from the President

The Morrill Act of 1862 made the establishment of land-grant institutions possible, introducing a vision of higher education focused on applying knowledge and research discoveries to advance the common good. Mindful of our heritage as the nation’s pioneer land-grant institution, we can look with pride across the host of outcomes from our Association of American Universities (AAU) scholarly enterprise in the first years of this century, celebrating the enduring value—and global significance—of our contributions.

MSU research transcends the boundaries of academic disciplines to address complex, worldwide problems such as climate change, biofuel production, and public health. Our faculty members are working to improve education itself by investigating how people learn and how best to teach mathematics, science, and writing. They are also creating, interpreting, and preserving the art, culture, and language that define and enrich human experience.

In this publication, we present a broad perspective of what our vibrant intellectual community is about at the beginning of the new millennium. We highlight several exemplary initiatives in research and creative activity undertaken by our outstanding faculty. This is coupled with an overview of MSU’s world-class infrastructure, including funding, equipment, and new construction—our investment in supporting the advances that MSU people make every day.

MSU continues to reinvent itself, responding to society’s needs, moving boldly—by design—to fulfill our land-grant mission in the 21st century. We look forward with confidence and heightened expectation.

Lou Anna K. Simon, President

from the Vice President for Research and Graduate Studies

As you will see in these pages, MSU faculty and students are continuously developing new knowledge and finding new avenues for creativity and artistic expression. We have achieved gratifying results in recent years, making scientific breakthroughs, producing high-technology patents, and publishing incisive studies that contribute to the betterment of society.

This progress was made possible by our approach to the challenges of the new century. We compete aggressively for the funding and recognition that will ensure the success of our endeavors. We make crucial connections between ideas and people, bridge language and cultural differences, and build on a wide variety of experiences and types of expertise. We collaborate with peers across the nation and around the world.

Ultimately, that’s the true foundation of our success: Michigan State University people are focused on making real-world progress every day—on stage, in the lab, in the library, and in the field. Whether you are looking for a research collaborator, a place to study, or access to new, market-ready technologies, I hope you find our highlights informative and welcoming.

Ian Gray, Vice President of Research and Graduate Studies
Facility for Rare Isotope Beams

The Facility for Rare Isotope Beams (FRIB) is a cutting-edge accelerator facility designed to produce the widest range of isotopes in the world, including thousands not yet observed on earth. Strategically important for the U.S., FRIB science is essential for maintaining world leadership in fundamental nuclear science research, for understanding how the earth’s elements were formed, and for understanding the life cycle of stars. In addition, FRIB science is critical for developing new applications of rare isotopes in the fields of homeland security, non-proliferation, stockpile stewardship, medicine, biology, materials, energy, and the environment.

FRIB will be a U.S. Department of Energy Office of Science (DOE-SC) national user facility, established and operated by MSU. The FRIB User Organization comprises more than 1,200 members from 108 U.S. institutions, including 92 colleges and universities and 10 National Laboratories in 35 states and from 47 countries. As a campus-based user facility, FRIB will attract and train the next generation of nuclear scientists needed to maintain the U.S. lead in science and technology.

MSU has the nation’s top-ranked nuclear physics graduate program, granting more than 10 percent of the nation’s nuclear physics PhDs. Locating the FRIB facility in this university environment will provide students with both hands-on training and interaction with world-leading scientists.

FRIB is designed to accommodate incremental upgrades efficiently and to be highly cost-effective. Established under a cooperative agreement between MSU and the DOE, the estimated total cost to DOE is $550 million with a $94.5 million cost share from MSU.
ABOVE: Lindsay Dubbs, superconducting radio frequency engineer at the Facility for Rare Isotope Beams (FRIB), processes and assembles accelerator components in a clean room at the National Superconducting Cyclotron Laboratory. Currently being designed and established at MSU, FRIB will be a national user facility for nuclear science funded by the U.S. Department of Energy Office of Science and MSU.

LEFT: Interior plan of the FRIB facility.

BELOW: The Facility for Rare Isotope Beams (FRIB) artist’s rendering, southwest view.
With more than 2,000 published patents worldwide and growing, MSU has a record of developing practical innovations that improve the quality of life around the world. MSU Technologies, the unit that licenses and commercializes the university’s intellectual property, maintains a database of technologies that are available for licensing. Here is a sampling of MSU intellectual property advances each year since 2000. MSU faculty are denoted in green throughout the publication.

2000
In 2000, the second edition of the Connected Mathematics Project was published by Pearson; it introduced a Spanish language version of the grades 6–8 curriculum. CMP-1 was developed in 1991 by MSU professors William Fitzgerald (now deceased), Glenda Lappan, and Elizabeth Phillips. Over its lifetime, the Connected Mathematics Project editors have grossed approximately $27M in royalties. CMP-3 is currently under development.

2001
U.S. PATENT #6,287,573
INVENTOR
Mendoza, Alberto L., HASLETT, MI

This patent, entitled: “Method and vaccine for treatment of Pythiosis insidiosi in humans and lower animals,” covers a vaccine comprising a mixture of extracellular and intracellular proteins that enables the cure of chronic pythiosis in some patients. Pythiosis is a form of infectious disease caused by Pythium insidiosum. It most commonly affects dogs and horses, but may also affect cats, cattle, and humans. This patent is currently licensed to Pythium Technologies, which is developing products for veterinary use.

2002
U.S. PATENT #6,472,169
INVENTORS
Frost, John W., OKEMOS, MI
Frost, Karen M., OKEMOS, MI
Knop, David R., OKEMOS, MI

This patent, “Biocatalytic synthesis of shikimic acid,” was licensed to Hoffman/LaRoche and to Draths Industries. It provides a precursor to Tamiflu®, a commercial medicine for flu treatment and flu prevention in adults and children.

2003
U.S. PATENT #6,638,510
INVENTORS
Brubaker, Robert R., VERMONTVILLE, MI
Motin, Vladimir L., EAST LANSING, MI
Smirnov, George B., MOSCOW, RUSSIA

This patent is entitled “Recombinant plasmid and a method of controlling the effects of Yersinia pestis.” Yersinia pestis is the bacterium that causes bubonic plague, one of the most devastating infectious disease known.
Chemistry Professor Marcos Dantus is perfecting a smart laser imaging technology at MSU.
2004  
U.S. PATENT #PP15,103 (PLANT PATENT)  
INVENTOR  
Hancock, James F., EAST LANSING, MI  
This patent is for the “Blueberry plant denominated ‘Draper,’” a productive, early-mid-season-ripening blueberry variety, intended for areas where northern highbush cultivars are grown successfully. It features high fresh-market quality and a long storage life. This variety, along with several others developed in Hancock’s laboratory, has produced in excess of $4M in royalties for MSU, under 14 licenses for various uses around the world.

2005  
U.S. PATENT #6,869,906  
INVENTORS  
Pinnavaia, Thomas J., EAST LANSING, MI  
Zhang, Wenzhong, BROKEN ARROW, OK  
Liu, Yu, EAST LANSING, MI  
“Ultrastable porous aluminosilicate structure” is licensed to InPore Technologies, Inc. (formerly Claytec, Inc.), a Michigan start-up company incorporated in 1996. “Catalytic cracking” is the central conversion process used in petroleum refineries. The cracking process requires catalysts that are stable in the presence of high-temperature steam. Ultraporous aluminosilicate compositions can offer “steam-stable” catalysis.

2006  
U.S. PATENT #7,147,810  
INVENTORS  
Reinhard, Donnie K., EAST LANSING, MI  
Asmussen, Jes, OKEMOS, MI  
Becker, Michael F., EAST LANSING, MI  
Grotjohn, Timothy A., OKEMOS, MI  
Schuelke, Thomas, BRIGHTON, MI  
Booth, Roger, TWIN LAKE, MI  
In 2003, MSU and Fraunhofer Gesellschaft formed a research partnership to establish the Fraunhofer Center for Coatings and Laser Applications, a Center of Excellence in coating and laser processing technologies. The partnership was based on complementary expertise in the areas of conventional coatings, carbon-based coatings, microwave plasma processing, and laser processing. The basic patent for plasma reactions was exclusively licensed to Lambda Technologies. “Drapable diamond thin films and method for the preparation thereof” provides intellectual property for additional applications.

2007  
U.S. PATENT #7,297,946  
INVENTORS  
Xi, Ning, OKEMOS, MI  
Li, Guangyong, EAST LANSING, MI  
Chen, Heping, EAST LANSING, MI  
“Automated nanoassembly” includes a design model for the nanoscale structure, image data of a sample
surface upon which the nanoscale structure is to be manufactured, a movable member configured to perform a nanomanipulation operation on the sample surface, and a path-planning subsystem adapted to receive the design model and the image data.

2008
U.S. PATENT #7,468,150
INVENTORS
Alocilja, Evangelyn C., EAST LANSING, MI
Zhou, John C., NORTHVILLE, MI

"Synthesis of conducto-magnetic polymers as nano-transducers in biosensor design" is part of a large suite of biosensor technologies licensed to Michigan start-up company NanoRETE, which specializes in food safety and biodefense.

2009
U.S. PATENT #7,567,596
INVENTORS
Dantus, Marcos, OKEMOS, MI
Pastirk, Igor, LANSING, MI
Lozovoy, Vadim V., HOLT, MI
Comstock, Matthew, NEW YORK, NY

"Control system and apparatus for use with ultra-fast laser" unlocks the potential of femtosecond lasers by automatically optimizing laser pulse duration at the target. It is licensed to Biophotonic Solutions, Inc., a Michigan start-up company.

2010
U.S. PATENT #7,709,654
INVENTORS
Smith, III, Milton R., EAST LANSING, MI
Maleczka, Jr., Robert E., DEWITT, MI
Kallepalli, Venkata A., EAST LANSING, MI
Onyeozili, Edith, TALLAHASSEE, FL

"Process for producing oxazole, imidazole, pyrazole boryl compounds" is licensed to Boropharm, Inc., a Michigan start-up company. The compounds are intermediates to functionalized compounds, both natural and synthetic, which are cytotoxic, anticancer, and antiviral agents.

2011
U.S. PATENT #7,915,017
INVENTOR
Dale, Bruce, MASON, MI

This patent, "Process for the treatment of lignocellulosic biomass," is part of a large suite of technologies using ammonia to process cellulosic biomass for ethanol production and other applications in the biofuels industry.

2011
U.S. PATENT #7,934,368
INVENTORS
Müller, Norbert, HASLETT, MI
Iancu, Florin Valcriu, LANSING, MI
Akbari, Pezhman, INDIANAPOLIS, IN

"Ultra-micro gas turbine" includes a wave rotor and provides a new approach for increasing the efficiency of a micro-scale turbine engine apparatus. It improves efficiency, lowers internal flow velocity, uses shock-wave compression, and achieves reliability through redundancy while being extremely small in size.
The Great Lakes Bioenergy Research Center (GLBRC) was established by the Department of Energy in 2007 to focus the most advanced biotechnology-based resources on the biological challenges of biofuel production. Researchers cover a wide array of disciplines—e.g., plant science, chemical engineering, economics, modeling, and ecology—all working together on a very challenging problem: how to deploy new bioenergy technologies in the rural environment. Sustainable deployment of new bioenergy technologies—ranging from agricultural practices to end use—has emerged as a critical national issue.

MSU’s GLBRC members are exploring the advances and the challenges of biofuels, from designing energy crops that produce higher yields to processing techniques that unlock the plants’ stored energy and convert plant sugars into fuels, to creating sustainable landscapes.

Kenneth Keegstra, professor of Plant Biology, Biochemistry, and Molecular Biology, is a renowned plant biologist and an expert in plant cell wall biochemistry. He leads a focus on improving plant biomass.

Bruce Dale, professor of Chemical Engineering and Materials Science, focuses on improving biomass processing. An expert on making ethanol from cellulose, plant stalks, grass, corn cobs, and other woody plant parts, he has developed a patented process called ammonia fiber expansion (AFEX). AFEX makes the breakdown of cellulose more efficient and tackles one of the thornier problems of producing ethanol. Dale views his role as “providing technical reality” to take such technology from the lab to the marketplace.

Eric Hegg, associate professor of Biochemistry and Molecular Biology, is the co-leader of GLBRC’s efforts to improve biomass conversion to biofuels. His research interests include the biosynthesis and activation of small molecules including \( \text{O}_2 \) and \( \text{H}_2 \).

G. Philip Robertson, professor of Crop and Soil Sciences, leads the efforts of the center to create sustainable bioenergy practices. An ecosystem ecologist who focuses on the role that agriculture plays in greenhouse gas dynamics, Robertson enjoys international recognition for his work in this area.

The University of Wisconsin–Madison leads the center, with MSU as the major partner. Additional scientific partners are Department of Energy National Laboratories, other universities, and a biotechnology company.
The BEACON Center is an NSF Science and Technology Center founded with the mission of illuminating and harnessing the power of evolution in action to advance science and technology and benefit society. BEACON is short for the "Bio/computational Evolution in Action CONsortium." Research at BEACON focuses on biological evolution, digital evolution, and evolutionary applications in engineering, uniting biologists who study natural evolutionary processes with computer scientists and engineers who are harnessing these processes to solve real-world problems.

BEACON promotes the transfer of discoveries from biology into computer science and engineering design while using novel computational methods and systems to address complex biological questions that are difficult or impossible to study with natural organisms.

The center is directed by Erik D. Goodman, professor of Electrical and Computer Engineering, and involves more than 30 faculty researchers at MSU, most in the Colleges of Engineering and Natural Science.

The key insight underlying the center is that transformative discoveries in both computing and biology are possible through studying evolution as it happens, in both natural and digital domains. BEACON aims to understand evolution in this universal framework.

BEACON is headquartered at MSU and also includes the University of Texas at Austin, the University of Washington, North Carolina A&T State University, and the University of Idaho. For more information, visit http://beacon-center.org/.
SOAR is a reflecting telescope located in the mountains of Chile 300 miles north of Santiago that serves as MSU’s laboratory for studying the cosmos. It was designed to produce the sharpest images possible with any ground-based telescope. Astronomers at MSU can operate SOAR from the Remote Observing Room on the MSU campus in East Lansing. The consortium project, which includes MSU, the University of North Carolina at Chapel Hill, the country of Brazil, and the National Optical Astronomy Observatories, enables observers to use the Internet to send instructions to the telescope and have images sent back.

The telescope works by collecting and focusing light with three mirrors—the primary mirror is 13.5 feet in diameter. In addition to visible light, SOAR can be used to observe infrared radiation. Several specialized instruments are used to record and analyze incoming light, including MSU’s Spartan Infrared Camera, an innovative imager with an unprecedented number of detector pixels covering a large area of the sky at high angular resolution.
SOAR is used by many MSU astronomers for a wide variety of research projects, including a recent series of studies of the various steps in the life cycle of stars. Having guaranteed access to this world-class facility has enabled MSU’s Department of Physics and Astronomy to expand its astrophysics program to now include nine faculty members, eight research associates, 11 graduate students, and 50 undergraduate astrophysics majors.
Africa and China projects highlight MSU’s global research

Africa

1 Geologists re-date development of African rift
GEOLOGY. The Great Rift Valley of East Africa—a suggested birthplace of the human species—may have taken much longer to develop than previously believed. Study by an international team including an MSU geologist provides new evidence that the two rift segments developed at about the same time, nearly doubling the initiation age of the western branch and the timing of uplift in this region of East Africa.

2 Nubian bones reveal ancient culture
ANTHROPOLOGY. MSU’s Forensic Anthropology and Bioarchaeology Program faculty and students are studying African skeletons from the Middle Ages in an effort to gain cultural clues.

3 Researcher studies child-killing diseases in Africa
HEALTH. An MSU pediatrician leads a project based in Nigeria to help prevent bacterial infections such as pneumonia, sepsis, and meningitis.

4 MSU researchers help African farmers cope with climate change
AGRICULTURE, ENVIRONMENT. A team of MSU researchers is studying the links between climate change and coping strategies, which impact food production, food security, and farm family income.

5 20-year African carnivore research expands across ecosystem
ZOOLOGY. MSU faculty and students are studying the basic mechanisms by which African carnivores interact with their environments and each other in the Mara-Serengeti ecosystem.

6 Agricultural productivity to improve Mozambique’s food security, nutrition
AGRICULTURE. An MSU project aims to improve productivity and marketing of fresh produce in southern Mozambique and create a school-feeding pilot program. The long-term goal is to expand program nationwide, since increasing Mozambique’s agricultural productivity will create economic opportunities and enhance nutrition throughout the country.

7 Research analyzes seizure risk in HIV patients, explores drug interactions
HEALTH. An MSU researcher is working on uncovering the risks of treating seizures in HIV-positive patients, providing much-needed data on the possible interactions between antiepileptic drugs and antiretroviral medicines that potentially could make HIV drugs less effective or the disease itself drug-resistant.

8 Shrubby crops help fuel Africa’s green revolution
AGRICULTURE. Crop diversification with shrubby legumes mixed with soybean and peanuts could be the key to sustaining the green revolution in Africa, according to an MSU study.

MICHIGAN STATE UNIVERSITY RESEARCH & CREATIVE ACTIVITY
Researchers link cerebral malaria to epilepsy, behavior disorders

HEALTH. The most comprehensive study to date on cerebral malaria in African children found that almost a third of survivors developed epilepsy or other behavioral disorders. This solidifies the link between malaria and neuropsychiatric disorders that affect hundreds of thousands of children.

MSU researchers are studying two important drugs in the fight against these diseases: ivermectin, which prevents worms from secreting proteins that inhibit a host’s ability to kill the parasite; and flubendazole, a promising drug that is being reworked in cooperation with the Filariasis University Consortium.

Researchers discover how key drug kills parasites in tropical diseases

HEALTH. Elephantiasis (lymphatic filariasis) and river blindness (onchocerciasis)—known as filarial diseases, in which the body is infected with parasitic worms—afflict about 140 million people worldwide, doing much of their damage in equatorial Africa.

MSU researchers are studying two important drugs in the fight against these diseases: ivermectin, which prevents worms from secreting proteins that inhibit a host’s ability to kill the parasite; and flubendazole, a promising drug that is being reworked in cooperation with the Filariasis University Consortium.

Lack of awareness, shortage of antiepileptic drugs in Zambia affect treatment efforts

HEALTH. Despite international efforts to raise awareness about epilepsy in resource-poor nations, a study found nearly 50 percent of pharmacies in Zambia do not carry antiepileptic drugs, seriously hampering efforts to tackle one of the most cost-effective chronic conditions to treat.

MSU, African educators expand agricultural education

AGRICULTURE. The Bill and Melinda Gates Foundation funded AgShare Open Education Resources (OER), an 18-month pilot project for African educational institutions, to create a virtual hub of resources and curriculum for Master of Science degrees in agriculture. Areas of emphasis focused on livestock, crops, and agribusiness. An interdisciplinary
MSU research team worked with OER Africa, headquartered in Nairobi, Kenya, and other international experts to develop best practices for sharing information through open education resources—an educational learning trend in which materials reside in the public domain—http://www.oerafrica.org/agricultureoer/AgricultureOER/tabid/1466/Default.aspx—for users to freely share and re-purpose.

1. **MSU research team studies malaria in Malawi**

   **Health.** As part of a continued effort to eliminate the scourge of malaria in the southern African nation of Malawi, an MSU-led research team is creating new prevention and control strategies in the small, landlocked country.

2. **MSU researchers study climate change, food production in East Africa**

   **Climate Change, Food Production.** With assistance from an MSU supercomputer and the Michigan Agricultural Experiment Station, an MSU interdisciplinary team of researchers from the College of Communication Arts and Sciences and the Department of Geography are linking a customized regional climate model with crop and water models.

   The research, conducted in drought-ravaged East Africa, will enable agriculture specialists to determine the impact of climate change on different crop varieties. As a result, they will develop crop varieties that better withstand climate change. For the first time, crop breeders and agricultural specialists in East Africa will have regionally specific climate data to research and manage crops in an effort to improve food production.

3. **MSU helps document and preserve oral histories of African citizens**

   **Oral History.** With U.S. Department of Education funding, MSU has partnered with African scholars to collect and digitize life histories, folklore, and songs through the African Oral Narratives project in Ethiopia, Gambia, Ghana, Malawi, Nigeria, South Africa, and Tanzania. The project expects to collect material in as many as 16 African languages. Twenty collections of oral narratives will be provided free through MSU’s renowned digital library known as MATRIX: The Center for Humanities, Arts, Letters and Social Sciences Online.

4. **China needs more protection of farmer land rights**

   **Agriculture.** An MSU research team found that secure farm land rights are key to closing the income gap between Chinese cities and the countryside.
Scientists study employment, leadership in environmental behavior
ENVIRONMENT. In a study of environmental behavior in China, MSU scientists found that city size can be linked to pro-environmental behavior, such as recycling plastic bags and sorting trash. People who live in larger cities like Beijing, Shanghai, and Tianjin showed significantly more of this “green” behavior than people in smaller cities.

Conservation limits environmental loss from China’s quakes
ENVIRONMENT. Analysis of satellite imagery and field data by scientists at MSU and in China show the 2008 quake—and the resulting landslides—affected 10 percent of the forests covering the mountains that are home to endangered species, including giant pandas. The devastation was substantially lessened by environmental conservation programs for some of the country’s most fragile habitats, according to MSU researchers.

Childhood malnutrition could weaken brain function in elderly
HEALTH. Malnutrition early in life appears to diminish brain function in older adulthood, according to a study led by an MSU researcher that has implications for many poor, developing nations. The study of more than 15,000 elderly people in China suggests that fighting hunger throughout childhood not only saves lives and improves health but also may enhance cognitive well-being in late life.

Joint MSU-Chinese research shows most panda habitat is outside nature reserves
ENVIRONMENT, ZOOLOGY. Although much effort and many resources have been expended to protect the endangered giant panda, research by an international team of scientists shows that much suitable panda habitat is outside the nature reserves and areas where the panda is reported to live.

Worldwide

Trends in International Mathematics and Science Study (TIMSS)
EDUCATION. The National Science Foundation funds TIMSS, which involves MSU faculty and students with partners in the U.S. and abroad. The project, ongoing since 1995, monitors math and science progress of 4th- and 8th-graders. TIMSS data have been collected in 1995, 1999, 2003, and 2007. Starting with 16 countries, by 2011 more than 60 were participating.

Microfinance tied to economy, according to MSU-led study
ECONOMICS. A nation’s economy plays a surprisingly large role in the success
or failure of microfinance, the practice of making small loans to farmers or business owners too poor to provide collateral, according to a study led by an MSU economist.

**Trade-offs in agriculture: short- vs. long-term goals**

AGRICULTURE. MSU researchers have pioneered a method for bridging the gap between what researchers are interested in and what farmers want: Researchers want long-term trials; farmers want immediate results. Researchers at a large, centrally located “mother” site test new technologies using conventional experimental designs. Smaller “infant” trials, carried out at participating farms nearby, allow the farmers to select the specific new technologies they are interested in for a “relevancy test” of labor costs and other practical issues.

**Video game helps avoid land mines**

HEALTH. An MSU professor and his students have developed a new video game to help teach children and others in war-torn countries to avoid death and injury from unexploded land mines and other explosives. Known as UXOs, or unexploded ordnance, the mines kill or injure as many as 20,000 people per year around the world, according to UN Mine Action Service estimates.

**Increasing international availability of legumes**

AGRICULTURE. The Pulse Collaborative Research Support Program supports international research partnerships to increase the availability of beans, cowpeas, and related pulses around the world.

**MSU launches first anti-counterfeiting research program**

PHARMACEUTICALS, FOOD ADDITIVES, BIOSYSTEMS. MSU’s Anti-Counterfeiting and Product Protection Program, or A-CAPPP, provides lessons to industry and government to help reduce counterfeiting and its negative impacts. The goal is to serve as an international hub for the purpose. MSU has created an interdisciplinary initiative that relies on researchers from a host of areas (including criminal justice, food safety, international business, engineering, public health and communications) to address the challenges. The market effect of global counterfeiting, estimated at $600 billion, is equivalent to the market for illegal drugs.

**MSU leads international teacher prep study in mathematics**

EDUCATION. The Teacher Education and Development Study in Mathematics (TEDS-M) project is a study of preparation to teach mathematics at primary and lower secondary levels, gathering data on the routes, institutions, programs, practices, and outcomes of teacher education. MSU researchers lead the international assessment of learning outcomes.
Music professor Molly Fillmore performs at the Met

Molly Fillmore, associate professor of Voice in the MSU College of Music, completed a 2011 run as Mrs. Naidoo in the Metropolitan Opera production of Philip Glass’s *Satyagraha*, loosely based on the life of Mohandas Gandhi. The title of the opera refers to Gandhi’s concept of non-violent resistance to injustice. The text is sung in Sanskrit. The production was simulcast live as part of The Met: Live in HD series, available in more than 1,500 movie theaters in 54 countries. Additionally, it debuted on PBS as part of the Great Performances series.

Following an international career as a mezzo-soprano, Fillmore recently moved...
into the dramatic soprano repertoire and has been at the Metropolitan Opera for the past five seasons. Besides singing the role of Mrs. Naidoo, Fillmore was cast in the role of Helmwige in Die Walküre in the Met’s 2011 and 2012 seasons.

Fillmore has appeared as a soloist with the San Francisco Opera, Seattle Opera, Detroit Symphony Orchestra, Seattle Symphony, Cologne Opera, Washington National Opera, Spoleto Festival, and Utah Symphony. She also has performed as a soloist at Carnegie Hall, Avery Fisher Hall, and the Kennedy Center Concert Hall in Washington, D.C.
The considerable research strengths of MSU faculty members stand at the central core of the intellectual climate of the university. Faculty move their research and scholarship from the library, archive, lab, and stage into print, publishing in a wide range of fields with some of the nation’s leading academic presses. Their observations of the world also find their way into fiction and poetry. Included, here, are titles published in 2010, 2011, and 2012.

The titles represented visually are all Michigan State University Press publications. Founded in 1947 as the university’s scholarly publishing arm, MSU Press reflects the university’s mission to serve as a catalyst for positive intellectual, social, and technological change through the publication of research and intellectual inquiry that make significant contributions to scholarship in the arts, humanities, sciences, and social sciences. A member of The Association of American University Presses and The Society for Scholarly Publishing, the Press has published close to 1,000 titles to date, nearly 600 of which are still in print. Currently, 40-plus new books are released annually together with nine scholarly journals that span a variety of disciplines.

Faculty Books from the MSU Press

2012

Sabry G. Elias, Oregon State University; Lawrence O. Copeland, Crop & Soil Sciences; Miller B. McDonald, Horticulture & Crop Science, The Ohio State University; Riad Z. Baalbaki, California Department of Food & Agriculture. Seed Testing: Principles and Practices (avail. 6/12)

William A. Lovis, Anthropology; Alan F. Arbogast, Geography; G. William Monaghan, Indiana University. The Geoarchaeology of Lake Michigan Coastal Dunes (avail. 10/12)


Igor Vojnovic, Geography. Urban Sustainability: A Global Perspective (avail. 12/12)

2011

Norman A. Graham, James Madison College. In the Shadow of Russia: Reform in Kazakhstan and Uzbekistan

Anita Skeen, English. Never the Whole Story

Thomas Dietz, Sociology. Climate Change in the Great Lakes Region: Navigating an Uncertain Future

Linda Kalof, Sociology; Georgina M. Montgomery. Lyman Briggs College. Making Animal Meaning

Rubén O. Martinez, Julian Samora Research Institute. Latinos in the Midwest

2010


Ionel Ciugulea, ZOOLOGY; Richard E. Triemer, PLANT BIOLOGY. A Color Atlas of Photosynthetic Euglenoids

Hiram E. Fitzgerald, UNIVERSITY OUTREACH & ENGAGEMENT. Engaged Scholarship: Contemporary Landscapes, Future Directions, Volumes 1 and 2

Robert S. Glew, CENTER FOR ADVANCED STUDY OF INTERNATIONAL DEVELOPMENT. International and Language Education for a Global Future: Fifty Years of U.S. Title VI and Fulbright-Hays Programs

Rebecca, Grumet, James F. Hancock, HORTICULTURE; Karim M. Maredia, ENTOMOLOGY; Cholani Weebadde, HORTICULTURE. Environmental Safety of Genetically Engineered Crops

Michael Largey, COLLEGE OF MUSIC. Haitians in Michigan

Lawrence Robbins, ANTHROPOLOGY. Tsodilo Hills: Copper Bracelet of the Kalahara

Recent MSU Press Books by Non-MSU Authors

Jeff Alexander, Pandora’s Locks: The Opening of the Great Lakes–St. Lawrence Seaway (2011)

Craig Fox, Everyday Klansfolk: White Protestant Life and the KKK in 1920s Michigan (2011)

Kathryn Hankla, Fortune Teller Miracle Fish (2011)


Lawrence M. Glazer, Wounded Warrior: The Rise and Fall of Michigan Governor John Swainson (2010)

Richard Jarrette, Beso the Donkey (2010)


Recent Faculty Books Published Elsewhere

Paul R. Abramsom, POLITICAL SCIENCE. Politics in the Bible (Transaction Publishers; CQ Press)

Jonathan R. Althouse, BIOSYSTEMS & AGRICULTURAL ENGINEERING. Interpreting the National Electrical Code, 9th Ed. (Delmar Cengage Learning)
Zarena Aslami, ENGLISH. The Dream Life of Citizens: Late Victorian Novels and the Fantasy of the State (Fordham University Press)

Johannes Bauer, TELECOMMUNICATIONS, INFORMATION STUDIES & MEDIA. Innovation Policy and Governance in High-Tech Industries: The Complexity of Coordination (Springer)

Kristi L. Bowman, MICHIGAN STATE UNIVERSITY COLLEGE OF LAW. Educational Policy and the Law, 5th Ed. (Wadsworth Cengage Learning)


Samantha Caughlan, TEACHER EDUCATION; Nell K. Duke, TEACHER EDUCATION; Mary M. Juzwik, TEACHER EDUCATION. Reading and Writing Genre with Purpose in K–8 Classrooms (Heinemann)


Richard T. Cole, ADVERTISING, PUBLIC RELATIONS, RETAILING. The New Media Driver’s License Resource Guide: Using Social Media and Digital Marketing for Business (Racom Communications)

Lucinda D. Davenport, JOURNALISM; Robert LaRose, TELECOMMUNICATIONS, INFORMATION STUDIES & MEDIA. Media Now: Understanding Media, Culture, and Technology, 7th Ed. (Wadsworth Cengage Learning)

Lucinda D. Davenport, JOURNALISM. Reporting for the Media, 10th Edition (Oxford University Press)

Patrick F. Dillon, PHYSIOLOGY. Biophysics: A Physiological Approach (Cambridge University Press)

Megan Donahue, PHYSICS & ASTRONOMY; Mark M. Voit, PHYSICS & ASTRONOMY. The Essential Cosmic Perspective, 6th Edition (Addison-Wesley)

Susan Florio-Ruane, TEACHER EDUCATION. Standing for Literacy: Teaching in the Context of Change (Hampton Press)

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- Carole Ames, Education
- James Anthony, Epidemiology and Biostatistics
- Naomi Breslau, Epidemiology and Biostatistics
- Wanda Chenoweth, Food Science and Human Nutrition

- Mike Thomashow, Plant Research Lab
- Jim Tiedje, Crop and Soil Sciences; Microbiology and Molecular Genetics
- Richard Witter, Veterinary Pathology; Veterinary Medical Officer, USDA Avian Disease and Oncology Laboratory

- Dean Della Penna, Biochemistry and Molecular Biology
- Francesca Dwamena, Medicine
- Barbara Given, Nursing
- Jay Goodman, Pharmacology and Toxicology
- Bradley Greenberg, Communication and Telecommunication; Information Studies and Media

- Norbert Kaminski, Pharmacology and Toxicology
- Victoria Purcell-Gates, Education
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- Timothy Zacharewski, Biochemistry and Molecular Biology
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- Robin Buell, Agriculture, Food and Renewable Resources
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- Dean Della Penna, Biological Sciences
- Tom Dietz, Social, Economic, and Political Sciences
- Megan Donahue, Astronomy
- Diane Ebert-May, Biological Sciences
- Asgerally Fazleabas, Biological Sciences
- Shelagh Ferguson-Miller, Biological Sciences
- George Garrity, Microbiology and Molecular Genetics
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- Brage Golding, Physics
- William Hartman, Physics
- Sheng Yang He, Biological Sciences
- Richard Hill, Zoology
- Greg Howe, Biological Sciences
- Anil Jain, Information, Computing, and Communication
- Nan Johnson, Social, Economic, and Political Sciences
- Ken Keegstra, Biological Sciences
- Rob Last, Biological Sciences
- Jianguo “Jack” Liu, Biological Sciences
- Jon D. Miller, Education
- Katherine Osteryoung, Biological Sciences
- Don Penner, Biological Sciences
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- Joan Rose, Biological Sciences
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- Bradley Sherrill, Physics
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- Alvin Smucker, Agriculture, Food, and Renewable Resources
- Michael Thomashow, Agriculture, Food, and Renewable Resources
- Jim Tiedje, Agriculture, Food, and Renewable Resources
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The MacArthur Foundation’s Fellows Program awards unrestricted fellowships to talented individuals who have shown extraordinary originality and dedication in their creative pursuits and a marked capacity for self-direction. The MacArthur Fellows Program is intended to encourage people of outstanding talent to pursue their own creative, intellectual, and professional inclinations.

- Robert Root-Bernstein, Physiology
- Richard Lenski, Crop and Soil Sciences; Microbiology and Molecular Genetics; Zoology
MSU graduate program strength:
An essential contribution to research excellence

Many MSU graduate programs scored high marks in the National Research Council’s (NRC) most recent rankings of U.S. doctorate research programs, released in 2010. Karen Klomparens, dean of MSU’s Graduate School and associate provost for graduate education, observed that, “We know we compete with the best in the world in many areas of research and graduate education, and these data simply confirm that. But we are by nature a multidimensional institution, balancing student focus and public mission with research effort and faculty reputation. For a land-grant university in the 21st century, both are critical.”

NRC-evaluated MSU doctoral programs include:

- AGRICULTURAL ECONOMICS
- AMERICAN STUDIES
- ANIMAL SCIENCE
- ANTHROPOLOGY
- ASTROPHYSICS & ASTRONOMY
- BIOCHEMISTRY & MOLECULAR BIOLOGY
- BIOSYSTEMS ENGINEERING
- CELL & MOLECULAR BIOLOGY
- CHEMICAL ENGINEERING
- CHEMISTRY
- CIVIL & ENVIRONMENTAL ENGINEERING
- COMMUNICATION
- COMMUNICATION ARTS & SCIENCES
- COMPUTER SCIENCE
- CRIMINAL JUSTICE
- CROP & SOIL SCIENCE
- ECOLOGY, EVOLUTIONARY BIOLOGY & BEHAVIOR
- ECONOMICS
- ELECTRICAL ENGINEERING
- ENGLISH
- ENTOMOLOGY
- ENVIRONMENTAL TOXICOLOGY
- FISHERIES & WILDLIFE
- FOOD SCIENCE
- FORESTRY
- GENETICS
- GEOGRAPHY
- GEOLOGICAL SCIENCES
- HISTORY
- HORTICULTURE
- HUMAN NUTRITION
- KINESIOLOGY
- LARGE ANIMAL CLINICAL SCIENCE
- LINGUISTICS
- MATERIALS SCIENCE & ENGINEERING
- MATHEMATICS
- MECHANICAL ENGINEERING
- MICROBIOLOGY & MOLECULAR GENETICS
- MUSIC EDUCATION
- NEUROSCIENCE
- PATHOBIOLOGY & DIAGNOSTIC INVESTIGATION
- PHARMACOLOGY & TOXICOLOGY
- PHILOSOPHY
- PHYSICS
- PHYSIOLOGY
- PLANT BIOLOGY
- PLANT BREEDING & GENETICS
- PLANT PATHOLOGY
- POLITICAL SCIENCE
- PSYCHOLOGY
- SOCIOLOGY
- SPANISH LANGUAGE & LITERATURE
- STATISTICS
- ZOOLOGY

Reponsible Conduct of Research

To prepare students and postdoctoral researchers to become globally engaged citizen-leaders, MSU promotes the ability to conduct quality research/scholarship as the foundation for strong professional performance by individuals, their departments, and graduate programs. To that end, professional development for students and postdoctoral trainees occurs under the guidance and leadership of individual faculty through partnerships intended to be mutually beneficial. These partnerships are based upon shared commitment to responsible research/scholarly practices derived from key principles of research integrity.
MSU is a member of the Association of American Universities (AAU), a group of only 61 U.S. and two Canadian universities widely regarded as among the top research-intensive institutions in North America.
Among multiple instruments, MSU’s Max T. Rogers Nuclear Magnetic Resonance Facility houses a 900MHz spectrometer. It is used for detailed structural studies of molecules ranging from small organic molecules to macromolecules, such as polymers, proteins, and nucleic acids. The facility has a cryoprobe for the highly sensitive measurement of samples in the solution state. The facility also houses equipment to perform measurements on materials in the solid state.

Nuclear Magnetic Resonance (NMR) spectroscopy is the preeminent technique for determining the structure of organic compounds. It is also an indispensible tool for the study of molecular dynamics, and for the characterization of materials at the molecular level by chemists, physicists, and molecular biologists.

Scientists use NMR to determine the three-dimensional structure of large, biologically important molecules, such as DNA, RNA, and proteins. Practical applications of NMR include applications in physics, chemistry, materials science, biology, and medicine.

The facility serves new users from both within and outside the university community.
Advanced research requires advanced facilities and equipment. At the Energy & Automotive Research Laboratories (EARL), the list of research equipment and facilities include dynamometer test cells, emission banks, high speed cameras, infrared cameras, a cold room, thermoelectric laboratory, optical engines, and laser diagnostics equipment. Some specific features include:

- **Optical Engines**, which are used in a wide range of power train studies. They include high-speed and thermal imaging of the combustion process, MTV flow field studies, oil film thickness studies, and LDV analysis. In the optical engine, the cylinder and/or the piston head are made of a translucent material or have a translucent insert.
- The **Single Cylinder Research Engine**, which is used in conjunction with the dynamometer. It is useful for a wide range of power train studies from power train efficiency studies to emissions analysis and component testing. Most recently, a single-cylinder research engine was designed and built for use in the research of a high-compression, direct-injection, spark-ignition, methanol-fueled engine with an integral injector ignition source insert.
- **High-Speed Imaging**, which was used recently with a firing optical engine to study different fuel injectors and the effect they had on the combustion process in diesel engines. The study used several different injectors and A/F ratios and observed the engine’s combustion progression and characteristics as well as the exhaust products.

EARL is led by Harold Schock, director, and professor of Mechanical Engineering. His research interests include thermo-dynamics, combustion, optical diagnostics, turbulence, and internal combustion engines.
Civil Infrastructure Lab

MSU’s Civil Infrastructure Laboratory is a facility dedicated to research on materials, transportation systems, and structures, all of which face the challenges of degradation from time, use, and the risk from unpredictable extreme events such as fires or earthquakes. All of these can jeopardize human life and cause great economic loss. The lab enables the civil engineering faculty to address these challenges with resources for micro-, meso-, and macro-scale testing under simulated loads (e.g., truck bridge traffic, maximum loads on building/bridge components, seismic loads, fire, freeze/thaw effects, etc.).

The large-scale structures and pavements testing area consists of a 30-foot-high bay area that encloses a reconfigurable 60 × 40-foot strong testing floor. Servo-controlled hydraulic actuators and high-speed data acquisition systems enable researchers to simulate the loads and deformations exerted to structures under extreme demands—such as earthquakes—and carefully measure their performance in a controlled environment.

A unique feature of the laboratory is the structural fire furnace, a 9 × 11 × 7-foot-high combustion chamber that enables the testing of structural components (columns, beams) and assemblies (frames, beam-slab units) under replicated hydrocarbon fires while simultaneously applying service loading. The laboratory is also linked to MSU’s computer services, and it features information technology tools for tele-presence and remote participation for geographically distributed research teams.

Led by Rigoberto Burgueño, associate professor of Structural Engineering and director, the Civil Infrastructure Laboratory works with federal and state agencies to understand the behavior (strength, deformation, and failure) of materials and structures under extreme demands and to develop new design methods and new materials that can lead to improved performance.
MSU Bioeconomy Institute

Repurposing a 138,000-square-foot building in Holland, Mich., donated to the university by Pfizer, the MSU Bioeconomy Institute complements and extends MSU campus research that supports biofuel, bio-based specialty chemicals, and biomaterial development. The institute provides chemical pilot plant scale-up production and conducts sponsored research and testing for both for-profit and not-for-profit entities of all sizes. It also offers business incubation opportunities and extensive laboratory space, as well as educational programming and training.

The institute has more than 28,000 liters of chemical reactor capacity, including centralized stainless steel, glass-lined, and Hastelloy™ vessels. It also features automatic controls, centrifuges, filters, and dryers, plus 31,000 square feet of modern laboratories, an auditorium, and more than 60 offices.

Structural Fire Testing Facility

MSU’s Center for Structural Fire Engineering and Diagnostics addresses fire issues related to the built environment (civil infrastructure) in the civil, mechanical, and transportation sectors. The center houses state-of-the-art equipment for undertaking fire experiments on materials and structural systems. This includes a natural gas–fueled structural fire testing furnace capable of reaching temperatures in excess of 2,200°F, the first of its kind in an American university.

The furnace can simulate the temperatures, heat transfer, and loads endured by structures in an actual fire. The material property instruments include: thermal property measurement gear; a cone calorimeter to measure flammability, mass loss, and gas emissions; a mechanical property measurement device for measuring stress-strain response of materials; and chemical composition measurement devices for undertaking material characterization at high temperatures.

Led by the Department of Civil and Environmental Engineering in collaboration with the Departments of Mechanical Engineering and Physics and Astronomy, the research conducted in the center advances fire safety science and produces innovative fire-resistant materials, high temperature sensors, and engineering design tools. It also offers opportunities to advanced degree holders to perform fire-resistant design and construction in multidisciplinary engineering applications.

Venkatesh Kodur, professor of Civil and Environmental Engineering and center director, is one of the world’s leading experts on the effects of fire on materials and structural systems.
Recent major research funding

- $600 million from Department of Energy for the Facility for Rare Isotope Beams (FRIB) to conduct experiments in nuclear science, astrophysics, and applications of isotopes to other fields.

- $142 million over five years from Department of Energy for the Great Lakes Bioenergy Research Center (GLBRC), including supplements and American Recovery and Reinvestment Act (ARRA) of 2009 funding. The GLBRC is a consortium led by University of Wisconsin–Madison that includes other universities and industry. MSU leads the sustainability thrust.

- $75.5 million from the National Institutes of Health to coordinate Michigan’s role in the National Children’s Study, the largest human health study ever undertaken in terms of sample size, duration, and depth.

- $25 million from the National Science Foundation for a science and technology Center for the Study of Evolution in Action (BEACON: Bio/computational Evolution in Action CONsortium). Four other universities from across the nation are partners.

- $16 million from the Superfund Basic Research Program, making a total of $52 million in funding over 20 years.

- $14.4 million grant from the U.S. Department of Agriculture's Specialty
Crop Research Initiative to lead scientists from 11 U.S. institutions and six international partners to **improve the quality of fruit** in the globally important Rosaceae family.

- $12.5 million from Department of Energy for an **Energy Frontier Research Center** to advance scientific understanding of thermoelectric energy conversion.

- $10.4 million from the Bill and Melinda Gates Foundation to create an **African Biosafety Network of Expertise** (ABNE) in partnership with NEPAD, the New Partnership for Africa’s Development.

- $10 million from Department of Homeland Security and Environmental Protection Agency for the **Center for Advancing Microbial Risk Assessment**.

- Nearly $7.45 million to MSU’s College of Nursing to **expand research facilities** and capacity in a new building.

- $6.8 million from the National Institute of Child Health and Human Development for the **Center for Women’s Health and Reproduction Research**.

- $6.2 million Morris K. Udall Center of Excellence grant from the National Institute for Neurological Disorders and Stroke to MSU and the University of Cincinnati for **Parkinson’s disease research**.

- $6 million grant from the **Coalition for Sustainable Egg Supply**, shared with University of California, Davis, to study the laying-hen housing and trade-offs among food safety, worker safety, environmental impact, hen welfare, and food affordability.

- $5 million U.S. Department of Agriculture National Institute of Food and Agriculture grant to **increase the efficiency and sustainability of milk production**.
College of Osteopathic Medicine’s Macomb Campus

The College of Osteopathic Medicine (COM) opened a new campus at the Macomb Community College University Center in Clinton Township in 2010. This expansion helped broaden its reach across the state, already established by another new campus at the Detroit Medical Center in downtown Detroit, which welcomed students in fall 2009.

The latest move places COM among a high concentration of osteopathic physicians and partner hospitals. Traditionally, osteopathic education seeks to prepare physicians who are especially concerned with maintaining continuing personal relationships with patients and their families, optimizing interaction with the community environmental patterns. This emphasis is reflected in the nature of the curriculum, and is particularly reinforced during clinical clerkship rotations through a variety of clinical disciplines in both hospital and non-hospital settings.

Mary Anne McPhail Equine Performance Center

Located in the MSU College of Veterinary Medicine, the center is dedicated to state-of-the-art equine sports and lameness research to benefit soundness and performance of equine athletes. The center integrates MSU’s clinical and research studies and is the Midwest’s leading veterinary diagnostic and treatment facility for performance horses. In addition to housing gait analysis equipment, it also has an indoor arena for lunging, riding, and driving, and firm surfaces for evaluating horses on a straight line.
Planned for a fall 2012 grand opening, the Eli and Edythe Broad Art Museum will publicly engage and be expressly dedicated to the exploration of contemporary culture and ideas through the probing gaze of artists. To that end, the Broad Art Museum will be a place where artists’ ideas, words, and actions can create a vibrant center for questioning and understanding the modern world. Committed to experimentation and study, the Broad will be a laboratory for the new, grounded in a deep appreciation for the past. With a historical collection containing objects from the Greek and Roman periods through the Renaissance and on to the Modern, the Broad seeks to frame the entire range of contemporary art practices within a firm historical context.
Plant and Soil Sciences Building Expansion

MSU’s new Molecular Plant Sciences Building, completed in spring 2012, connects the Plant Science and the Plant and Soil Sciences buildings. In this four-story, 90,000-square-foot building, basic research departments (Plant Biology and the Department of Energy-sponsored Plant Research Lab) come together with applied research departments (Crop and Soil Science, Horticulture, and Plant Pathology). The labs provide space for as many as 18 research groups, including nearly 150 graduate students, postdoctoral students, undergraduate students, and technicians. The lower level provides increased space for state-of-the-art growth chambers, allowing for year-round plant growing in clean environments.

The Molecular Plant Sciences Building evolved from the Plant Science Excellence initiative, a program that has solidified MSU’s status as one of the world’s top plant-research universities. The initiative has resulted in the recruiting of several dozen world-class plant scientists to MSU, including members of the National Academy of Science and a Howard Hughes Medical Institute and Gordon and Betty Moore Foundation Investigator, Sheng Yang He, named one of the nation’s most-innovative plant scientists.

The Bott Building for Nursing Education and Research

The Bott Building for Nursing Education and Research, slated for fall 2012 completion, will support the college’s growth as a national research leader and will help the state address its nursing shortage. Some key features include 60 modular pods/workstations for teams of students and staff assigned to funded nursing research, classrooms, atrium, student commons, student services, conference rooms, and a reception lobby. The three-story, 50,000-square-foot building will be LEED (Leadership in Energy and Environmental Design) certified, meaning it incorporates sustainable environmental design. It also will be the first on the MSU campus to use ground-source geothermal energy for heating and cooling. The college’s expansion effort also was boosted by a $7.45 million stimulus funding grant from the National Institutes of Health to support nursing research.
Secchia Center in Grand Rapids

MSU’s College of Human Medicine opened the Secchia Center in Grand Rapids in fall 2010, establishing the university’s presence in this progressive, high-quality medical community.

The $90 million, 180,000-square-foot Secchia Center serves as the college’s headquarters. Privately funded, the state-of-the-art medical education building includes clinical examination rooms, simulation suites, classrooms, offices, and student areas.

Nearly 300 medical students attend the Grand Rapids campus, including 200 preclinical students at the Secchia Center and another 100 clinical students at area hospitals.

The opening of the Secchia Center is only part of the college’s growing footprint in communities across the state—new community campuses have also opened in Traverse City and Midland, administrators are working in Flint to develop a public health research and education model built specifically around that region’s needs, and early admission programs have been signed with several colleges and universities across the state.

The college’s research profile has grown considerably over the past several years, including the recent designation of a $6.2 million Morris K. Udall Center of Excellence for Parkinson’s disease research, a $6.8 million Center for Women’s Health and Reproduction Research, and a $5.8 million award from the Bill & Melinda Gates foundation to study deadly bacterial diseases in African children.
Michigan State University’s Innovation Center combines the diverse resources needed for business outreach, technology commercialization, and new business formation under one roof. Through the MSU Innovation Center, entrepreneurs and established businesses of all sizes can:

- find what they need at MSU by working with Business-CONNECT, MSU’s portal for engagement with the business community;
- access patented technologies at MSU Technologies, the university’s technology transfer office; and
- engage in company creation and investment at Spartan Innovations, LLC, where sustainable MSU start-ups begin.

Visit http://innovation.msu.edu