

By Jenny Linscott and Paige Brown

LSU is well-known for leading the field in a number of different areas, from environmental science, to engineering, to ecology, to materials science, to football. But LSU is a hotbed for another field that remains mysterious to most of us in our daily lives: quantum technology.

Imagine a computer that could solve a mathematical problem larger than the number of all the atoms in our universe, a sensor that could read pilots' minds to steer a plane, or a Doppler sensor sensitive enough to detect individual raindrops in a hurricane. What do all of these futuristic devices have in common? The answer is

quantum technology, a field of physics and engineering that applies some of the stranger features of quantum mechanics to computing, cryptography, and sensing.

The term "quantum technology" was coined by LSU physics professor Jonathan Dowling, author of a new book—*Schrödinger's Killer App*—that documents the ongoing race to build the world's first quantum computer. Dowling is co-chair of the Hearne Institute of Theoretical Physics at LSU, where his work lays the foundation for quantum computers that could one day vastly outperform our current classical hardware. The man who has the term "qbit" imprinted on the license plate of his car is also helping to coordinate the work of a growing team of quantum technology researchers at LSU.

"We are becoming well known at LSU as a hotbed of quantum technologies," Dowling said. "And we are gaining a critical mass of quantum researchers to be able to tackle applications of quantum sensing and quantum computing."

Theoretically, quantum technology exploits quantum mechanics, or the rules that govern matter and energy at scales smaller than the atom. As scientists who study the physics of atoms and subatomic particles such as photons and electrons know, small particles behave in weird ways not observed at scales that the human eye can see.

"Any time you start talking about quantum mechanics, it's totally different from any other field of physics," said Joel Tohline, former director of the LSU Center for Computation & Technology (CCT).

Because subatomic particles such as photons can behave as both discrete particles and as continuous waves at the same time, they can interact in ways that allow them to store information in an almost infinite number of possible states. The weird wave-particle duality allows for more complex storage of information in quantum bits, or "qbits," than in classical computer information bits. While traditional computing bits are either "on" or "off," in one of two states, two photons can be engaged in a relationship known as quantum entanglement that allows them to encode many different possible states. Because of this greater potential for information storage, quantum computers could theoretically solve complex mathematical equations at a blistering speed.

"There are certain problems that are so complex, the computer resources needed would exceed the number of atoms in the whole universe," said Tohline. "But quantum computing brings in another element that does away with traditional limits. We are just beginning to build tiny versions of such quantum computers. It's technically very challenging, but the CCT is getting ready for the computer technologies of the future."

The race to the quantum computer is just one way that research in theoretical physics is shaping both technology and our understanding of the universe. LSU's tradition in this research is a strong one, beginning in the 1970s with groundbreaking work on the quantum properties of light.

Today, the tradition continues with the world-class Hearne Institute, created with an endowment from LSU alumnus Horace J. Hearne in 1994, and the CCT, which is working on building and supporting research groups in materials science and quantum physics at LSU. The co-directors of the Hearne Institute, Dowling and fellow LSU physics professor Jorge Pullin, are behind the Institute's two foci: quantum computing and quantum gravity. Mark Wilde, a new assistant professor with a joint appointment in the Department of Physics & Astronomy and the CCT, is also collaborating with Dowling to apply quantum technologies to computer science.

Quantum Computing

As Tohline explains, the CCT is looking to researchers like Dowling to help computer scientists prepare for the future of computer technologies. The CCT is always planning for the next revolution in supercomputing.

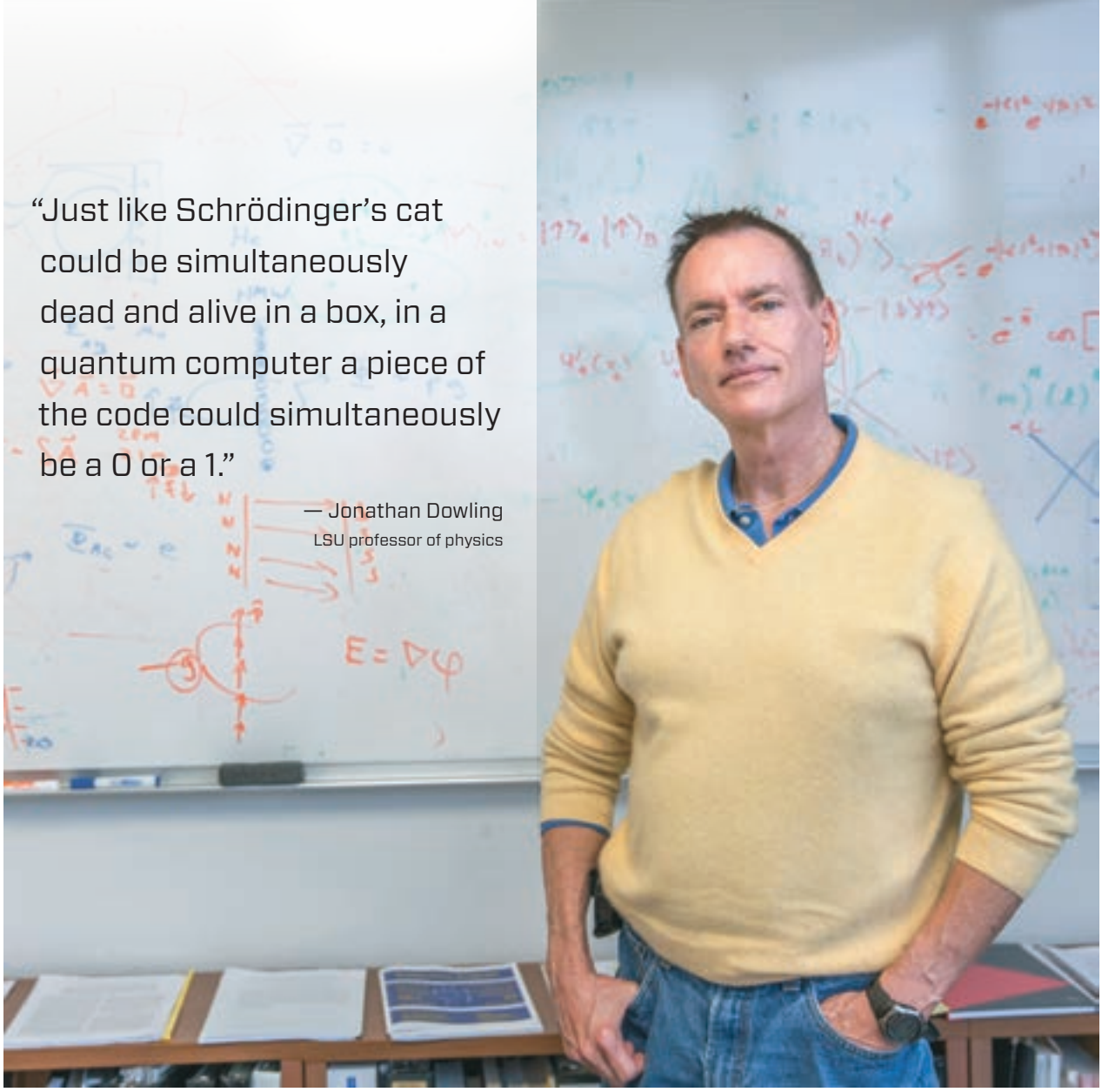
"Another 40 years down the road, quantum computing will be coming," Tohline said. "We are planning for that, and it's fun to be on the frontiers of this technology."

The promise of quantum technologies, Dowling explained, is a knack for long division. For example, Internet encryption today relies on the difficulty of long division to protect data like credit card numbers and bank transactions.

"Up until 1994, people thought long division, or factoring, was a hard problem on any computer," Dowling said. "This kept data safe because the codes use numbers so huge it would take longer than the lifetime of the universe to divide them out and crack the code. But in 1994, Peter Shore at Bell Labs built a mathematical proof to show that if you had a quantum computer, running on quantum physics, it could actually divide out long numbers very quickly. What would take your laptop longer than the life of the universe to divide out would take a quantum computer a fraction of a second."

At that rate, a quantum computer could make fast work of search functions, data analysis, and improved codes for encrypting Internet data, for example. But that kind of power is only possible if computers can think differently than they think today.

Classical computers operate on the principles of classical mechanics, the linear set of rules of Newton and Galileo. But when looking at the universe on the smallest scale, the rules of classical physics no longer



apply. This is the bewildering world of quantum theory, where light can be simultaneously both a wave and a particle, and an electron can simultaneously inhabit all its possible positions. There, in a famous thought experiment, Schroedinger’s cat can be simultaneously dead and alive. It is these simultaneous “superpositions” that are key to the future of computing.

“In a quantum computer, we replace bits with quantum bits, or qbits,” Dowling said. “In the quantum computer, the quantum bit could be a 0 and a 1 simultaneously. Just like Schroedinger’s cat could be simultaneously dead and alive in a box, in a quantum computer a piece of the code could simultaneously be a 0 or a 1.”

Qbits would yield an exponential increase in processing power and an exponential speed up in problem solving. Imagine, for example, a classical computer and a quantum computer faced with the same long division problem. The classical computer sits in one universe deliberately trying out every possible answer, one by one, while the quantum computer rushes out into parallel universes, trying out every possible answer at the exact same time. When it finds the right answer, it rushes back—and the parallel universes with their wrong answers instantly vanish.

Quantum computers could also be tweaked to do things other than compute. For example, the hardware can work as a magnetic field, radar, or light sensors that are much more sensitive than classic hardware. Imagine a quantum MRI machine inside of his helmet that could scan a football player’s skull for injuries, instead of requiring magnets the size of an entire hospital room. Sensors traditionally have a signal-to-noise ratio—or the extent to which they can measure a signal above background noise—limited by the laws of physics. But qbits could raise the “ceiling” of signal-to-noise capability by operating at the subatomic level. It’s all about the quirky nature of quantum particles existing in multiple states simultaneously.

For quantum computers and sensors to move from mathematical proof to reality, however, qbits need to maintain their superpositions for long periods of time without collapsing into one state or the other. Because the culprit of collapse is usually heat from the environment, engineers will need to create highly advanced cooling systems and quantum error correction techniques that can replace the qbits that mistakenly collapse.

Wilde, collaborating with both Dowling and computer scientists at the CCT, has been working on devising a new quantum theory of information that could help make quantum computers a reality. Wilde currently teaches a course on quantum communications in the physics department at LSU.

"A lot of what I do is try to find out what are the fundamental limits of communication," Wilde said. "There has recently been a revolution in revising the laws of information and communication with quantum theories."

Wilde explained that while people currently use fiber optic cables that transmit photons for their Internet communication devices, current schemes of information storage and transmission don't incorporate the laws of quantum mechanics that govern the photons themselves. As photons increasingly become a promising source of quantum information storage, Wilde is working on creating algorithms that would protect this quantum information and correct for errors as photons are shuttled around inside of a computer.

"In a hundred years, it's very clear that we will have a quantum computer," Dowling said. "When it comes online is very hard to predict. It will be trial and error over a long period of time."

Quantum Gravity

Pullin, Hearne Institute co-chair, turns the insights of quantum theory onto another realm altogether: gravity. It's a meeting of two radically different theories.

"Quantum is the theory of small stuff," Pullin explained. "Gravity, on the other hand, is the theory of big stuff—stars, planets, the earth. These theories have developed separately, and we don't understand how they fit together."

Quantum gravity attempts to reconcile these two theoretical regimes, to understand how they fit together.

"That could help us understand what happened very close to the beginning of the universe," Pullin said. "Our universe expanded from a very small state, and therefore we need quantum theory to describe it. But we're talking about the whole universe, so you need gravity as well."

Pullin's work could also help to explain the great cosmological enigma of black holes, those ominous regions of space that are dense, ominous deformations of space/time.

"We believe that inside black holes, matter is being compressed into a very small space," Pullin said. "You have a lot of matter there, so you need gravity, but it's a small space, so you need quantum."

The mathematical equations that we use to describe gravity today fail to describe black holes. There, the equations break down, producing a troublesome outcome called singularity—where the gravitational field seems to become infinitely strong and crushes matter to an infinite density. Quantum gravity, however, could describe the bizarre phenomena of black holes without resorting to the paradox of singularity.

Quantum gravity would also refashion the way researchers think of the texture of the universe. Modern descriptions come from Einstein and his vision of gravity as a deformation of space/time. Quantum gravity would actually quantize space/time, showing that it's made of elementary units just like matter is made of atoms.

"We're trying to build the equivalent of atoms for space/time," Pullin said.

Much like quantum computing, quantum gravity is still a theoretical horizon. But theory can yield very observable consequences. As Pullin explained, the history of physics is littered with examples of people discovering how two theories fit together and suddenly arriving at new predictions.

Pullin joined the LSU faculty as the first Hearne Institute Chair in 2001. Today, the quantum gravity research group is growing, drawn by LSU's history of quantum research and by experimental gravity projects nearby at the Laser Interferometer Gravitational-wave Observatory (LIGO) in Livingston, Louisiana, one of only two of the largest gravity wave detectors in the United States.

"Students are coming from all over the world to study quantum technologies at LSU," Dowling said. "All the pieces are here to punch through the glass ceiling of the classical laws of physics."

MEANS BIG POTENTIAL FOR LSU

Everything we do generates data these days. When you use a search engine like Google or Bing, you leave behind data. Your purchasing habits are recorded as data. Clinical studies run by universities and biomedical research institutions create masses of valuable data. Weather forecasts leave behind waves of data. Even your annual checkup at the doctor's office creates data.

What if all of this information from many multiple sources could be synthesized and analyzed for overarching themes, trends, or anomalies? What if, instead of looking at a sample group of 100 or even 1,000, you could gather data for tens of thousands—even millions? We've already developed vaccines, launched satellites, and created supercomputers. What could we do next if researchers had a better way to look at the massive amounts of data just lying around?

That's where "big data" comes in.

"Big data is an all-encompassing term that refers to the handling of vast amounts of data," explained LSU Associate Vice Chancellor of Research & Economic Development K. Gus Kousoulas. "It allows for storage and mining of data that enables more informed strategic decision-making at the highest levels."

That's why the movement is so popular. There are big data consortiums, big data conferences, and a rash of big data grants. The term is peppered throughout speeches and applied liberally to proposals, presentations, and meetings. But, despite its popularity, there are many of us who feel a little left in the dark when it comes to big data applications, both current and projected.

LSU's Big Data Foundation

Big things are happening in big data at LSU. There's never been more excitement surrounding computer science and its applications in the capital city region and beyond. Last year saw the announcement of an innovative public/private partnership between IBM, LSU, and Louisiana Economic Development, which spurred enthusiasm in response to the creation of 1,342 new, permanent jobs in the region as well the opportunity IBM's support center symbolizes to Louisiana citizens. LSU designed a streamlined computer science degree program to prepare students for the new jobs the center will create, offering a fast-track to higher education—and a job—for Louisianans.

"LSU's Computer Science faculty have embarked on an unprecedented initiative to create a program that will serve as a major force in positioning Louisiana as one of the most tech-savvy states in the nation," said LSU College of Engineering Dean Richard Koubek. "We've not only produced a streamlined, three-year degree program, but introduced concentrations in cloud computing and data analytics, making LSU one of only a handful of universities offering these studies at the undergraduate level."

While all these advances are great accomplishments, the work isn't done, and things aren't slowing down at LSU. In February 2014, more than 70 representatives from IBM and LSU gathered in the new Digital Media Center—another example of a successful public/private investment focused on digital technology and supercomputing—for a summit on focal research areas and major developments that could spur future big data collaborations.

"Supercomputing and high-performance computing are key research areas at LSU," said Vice Chancellor of Research & Economic Development Kalliat T. Valsaraj. "Working with industry giants like IBM is the perfect complement to our faculty's basic and applied research. We're looking forward to expanding this collaboration to the benefit of our researchers, our students, and our state."

High-performance computing and big data capabilities also serve as the backbone of all of LSU's other research strengths. It is necessary to study coastal processes and develop better, more integrated methods of hurricane protection. It is a driving force behind the search to find safer, more efficient ways to extract energy from the Earth and the development of new alternatives to fossil fuels. And it is vital to identifying better methods to treat disease and illnesses and to determine patterns of healthcare outcomes in our citizenry.

"The capacity is here, and this movement is only going to gain momentum in the days and years to come," said LSU President and Chancellor F. King Alexander. "Just the very fact that so many of us from LSU and IBM came together to identify new ways to work together is proof that we are all committed to collaborations that will have real impact and provide real solutions for Louisiana."

LSU's Big Data Needs

One of the challenges Louisiana—and many other states face is that every important industry generates massive amounts of data that require extensive amounts of storage. Supercomputing and big data capacity is needed not only to support the growing needs of industry, but also to explore data-sharing in fields that could benefit from cross-referencing information. For example, LSU Health Sciences Centers in Shreveport and New Orleans generate large amounts of bioinformatics data, which is stored at their individual locations. Meanwhile, the LSU School of Veterinary Medicine and the Pennington Biomedical Research Center likewise produce enormous amounts of biomedical data. With the proper connections and support, researchers across LSU's campuses could combine their data and expertise using the Louisiana Optical Network Initiative (LONI), which is the fiber optics network connecting Louisiana research universities to one another, as well as to Internet2 and the National LambdaRail, to look at healthcare outcomes, for instance, in an entirely new way.

One such example is genome sequencing, which involves determining the exact sequence of an organism's DNA and has many applications in biological and medical research. However, it requires expansive amounts of data processing.

"The human genome contains three billion molecular units. Assembling and analyzing this amount of data, or even assembling and analyzing many much shorter genome sequences like those of the West Nile or AIDS viruses or pathogenic bacteria that cause acute human disease, will require massive computational power and data storage capabilities, such as those produced through big data networks," Kousoulas said.

Researchers at LSU are already investigating a cyberinfrastructure to satisfy these big data demands through a $1 million grant from the National Science Foundation. Seung-Jong Park, associate professor of computer science with a joint appointment in the Center for Computation & Technology (CCT), along with co-investigators Joel Tohline, Sean Robbins, Lonnie Leger, Gus Kousoulas, and other senior LSU faculty are involved in a campus-wide project aimed at bringing big data computational capabilities to various university research groups.

"Processing terabytes of data, such as a metagenome data set, has been a headache for researchers using their own equipment. But that kind of problem can be solved with our technology based on Hadoop and cyberinfrastructure that includes a 10Gbps high-speed network and solid-state drive storages," Park said. "We can help researchers transfer their data to, and analyze that data on, bigger machines, not just one or two computers."

While Park's group focuses on the logistics and technical sides of such connectivity, work in specific fields—such as biomedical, environmental and coastal sciences, materials and manufacturing, physics and astronomy—is already making use of existing capacity.

Coastal Issues

A state like Louisiana faces many unique geographical challenges, such as threats from hurricanes and coastal erosion. As a hurricane forms and begins moving toward land, emergency officials in coastal states tap into groups like those at LSU for the most up-to-date modeling, tracking, and monitoring systems available so that they can have the best data to inform their decisions. LSU has significant expertise in these areas—expertise necessary to allow government emergency preparedness officials to make the right call as early as possible for public safety.

One example of the impact big data can have on public safety is the Coastal Emergency Risks Assessment (CERA) interactive website, a collaboration between the supercomputing power of LSU's CCT, LSU's School of the Coast & Environment, and the Louisiana Sea Grant.

"CERA makes use of the ADCIRC Coastal Circulation and Storm Surge Model, which takes an incredible amount of supercomputing power to generate real-time hurricane models," said Robert Twilley, director of Louisiana Sea Grant and CERA project manager. "During the last hurricane to make landfall in Louisiana, Hurricane Isaac in 2012, our projections were the only ones that identified its specific path accurately."

The ADCIRC model used by the CERA project is impressive because of its speed and detail. When Hurricane Katrina made landfall in 2005, computer models used about 300,000 nodes—locations where the computer makes calculations to determine how water levels will change during a storm—and took four hours to run.

More nodes result in more detail. For example, a typical grid used for modeling employs a million nodes. During Hurricane Isaac, 1.1 million nodes were used on three different storm tracks, and the simulations were completed in two hours using a suite of high-performance computers.

"State emergency officials start the decision-making process five days before landfall and need constantly updated models throughout a weather event," said Twilley. "Our software was built to configure big data and turn it into a useable framework for quick evaluation by these officials, who literally are responsible for people's lives during a hurricane."

Since Katrina, Louisiana has had four hurricanes make landfall, and the system has seen some failures and some successes.

"That's what we built this system for," said Carola Kaiser, an IT consultant at LSU who built and now operates CERA. "We knew it would be a trial-and-error approach, but in the end, there's no way to get accurate models to provide data driving the most informed decision possible without supercomputers and big data."

The Future of Medicine

LSU has extensive biomedical expertise. One of its most unique assets is its connection with the Mary Bird Perkins Cancer Center (MBPCC). In 1980, this partnership resulted in the development of LSU's medical physics program, the only program of its kind in Louisiana and one of only 40 in the nation accredited by the Commission on Accreditation of Medical Physics Educational Programs, Inc. The program leverages Mary Bird Perkins' clinical team and facilities, treatment planning, and dosimetry laboratories with LSU's expertise in imaging and medical physics within the College of Science.

We can help researchers transfer to, and analyze their data on, bigger machines, not just one or two computers.

— Seung-Jong Park
LSU professor of computer science

LSU's Supermike II is a world-class supercomputer with 146 teraflops of computing power.

One of the (albeit many) challenges facing those tasked with developing treatment regimens for cancer patients is that, technically, cancer isn't a single disease. It's hundreds, joined together by one common reality—uncontrollable cell growth.

"Traditionally, cancer treatment options are based off of large-scale clinical trials," said Wayne Newhauser, LSU's Dr. Charles M. Smith Professor of Medical Physics and Chief of Physics at MBPCC. "So basically, you're basing treatment on averages. Modern medicine is moving more toward personalized medicine, which requires big data in order to process and analyze your DNA and genetics."

In other words, big data can provide individuals with the lowest-risk, highest-return type of treatment available based on a person's specific genetic makeup.

"With the right kind of capabilities, we will be able to use imaging studies to build a genomic profile at even a basic physician's appointment," said Newhauser. "Some of the world's leading institutions already have this capability. We're only a few years away from it ourselves."

Using information to diagnose and develop treatment options is known as bioinformatics, and it's an up-and-coming field of study that stands to revolutionize the way we look at healthcare options.

"We're not there yet in terms of applying all this information to the average cancer patient," said Newhauser. "But we have the clues, and we know the pathways. This partnership between LSU and Mary Bird Perkins Cancer Center links Louisiana citizens with world-class treatment, university supercomputing and biomedical expertise, and clinical trials to bring us one step closer to the holy grail of treatment."

In the Sky

One relatively unexpected way that big data is making an impact is in the field of astrophysics.

LSU is involved in the Laser Interferometer Gravitational-wave Observatory (LIGO) project, and in fact one of only two such observatories in North America is located in Livingston, Louisiana, only 30 miles away from campus. This group has been attempting to record the existence of gravitational waves for years.

The Center for Computation & Technology (CCT) sponsors RedStick FutureFest each year, providing a showcase for new computing talent, cutting-edge digital research and culture, and a wide range of media projects.

"According to general relativity, gravitational waves are ripples in space-time that are produced when massive astronomical objects suffer violent processes, like black hole collisions," said Gabriela Gonzalez, LSU professor of physics and astronomy and LIGO Scientific Collaboration spokesperson. "These ripples travel almost unperturbed through the universe, and when they pass through interferometers, they affect the fringes in them. Being able to view the universe through these ripples of space-time will open a complete new window to the universe."

The entire LIGO system recently underwent upgrades to enhance sensitivity of measurement devices and won't be brought back online until 2015. But it is expected that, when it is up and running again, the acute nature of its new mechanisms will record many astrophysical occurrences—far too small to detect using traditional tools—hiding in large amounts of data.

"The expectations are that Advanced LIGO will result in terabytes of data, with only intermittent bits relevant to the rare events our astronomers hope to better understand," said Michael Cherry, LSU chair of the Department of Physics & Astronomy. "There's significant difficulty in extracting real science from extremely large data sets, and it requires true big data capabilities."

The New Worlds, New Horizons in Astronomy and Astrophysics Decadal Survey, which was commissioned by the National Research Council, identified the two highest-priority facilities in astrophysics as the Wide-field Infrared Survey Telescope (WFIRST) and the Large Synoptic Survey Telescope (LSST). These represent space and land missions, respectively, each of which will involve data sets on the petascale level.

"What this means is that astrophysicists can no longer be astronomers alone, but also have to be well-trained and exceptionally competent data scientists as well," Cherry explained. "So, big data isn't just a scientific tool … it's a workforce development tool as well."

While all these fields are still emerging and it's too early to tell what the future will truly hold for big data, the implications are clear, and LSU has built a strong foundation in the area—one that will certainly yield impressive results in due time.

IBM, LED, and LSU College of Engineering Partner to Transform Computer Science

The rapid and widespread adoption of mobile and social technologies within the last three years has changed the way customers and companies interact with one another—driving fundamental transformations in business processes and applications. Louisiana Economic Development plans to make a major investment in LSU's College of Engineering to rapidly grow the state's technology workforce needs and support the new IBM Services Center in Baton Rouge.

The center is the result of an innovative, public/private partnership that will include expanded higher-education programs related to computer science. The center will employ college graduates and experienced professionals with a broad range of backgrounds in computer science and other fields—such as engineering and mathematics—to provide software development and software maintenance services to clients in the United States. In addition to the 800 jobs that will be created at the center over the next four years, LSU estimates the project will result in approximately 542 new indirect jobs, for a total of approximately 1,342 new, permanent jobs in the capital region.

The state will provide $14 million in funding over 10 years for expanded higher-education programs designed primarily to increase the number of annual computer science graduates. At least 65 percent of these funds will be provided for expansion of the Division of Electrical and Computer Engineering of the School of Electrical Engineering & Computer Science at LSU.

To support this new endeavor, the LSU College of Engineering is committed to double its computer science faculty and triple the number of computer science graduates in five years, which will place the LSU Computer Science program in the top 10-15 nationally for the number of BS degrees in computer science awarded annually. The college will also expand its computer science programs and curriculum, and LSU students will benefit from internship opportunities and more jobs upon graduation, keeping the best and brightest in the state.

"This public/private partnership with Louisiana Economic Development (LED), IBM, and LSU is a powerful example of the triangulation between industry, government, and academia that elevates the state's role as a national leader in economic development," said Richard Koubek, dean of the LSU College of Engineering. "LSU's College of Engineering is committed to developing a mutually beneficial partnership with IBM and LED that stimulates economic growth and helps to meet the workforce development needs of the state."

To fast track program growth, the LSU College of Engineering will launch the "Geaux Digital Louisiana" consortium. This unique initiative represents a statewide partnership with high schools, community and technical colleges, and other universities to promote interest in computer science-related career fields and to enhance student recruitment.

Additionally, IBM will work closely with local professors at LSU to create course work focused on technology, math, and software development and equip students to meet the growing demand for business services including advanced analytics, process innovation, and application development.

New Mineral Discovered—Named After LSU Professor

A new species of tourmaline, discovered by geologists in the Czech Republic, has been named "darrellhenryite" in honor of LSU Campanile Charities Professor of Geology & Geophysics Darrell Henry for his significant contributions to the mineralogy and petrology of the tourmaline supergroup minerals.

This new mineral species was discovered by geologists from the Czech Republic in a quarry at Nová Ves near Český Krumlov, Czech Republic. The mineral was further characterized by crystallographers from the University of Vienna and California Institute of Technology.

To name a new species, the mineral has to be fully chemically and structurally characterized, and a new mineral proposal submitted to and accepted by a committee of the International Mineralogical Association.

Although darrellhenryite was originally found in the quarry in the Czech Republic, other examples are likely to be found. Already there are reports of a green, gemmy tourmaline from Maine that is possibly darrellhenryite.

This type of material has been deposited in the collections of the Department of Mineralogy and Petrography of the Moravian Museum, Brno, Czech Republic, and in the Smithsonian Institution, National Museum of Natural History, Washington, D.C.

Approximately 4,000 species of minerals have been named over the last 150 years. In most cases the species are named for the places where the species are discovered (e.g., elbaite after the island of Elba, Tuscany, Italy) or after some chemical characteristic (e.g., zincite after the high zinc content in the mineral). However, some species are named after geoscientists who have made significant contributions to the science of mineralogy and petrology, which is the case for darrellhenryite.

The published article describing the new mineral species states that "the name is for Darrell J. Henry, professor of geology at the Louisiana State University, Baton Rouge, USA, an expert on the mineralogy, petrology, crystal chemistry and nomenclature of tourmaline-supergroup minerals." This honor marks the first time that a mineral has been named after anyone from LSU.

A full desciption is found in:

Novák, M., Ertl, A., Povondra, P., Galiová, M.V., Rossman, G.R., Pristacz, H., Prem, M., Giester, G., Gadas, P., and Škoda, R. (2013). Darrellhenryite, Na(LiAl2) Al6(BO3)3Si6O18(OH)3O, a new mineral from the tourmaline supergroup. *American Mineralogist*, 98(10), 1886-1892.

Winona Ward Wins Prestigious Award

Winona Ward, Executive Director of the Office of Sponsored Programs, was recently honored by the Society of Research Administrators International for her work in forging international collaborations. Ward was recognized by the SRA with its Partnership Award for International or Inter-Collegiate Collaboration for her successful negotiation of the ROAd (Development of a Model Research Operation and Administration Program) program with the Petroleum Institute in Abu Dhabi, United Arab Emirates, as well as for her development and implementation of a master agreement with the Petroleum Institute. Being cited as a "model of accomplishment" by the awards committee, Ward has been working closely with the Petroleum Institute to help build their sponsored programs management infrastructure to facilitate additional collaborations with LSU.

LSU Professor Ward Plummer Named Member of American Academy of Arts and Sciences

The American Academy of Arts and Sciences recently announced the election of 204 new members, including LSU Professor of Physics and Astronomy Ward Plummer. He will be inducted at a ceremony on October 11 at the academy's headquarters in Cambridge, Massachusetts. The American Academy of Arts and Sciences was founded by Benjamin Franklin and is one of the oldest scientific societies.

"I am honored and humbled by my election to the American Academy of Arts and Sciences. This is a great day for me and for LSU," said Plummer.

Plummer, who is also special assistant to the vice chancellor of research and economic development and director of the Institute for Advance Materials is widely considered one of the world's leading physicists. A member of the National Academy of Sciences, which was founded by Abraham Lincoln, Plummer has served on many national and international committees, both to review existing scientific programs and to identify future directions for science and technology.

"LSU is proud to count Ward Plummer among its faculty," said Vice Chancellor of Research & Economic Development Kalliat T. Valsaraj. "He is truly one of the world's leading physicists, so his recognition by the academy comes as no surprise to us."

Plummer is the author of more than 380 refereed papers and is counted among the 1,000 Most Cited Physicists, a list compiled by the Institute for Scientific Information based on papers published between 1981 and 1997. He has advised or co-advised more than 50 graduate students, hosted more than 30 postdoctoral fellows, and assisted many young scientists in advancing their careers.

Plummer was a driving force behind the creation of a "dual degree" program in materials science between LSU and institutes and universities in China. In 2010, he was appointed to a visiting professorship for senior international scientists by the Chinese Academy of Sciences.

For more information about Plummer and his work, visit phys.lsu.edu/newwebsite/people/plummer.html.

LSU Research Recognized in *Discover Magazine's* Top 100 Stories of 2013

LSU faculty accomplishments get more impressive each year, with bigger grants, awards, and discoveries being announced all the time. Last year was no exception, proving to be a banner year for three LSU researchers whose work has been featured in *Discover Magazine's* Top 100 Stories of 2013.

"We selected the top 100 stories based in part on each item's impact and implications on its particular field," said Steve George, editor of *Discover*.

Brent Christner, associate professor of biological sciences; Thomas Kutter, professor of physics and astronomy; and Martin Tzanov, assistant professor of physics, conducted research recognized in the magazine's annual listings.

Christner's work on the exploration of lakes beneath Antarctica's ice sheet came in at number 12 on the list. His groundbreaking work in this arena has been attracting international attention for years, and this is his second time being featured in *Discover's* Top 100.

"Understanding how microorganisms live in subfreezing, hostile conditions like those found beneath deep ice in Antarctica offers new scientific insights that could aid in identifying environments for microscopic life on other planets," said Christner. "This type of research is ushering in a new era of polar science."

Kutter's and Tzanov's work with the Tokai to Kamioka, or T2K, international collaboration has also received global attention for several years. Coming in at number 66 on *Discover's* list, the magazine describes the team's discovery of new evidence of neutrino oscillations from one "flavor" to another as information that "may lead to insights about why there is more matter than anti-matter in the universe."

"Our team at LSU is proud to contribute to the T2K experiment. It is fantastic to see such strong evidence that muon neutrinos transform into electron neutrinos as they travel 295 km through the crust of the Earth. It's mind boggling in many ways," said Kutter. "Our results just cracked open a door to allow further exploration of nature, in particular, whether neutrinos and their anti-matter partners behave differently. Future work on neutrinos may reveal why our universe is made of matter rather than anti-matter. It is a crucial stepping stone toward resolving one of the biggest mysteries of our own universe and existence."

Going the Distance

To celebrate success and acknowledge exceptional achievements in research and scholarship, LSU's Office of Research & Economic Development, or ORED, presents two faculty members with the Distinguished Research Master Award each year. At the same time, the LSU Alumni Association and the LSU Graduate School recognize two graduate students for excellence in their academic efforts with the Distinguished Dissertation Award.

LSU recently named R. Kelley Pace and Susanne C. Brenner as Distinguished Research Masters. Michael Robinson and Caitlin Elizabeth King were also recognized as recipients of the annual Josephine A. Roberts Alumni Association Distinguished Dissertation Award in Arts, Humanities & Social Sciences, and the LSU Alumni Association Distinguished Dissertation Award in Science, Engineering & Technology, respectively. The annual recognition event, held at the Club at LSU Union Square, is sponsored by LSU's Office of Research & Economic Development (ORED) and the Graduate School.

LSU Distinguished Research Masters

The LSU Council on Research has proudly presented the Distinguished Research Master Awards since 1972 in recognition of outstanding faculty accomplishments in research and scholarship. The council chooses recipients from a list of worthy nominees proposed each December by the university community. Nominations are made in the categories of science, technology, engineering, and mathematics; and the arts, humanities, and social and behavioral sciences.

The Distinguished Research Master Award provides winners a salary stipend and the University Medal—the symbol of exceptional academic accomplishment at LSU.

Distinguished Research Master of Arts, Humanities, Social & Behavioral Sciences

R. Kelley Pace

Pace received his undergraduate degree from the College of Idaho and his doctorate from the University of Georgia. He has held the LREC Endowed Chair of Real Estate at LSU's E. J. Ourso College of Business since 1997.

He has authored many articles in real estate, geography, statistics, and economics journals. His book, *Introduction to Spatial Econometrics*, has garnered more than 1,200 citations since its publication in 2009 and was translated into Chinese by the University of Peking Press in 2013.

Distinguished Research Master of Science, Technology, Engineering & Mathematics

Susanne C. Brenner

Brenner was born in Pennsylvania and received her PhD in mathematics from the University of Michigan. She holds the Michael F. and Roberta Nesbit McDonald Professorship and has a joint appointment with the Department of Mathematics and Center for Computation & Technology, where she is also the Associate Director for Academic Affairs. She joined the LSU faculty in 2006.

Her research area includes numerical analysis and scientific computing, with special focus on novel discretization and fast solution techniques for partial differential equations. She has maintained National Science Foundation funding since 1989 and received several significant awards, including a Humboldt Research Award from the Alexander von Humboldt Foundation (2005-2008) and the 2011 AWM-SIAM Sonia Kovalevsky Lecture. She is a Society for Industrial and Applied Mathematics (SIAM) Fellow, Class of 2010, American Mathematical Society (AMS) Fellow, inaugural class 2012, and the American Association for the Advancement of Science (AAAS) Fellow, 2012.

At the recent Distinguished Dissertation awards presentation were, from left, Vice Chancellor of Research and Economic Development Kalliat T. Valsaraj, award recipients Michael Robinson and Caitlin King, Graduate School Dean Gary Byerly, LSU Alumni Association Acting CEO Cliff Vannoy, and Executive Vice Chancellor and Provost Stuart Bell.

Distinguished Dissertation Award Recipients

The LSU Alumni Association and the Graduate School sponsor the Distinguished Dissertation Awards—one for arts, humanities, and social sciences and one for science, engineering, and technology—which are presented annually since 1983. The awards, also representing two categories, are given to doctoral students whose research and writing demonstrate superior scholarship. Graduates at any of the three commencements in a calendar year are eligible for nomination. A committee of the graduate faculty selects the winning dissertations. Award recipients receive a monetary gift and a certificate of commendation.

Josephine A. Roberts Alumni Association Distinguished Dissertation Award in Arts, Humanities & Social Sciences

Michael Robinson was born in Durham, North Carolina, and received a Bachelor of Science in business from North Carolina State University and a Master of Arts in History prior to beginning his studies at LSU. Here, he was awarded the T. Harry Williams Fellowship and obtained numerous other fellowships and grants, allowing him to explore historical archives across the United States. His faculty advisor was Boyd Professor William Cooper. Since receiving his PhD from LSU in May 2013, Robinson has taken a position as an assistant professor at the University of Mobile.

Robinson's dissertation, "Fulcrum of the Union: The Border South and the Secession Crisis, 1859–1861," explores the "Border South" states leading up to the American Civil War. It was written in a style accessible to both academic and popular audiences and reveals a much more complex context of politics, economics, and societal structures that kept these states from secession. He used descriptive quantitative analyses to support his story, based on information collected through exhaustive research in collections from Missouri to Delaware. He recently received the Atherton Award for best dissertation in Missouri history. The dissertation is currently under review at the Johns Hopkins University Press.

LSU Alumni Association Distinguished Dissertation Award in Science, Engineering & Technology

Caitlin King was born in Baton Rouge to two LSU graduate students. She received her Bachelor of Science in microbiology prior to beginning her doctoral studies at LSU. During this time, she also married, had her first child, and served as the principal mentor for several undergraduate research students. She received her PhD in December 2013 and was advised by Professor Gary King.

King's dissertation, "Diversity and activity of aerobic thermophilic carbon monoxide-oxidizing bacteria on Kilauea volcano, Hawai'i," examines a group of microbes that were poorly understood before this work. While conducting fieldwork on the slopes of the Kilauea Volcano, she found unusual carbon monoxide oxidizers among other thermophilic microbes. Her studies cultured these organisms, allowing for experimental work to better characterize their ecology and for genetic work to find their place in evolution. As a result of this dissertation, three manuscripts have been published in high-impact journals, and four more are in submission.

Rainmakers

LSU's status as a top-tier research institution means that our faculty are leaders in their fields, performing at truly outstanding levels every day. Once a year, LSU's Office of Research & Economic Development, with the support of Campus Federal Credit Union, takes the opportunity to acknowledge some of our many outstanding faculty with the Rainmaker Awards for Research and Creative Activity.

Rainmakers are those faculty members who balance their many responsibilities, which extend far beyond the classroom, with external expectations, such as securing funding for their research and establishing the impact of their findings to the scholarly community and society as a whole. These exemplary representatives of LSU garner national and international recognition for innovative research and creative scholarship, compete for external funding at the highest levels, and attract and mentor exceptional graduate students.

"We are excited to acknowledge the incredible and impressive achievements of the 2013 Rainmakers," said LSU Vice Chancellor of Research & Economic Development Kalliat T. Valsaraj, who presented the awards in a ceremony held at the Club in Union Square. "These researchers and creative scholars represent our university's excellence and are standard-bearers within their own respective fields. We couldn't do this without the support of Campus Federal Credit Union, and we thank them for their support of our commitment to academic and research excellence."

Ron Moreau, chief development officer at Campus Federal, was also on hand to congratulate the recipients.

"We [Campus Federal] understand the important role research plays not only in LSU's long-term success, but also in the economic and social stability of Louisiana," said Moreau. "We appreciate the opportunity to support these innovative faculty members who represent not only academic accomplishments, but also support and mentorship for LSU students. Campus Federal was founded by seven distinguished LSU faculty members in 1934, so it is a fitting legacy for us to continue supporting distinguished faculty for their accomplishments in research today."

Each of the following award-winning faculty members has met one or more of the criteria for high-quality research or creative activities and scholarship, which include publication in high-impact journals; highly cited works; external awards; invited presentations at national and international meetings; high journal publication productivity; critically acclaimed book publications, performances, exhibits, or theatrical productions; high grant productivity; and, for more senior candidates, outstanding citation records and high-impact invited presentations at national and international meetings.

Emerging Scholar Award

Arts, Humanities, or Social or Behavioral Sciences

Michael Pasquier, associate professor of religious studies and history, is a native of Rayne, Louisiana, and a 2002 graduate of LSU. Before returning to LSU in 2008, Pasquier received his PhD in American Religious History from Florida State University in 2007 and served as a Visiting Scholar at the American Academy of Arts and Sciences in 2008-2009. He specializes in the history of religion, culture, and the environment in the United States. His first book, *Fathers on the Frontier: French Missionaries and the Roman Catholic Priesthood in the United States, 1789-1870* (Oxford University Press 2010), profiles the lives of French missionary priests in the early American republic.

He is the editor of the book *Gods of the Mississippi* (Indiana University Press 2013), which explores the history of religion in the Mississippi River Valley from the colonial period to the present. He also partnered with Zack Godshall, assistant professor of screenwriting at LSU, to produce the documentary *Water Like Stone* (2013), which is a film about the people who live in Louisiana's vanishing wetlands.

With support from the National Endowment for the Humanities, Pasquier is currently working on a book about the cultural impact of engineering the Mississippi River in the 20th and 21st centuries. With support from the National Endowment for the Arts and the LSU Coastal Sustainability Studio, Pasquier is in the final stages of developing an exhibit entitled "On Land / With Water: Tracking Change in a Coastal Community," which showcases the past, present, and future of life along Bayou Lafourche in ways that provide audiences with a deeper understanding of the social and environmental forces at play in Louisiana's ever-changing landscape.

Most recently, Pasquier has been asked by Routledge to write a textbook on the history of religion in the United States.

Brian Shaw is an LSU associate professor of trumpet and jazz studies and co-principal trumpet of the Dallas Wind Symphony. In addition to his work at LSU, he is active as an international performing and recording musician on modern and valveless trumpets. His diverse research interests include 18th century German and Austrian trumpet repertoire, modern trumpet pedagogy, and the music of jazz trumpeter and composer Kenny Wheeler.

Shaw has been a prizewinner in several international competitions and is the dedicatee of numerous new compositions. His upcoming CD recording, *redshift*, accompanied by the Dallas Wind Symphony, was made possible by an ATLAS grant from the Louisiana Board of Regents, and will be released in fall 2014 on Klavier records. His 2008 debut album, titled *Virtuoso Concertos for Clarino*, includes some of the most difficult pieces ever written for the Baroque trumpet and is accompanied by an orchestra composed of New York's finest period musicians.

As a jazz musician and scholar, Shaw directs the LSU Jazz Ensemble, which has hosted such luminaries as Wayne Bergeron, Wycliffe Gordon, and Rufus Reid during his leadership. His jazz books and transcriptions have been published by Advance Music, Presser, Schott, and Universal Edition. Over the past two years, Shaw has served as a consultant to the newly established Kenny Wheeler Archive and Exhibition at the Royal Academy of Music in

At the recent event honoring LSU Rainmakers were, front row left to right, Executive Vice Chancellor and Provost Stuart Bell, President and Chancellor F. King Alexander, Assistant Professor of Mathematics Hongchao Zhang, Professor of English Sharon Aronofsky Weltman, President and CEO of Campus Federal Credit Union Dawn Harris, Roy Paul Daniels Professor Michael Malisoff, and Vice Chancellor of Research and Economic Development Kalliat T. Vasaraj; and back row left to right, Associate Professor of Religious Studies Michael Pasquier, Associate Professor of Trumpet and Jazz Studies Brian Shaw, and Professor of Sociology Troy Blanchard.

London. Shaw also performs regularly on the popular LSU concert series "Hot Summer Nights and Cool Jazz" alongside pianist Willis Delony and bassist Bill Grimes.

Science, Technology, Engineering, or Mathematics

Hongchao Zhang is an assistant professor in the Department of Mathematics and the Center for Computation & Technology (CCT). Zhang earned his BS degree in computational mathematics from Shandong University, China, in 1998; his MS degree in applied mathematics from the Chinese Academy of Sciences in 2001; and his PhD in applied mathematics from the University of Florida in 2006. From September 2006 to July 2008, he was an industrial postdoctoral fellow at the Institute for Mathematics and Its Applications associated with the IBM T. J. Watson Research Center. Since August 2008, Zhang has been an assistant professor in LSU's Department of Mathematics and CCT. His research mainly focuses on nonlinear optimization theory, algorithms and their applications to sparse matrix computing, graph partitioning, inverse problems in medical imaging, and petrophysics and derivative-free optimization.

Mid-Career Scholar Award

Arts, Humanities, or Social or Behavioral Sciences

Troy Blanchard is a professor of sociology at LSU. He joined the department as an associate professor in 2007 after serving on the faculty at Mississippi State University from 2001 to 2007. His primary research interests include demography, health, socioeconomic inequality, and social impact assessment. His research agenda focuses on the interconnections between community organizations (such as local businesses, voluntary associations, and churches), social inequality, and demographic outcomes within U.S. communities.

His research projects are designed to speak to both academic and policy-related audiences and address key social problems facing communities. He has received competitive grants from a variety of federal agencies, including the National Science Foundation, U.S. Department of Agriculture, and the Bureau of Ocean Energy Management. Blanchard also directs the Louisiana Population Estimates Program that is tasked with developing parish and municipal population estimates. His research has been featured in national, statewide, and local media outlets (such as *Time* magazine, *USA Today* and the Baton Rouge *Advocate*) and he is a regular contributor to media coverage of social policy issues related to demography and social inequality.

Science, Technology, Engineering or Mathematics

Michael Malisoff received his PhD in 2000 from the Department of Mathematics at Rutgers University in New Brunswick, New Jersey. His doctoral research was in optimal control and Hamilton-Jacobi theory. He was a Defense Advanced Research Projects Agency (DARPA) Research Associate in the Department of Systems Science and Mathematics at Washington University in St. Louis as part of the Joint Forces Air Component Commander Project.

In 2001, he joined the LSU Department of Mathematics, where he is now the Roy Paul Daniels Professor #3 in the College of Science. His main research has been on controller design and analysis for nonlinear control systems with time delays and uncertainty and their applications in engineering.

One of his projects is with the Georgia Tech Savannah Robotics team. This joint project has as its goal to develop marine robotic methods to help understand the environmental impacts of hazards such as oil spills. His more than 80 publications include a monograph on constructive Lyapunov methods in the Springer Communications and Control Engineering Series. His other awards include the First Place Student Best Paper Award at the 1999 Instititute of Electrical and Electronic Engineers (IEEE) Conference on Decision and Control, two three-year National Science Foundation Mathematical Sciences Priority Area grants, and six Best Presentation awards in American Control Conference sessions. He is an associate editor for *SIAM Journal on Control and Optimization* and for *IEEE Transactions on Automatic Control*.

Senior Scholar Award

Arts, Humanities, or Social or Behavioral Sciences

Sharon Aronofsky Weltman is a professor of English at LSU. She is the author of two books, *Performing the Victorian: John Ruskin and Identity in Theater, Science and Education* (2007) and *Ruskin's Mythic Queen: Gender Subversion in Victorian Culture* (1999), named Outstanding Academic Book by *Choice* magazine. She also put together a scholarly edition of the original Sweeney Todd melodrama published in 2012 as a special issue of *Nineteenth-Century Theatre and Film*. She has, in addition, approximately 50 essays and reviews on Charles Dickens, Christina Rossetti, Charlotte Brontë, and other topics either in print or under contract. In July, she directed a National Endowment for Humanities Summer Seminar for College and University Teachers called "Performing Dickens: *Oliver Twist* and *Great Expectations* on Page, Stage, and Screen" at the University of California—Santa Cruz. Weltman serves on many international boards and committees, including the Modern Language Association program committee. She has presented more than 40 conference papers, including multiple keynotes. Universities regularly bring her in to speak, including (in the U.K.) Oxford, Lancaster, and Birmingham, and (in the U.S.) Berkeley, Notre Dame, and the University of Tennessee—Knoxville. Her current book project is *Victorians on Broadway: The Afterlife of Nineteenth-Century British Literature on the American Musical Stage*.

All Rainmaker recipients receive a one-time stipend of $1,000 and a plaque in recognition of their achievements.

For more information about the Rainmakers Awards, visit **www.lsu.edu/research**.

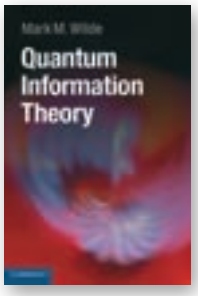
For more information about Campus Federal, visit **www.campusfederal.org**

Media Shelf

Garments of Paradise

Susan Elizabeth Ryan, Emogene Pliner Professor of Art

Wearable technology—whether a Walkman in the 1970s, an LED-illuminated gown in the 2000s, or Google Glass today—makes the wearer visible in a technologically literate environment. Twenty years ago, wearable technology reflected cultural preoccupations with cyborgs and augmented reality; today, it reflects our newer needs for mobility and connectedness. In this book, Susan Elizabeth Ryan examines wearable technology as an evolving set of ideas and their contexts, always with an eye on actual wearables—on clothing, dress, and the histories and social relations they represent. She proposes that wearable technologies comprise a pragmatics of enhanced communication in a social landscape. "Garments of paradise" is a reference to wearable technology's promise of physical and mental enhancements.



Quantum Information Theory

Mark Wilde, Associate Professor of Physics and Astronomy

Developing the subject "from the ground up," this text covers classical results as well as major advances of the past decade. Beginning with an extensive overview of classical information theory suitable for the nonexpert, the author then turns his attention to quantum mechanics for quantum information theory and the important protocols of teleportation, super-dense coding, and entanglement distribution. He develops all of the tools necessary for understanding important results in quantum information theory, including capacity theorems for classical, entanglement-assisted, private, and quantum communication. The book also covers important recent developments such as superadditivity of private, coherent, and Holevo information and the superactivation of quantum capacity.

The Offshore Drilling Industry and Rig Construction Market in the Gulf of Mexico

Mark Kaiser and Brian Snyder, LSU Center for Energy Studies

This comprehensive text examines the mobile offshore drilling units (MODUs) service and construction industry and the economic impacts of rig construction in the U.S. MODUs, which include jackups, semisubmersibles, and drillships, are supplied through newbuild construction and operate throughout the world in highly competitive regional markets. The book describes and categorizes the industrial organization and major players in the contract drilling and construction markets. It features an evaluation of day rates and tests hypotheses regarding day rate factors. Contractor decision-making models are developed, including a net-present value model of newbuilding investment, and market capitalization models are derived. The text also examines jackup construction shipyards and processes and provides estimates of labor, equipment, and material cost in U.S. construction.

Death of an Elephant

Brij Mohan, Professor Emeritus of Social Work

Death of an Elephant is an allegory of existence. Pran Dubey, a professor failed by avowed social institutions, is a conflicted man torn apart by his strife and Diaspora neurosis in the ambiguities of past and present, tradition and modernity, and life and death. Human incompleteness and life's absurdities—hope and despair trapped in the paradox of pain and pleasure—are dramatized through an Eastern soul with a Western mind and a pen dipped in the ink of reflective reality. *Death of an Elephant* is a harbinger of the neo-existential genre. Mohan plumbs the lives of his characters beyond the academic dimensions. They are human beings caught in the web of life who struggle to extricate themselves with honor from their problems.

Accalia and the Swamp Monster

Kelli Scott Kelley, Associate Professor of Painting

As the author and artist of a heroine's surreal journey through a haunting southern landscape, Kelli Scott Kelley reveals the mastery of her craft and the strong narrative ability of her artwork. Borrowing from Roman mythology, Jungian analysis, and the psychology of fairy tales, Kelley presents a story of family dysfunction, atonement, and transformation.

Reproductions of her artwork—mixed-media paintings executed on repurposed antique linens—punctuate the tale of Accalia, who is tasked with recovering the arms of her father from the belly of the swamp monster. Visually and metaphorically, Accalia's odyssey enchants and displaces as Kelley delicately balances the disquieting with the familiar.

Rich in symbolism and expertly composed, *Accalia and the Swamp Monster* pulls readers into the physical realm through Kelley's chimerical imagery and then pushes them towards the inner world of the subconscious. To that end, Kelley's story is accompanied by essays from Jungian analyst Constance Romero and art historian Sarah Bonner.

Handbook of Damage Mechanics: Nano to Macro Scale for Materials and Structures

Edited by George Z. Voyiadjis, Chair of Civil & Environmental Engineering

This authoritative reference provides comprehensive coverage of the topics of damage and healing mechanics. Computational modeling of constitutive equations are provided as well as solved examples in engineering applications. A wide range of materials that engineers may encounter are covered, including metals, composites, ceramics, polymers, biomaterials, and nanomaterials. The internationally recognized team of contributors employ a consistent and systematic approach, offering readers a user-friendly reference that is ideal for frequent consultation.

Handbook of Damage Mechanics: Nano to Macro Scale for Materials and Structures is ideal for graduate students and faculty, researchers, and professionals in the fields of mechanical engineering, civil engineering, aerospace engineering, materials science, and engineering mechanics.

Student Teaching: A Journey in Narratives

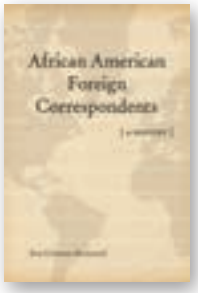
K.J. Fasching-Varner, H.B. Eisworth., T.H. Mencer, LSU School of Education, and D.R. Lindbom-Cho, M.C. Murray, and B.C. Morton, Editors (2013)

The journey of becoming a teacher is a complicated, emotional, and often intricate endeavor. Much has been written about pre-service teachers, but rarely do we understand the journey through their own voices. Join nine pre-service teachers as they share their experiences, challenges, and victories through a series of powerful narratives. Committed to making the process more transparent for those embarking on a similar journey, the chapter authors share honest, personal, and heartfelt viewpoints about what it means to become a teacher. The nine pre-service teachers in this volume all participated in yearlong student teaching in the renowned Elementary Holmes Master of Arts in Teaching program at Louisiana State University. Putting to practice critical perspectives about what it means to teach in the 21st century, these authors expose their vulnerabilities with a range of literary approaches including metaphor, reflective journaling, and storytelling. The volume is framed by teacher educator insights about the contexts and complexities of teaching. A must read for anyone preparing to student teach or for those already student teaching, *Student Teaching: A Journey in Narratives* deals directly with the realities of learning to teach.

Afro-Cuban Diasporas in the Atlantic World

Solimar Otero, Associate Professor of English

This text explores how Yoruba and Afro-Cuban communities moved across the Atlantic between the Americas and Africa in successive waves in the nineteenth century. In Havana, Yoruba slaves from Lagos banded together to buy their freedom and sail home to Nigeria. Once in Lagos, this Cuban repatriate community became known as the Aguda. This community built their own neighborhood that celebrated their Afrolatino heritage. For these Yoruba and Afro-Cuban diasporic populations, nostalgic constructions of family and community play the role of narrating and locating a longed-for home. By providing a link between the workings of nostalgia and the construction of home, this volume re-theorizes cultural imaginaries as a source for diasporic community reinvention. Through ethnographic fieldwork and research in folkloristics, Otero reveals that the Aguda identify strongly with their Afro-Cuban roots in contemporary times. Their fluid identity moves from Yoruba to Cuban, and back again, in a manner that illustrates the truly cyclical nature of transnational Atlantic community affiliation.



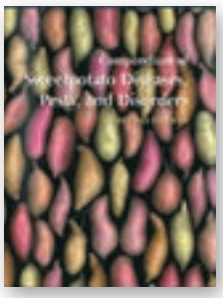
African American Foreign Correspondents: A History

Jinx Broussard, Professor of Public Relations

Though African Americans have served as foreign reporters for almost two centuries, their work remains virtually unstudied. *African American Foreign Correspondents: A History* traces the history of black participation in international newsgathering.

Beginning in the mid-1800s with Frederick Douglass and Mary Ann Shadd Cary—the first black woman to edit a North American newspaper—*African American Foreign Correspondents* provides insight into how and why African Americans reported the experiences of blacks worldwide. In many ways, black correspondents upheld a tradition of filing objective stories on world events, yet some African American journalists in the mainstream media, like their predecessors in the black press, had a different mission and perspective. They adhered primarily to a civil rights agenda, grounded in advocacy, protest, and pride. Accordingly, some of these correspondents—not all of them professional journalists—worked to spur social reform in the United States and force policy changes that would eliminate oppression globally.

By examining how and why blacks reported information and perspectives from abroad, African American Foreign Correspondents contributes to a broader conversation about navigating racial, societal, and global problems, many of which we continue to contend with today.



Compendium of Sweetpotato Diseases, Pests, and Disorders, 2nd Edition

Christopher A. Clark, Donald M. Ferrin, Tara P. Smith, and Gerald J. Holmes, LSU Plant Pathology

Compendium of Sweetpotato Diseases, Pests, and Disorders, Second Edition arrives as sweet potato production is increasing dramatically in the United States, expanding to states that have not traditionally produced the crop, and as sweet potato is being adopted as a critical source of vitamin A in many countries around the world. Nearly 50% longer than the previous edition, this is the most comprehensive book ever published describing the many diseases, insect pests, nutrient disorders, herbicide damage, and other disorders affecting the world's seventh most important food crop.

The second edition contains 325 color photographs (an increase of 243 compared with the previous edition) depicting the diagnostic symptoms of these diseases and disorders. These features make the book invaluable to growers, extension specialists, and diagnosticians in their efforts to accurately identify diseases and disorders they find on sweet potatoes and to develop strategies to manage these problems.

This book provides the most up-to-date and authoritative information available, prepared by leading experts in each discipline, on each disease. Each section has a comprehensive list of the critical research publications that will allow researchers to quickly dive into work on diseases that may be new to them.

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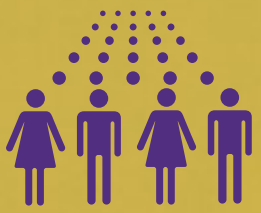

36,757 Jobs

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