MU Faculty Investigators Reach Another All-Time High in Research Funding

By Rob Hall, Interim Vice Chancellor for Research

Scientists and scholars at the University of Missouri received more than $149 million in external sponsorship during the previous fiscal year, the highest total in the University’s history. This robust level of funding affirms that MU’s faculty investigators continue to occupy a place among the nation’s leaders in research, scholarship and higher learning.

Much of MU’s external sponsorship, as in previous years, was generated through competitive grants awarded by federal agencies, most notably the National Science Foundation and the National Institutes of Health. Awards from NSF, for example, reached an all-time high of $21.3 million in FY 2007, a nine percent increase over the previous year’s total of $19.5 million.

Totals from the federal Department of Health and Human Services, the NIH’s parent agency, showed even more dramatic gains, jumping from an FY 2006 total of $56.5 million to more than $65.5 million in FY 2007. As we have pointed out in previous reports, an increased level of funding from these sources is significant in more than just dollar terms: Because competition for NSF and NIH funding is particularly keen, projects selected for support from these agencies tend to represent the very best of contemporary research.

Among the notable investigations that received NSF support in FY 2007 was that of biological sciences professor James Birchler, who was awarded a five-year, $1.9-million grant to create engineered “minichromosomes” in maize. Birchler’s work could lead to the development of crops that are resistant to various viruses, insects, fungi, bacteria and herbicides, and of proteins and metabolites used to treat human illnesses.

In addition, Matt Liu, professor of geophysics in the College of Arts and Sciences, received a $2.1-million grant from NSF to lead a multi-institutional study with Associate Professor Eric Sundlov and Assistant Professors Francisco (Paco) Gomez and Milene Cormier of MU’s Department of Geological Sciences. The researchers will work with a team of U.S. and Chinese researchers to explore the fundamental physics that control intraplate earthquakes. Their findings will not only help scientists better understand quakes in China, but will lead to advances in knowledge for U.S. seismology as well.

In September, meanwhile, the National Institutes of Health announced the creation of a $20 million, five-year program to fund a national team of scientists investigating issues related to “fertility preservation” for women. The project’s aim is to provide conception options to women whose reproductive health may have been compromised by cancer treatments. Led by Teresa Woodruff, a professor of obstetrics and gynecology at Northwestern University, it includes more than 15 different institutions across the country. At MU, John Critser will receive approximately $1.25 million over five years to study cryopreservation methods of human eggs. “The long-term goal is to allow people to have children who otherwise might not be able to do so,” says Critser, the Gilbreath McLorn Professor of Comparative Medicine.

Such projects, as well as hundreds of additional ongoing University investigations, are making significant contributions to the advancement of science and higher learning at MU. They are also boosting Missouri’s economic development. The previous fiscal year, for instance, saw the University’s entire research enterprise generate more than $248 million in annual research and development spending, expenditures that supported some $450 million in economic activity and 9,000 jobs.

Before he left MU to lead the Office of Research at Rice University in Houston, MU’s former vice chancellor for research, Jim Coleman, succinctly summed up the accomplishments of FY 2007. “These results truly speak to the excellence of our faculty,” said Coleman. “Our faculty shares a common passion for discovery, creativity and innovation that generates the support of federal agencies. We have come a long way in 10 years, but we know that we still have a lot of work to do.”

Part of that work will involve selecting a new research division leader who can help our faculty scientists and scholars maintain the momentum they have built during the past decade. In the meantime, new and ongoing projects ensure that our new vice chancellor for research will inherit a healthy and vibrant research enterprise.

In August, for example, Chancellor Brady Deaton and Research Reactor Director Ralph Butler teamed up with Mid-America Cyclotron CEO Scott Brower to announce a public-private partnership that will supply area medical centers with much-needed isotopes for diagnosing illnesses such as cancer and heart disease. At the center of the partnership is the installation of a new cyclotron — an apparatus that produces the isotopes — housed in a recently completed addition to the MU Research Reactor.

The addition is part of a major expansion of Research Park, one that includes construction of the $10-million International Institute for Nano and Molecular Medicine. Construction also continues on the new Donald W. Reynolds Journalism Institute, a 30,000-square-foot facility that will enhance teaching and scholarship at the already world-renowned MU School of Journalism.

Work on MU’s new $18.4-million Regional Biocomputation Laboratory, one of only nine such facilities in the nation, is also nearing completion. And technicians working with MU’s Nuclear Magnetic Resonance Core recently installed a new, 800 MHz NMR instrument in the recently completed, $10-million Schweitzer Hall Addition.

These developments represent just a few of the initiatives and programs that are laying the foundation for many years of discovery, innovation and scholarly achievement. As this report will show, we are making exciting strides forward, developments indicative of MU’s commitment to a future in which research and higher learning inform all aspects of our rapidly changing world.
Grant Boosts Researchers’ Quest for Alzheimer’s Cure

Two University of Missouri professors last year received a $6-million grant from the National Institutes of Health to extend a long-term investigation that could have major implications in the development of treatments for Alzheimer’s disease, a devastating neurological illness affecting some four million people in the United States and 15 to 20 million worldwide.

Grace Sun and Gary Weisman, professors of biochemistry in the School of Medicine and the College of Agriculture, Food and Natural Resources, will use the funding to launch the second phase of an $11 million project aimed at identifying the causes of Alzheimer’s disease. Previous studies have indicated toxic effects of a protein, the amyloid-beta peptide or “A-beta,” which accumulates in amyloid plaques in the brain of Alzheimer’s patients. Though its mechanisms are as yet unknown, researchers believe increased production of the peptide may impair brain functions.

“When the A-beta protein comes together inside the plaque, it will fold into an abnormal shape that is toxic to cells,” Sun told the MU News Bureau last June. “While we know this has some effect on brain function, we don’t know how toxic it is or at what stage the toxicity begins. In the past five years, we have started to understand how this disease works. With the new grant, we will be able to go forward and see if there are treatments that can modify the cellular response in the brain.”

extremity infections, fewer surgeries and fewer amputations,” he said.

In April, the University secured another major U.S. defense-related contract, a five-year deal worth up to $10 million. The arrangement will partner Shubhra Gangopadhyay and other MU College of Engineering faculty with the Picatinny Arsenal, a military installation in New Jersey, to produce nanotechnology devices that could help improve military capabilities.

A separate nanotechnology-related project, announced in June, is being led by Peter Pfeifer, an MU professor of physics. Pfeifer, along with M. Frederick Hawthorne, director of the MU International Institute for Nano and Molecular Medicine, and Carlos Weidner, associate professor of physics, will use an integrated theoretical, computational and experimental approach to develop and test hydrogen storage materials. The goal is to advance implementation of hydrogen and fuel cell technologies. It is part of a DOE hydrogen fuel initiative that gave $11.2 million to 13 projects across the nation (see page 8).

In August, David J. Schulz, an assistant professor of biological sciences, contributed an important advance in scientists’ understanding of a fundamental mechanism governing cell activity. His study, published in the Proceedings of the National Academy of Science, showed that there is no standard blueprint for how many ion channels a neuron needs to do its specific task, but that there is more than one way to construct the same nerve cell.

By helping researchers better grasp the function of cells’ basic building blocks, Schulz says, the finding will give researchers “a much better chance of understanding what these cells do to cope with problems they encounter.”

Expenditures and Awards

Sponsorship by the federal government, Missouri’s state government and various corporate and nonprofit agencies is crucial to the health of the University’s research enterprise. In this report you will encounter charts and graphs that reflect the extent of these agencies’ involvement in MU research. Some are expressed in terms of “expenditures,” which represent resources spent by a researcher during a given fiscal year. Others are expressed as “awards,” which show the total amount of funds available for use, money often expended over a period of years.

Eye Implants for Cats Hold Potential for Human Vision

Kristina Narfstrom, an MU veterinary ophthalmologist, has been working with a microchip implant to help blind animals “see.”

“This is really for the millions of people affected worldwide with a hereditary disease, retinitis pigmentosa, that causes the death of retinal cells and, eventually, blindness,” says Narfstrom. “Our current study is aimed at determining safety issues in regard to the implants and to further develop surgical techniques. We also are examining the protection the implants might provide to the retinal cells that are dying due to disease progression with the hope that natural sight can be maintained much longer than would be possible in an untreated patient.”

Narfstrom, the Ruth M. Krauschi-Missouri Professor in Veterinary Ophthalmology, is working primarily with Abyssinian and Persian cats that are affected with an hereditary retinal disease that causes blindness. The cat’s eye is a good model to use for this type of research because it is very similar to a human eye in size and construction. Preliminary results, Narfstrom says, have been promising.

“We are really excited about the potential uses for this technology and the potential to create improved vision in some of the millions of people affected worldwide with retinal blindness,” Narfstrom says.
SPONSORED RESEARCH

Researchers Sustain High Levels of External Sponsorship

Total sponsored research expenditures at the University of Missouri-Columbia increased four percent in FY 2007 to a new record high of more than $128 million in external support. As in previous fiscal years, expenditures generated from federal sources — the majority of which are awarded through the competitive grants process — accounted for the bulk of sponsored research funding.

Faculty scientists and scholars working in medicine, arts and science, agriculture and engineering accounted for just under 73 percent of total sponsored research expenditures. The School of Medicine, with more than $31 million in FY 2007 expenditures, posted particularly noteworthy gains in external support for research. Medicine, along with the College of Agriculture, Food and Natural Resources, and the College of Arts and Sciences, posted particularly noteworthy gains in external support for research. Medicine, along with the College of Agriculture, Food and Natural Resources, and the College of Arts and Sciences.

In addition to providing dollars directly to investigators, agencies also provide a percentage of grants for "facilities and administration" costs. The rate at which these costs are recovered is a reimbursement based on the cost of building and maintaining research infrastructure. Higher rates of F&A recovery allow the University to more effectively support the work of its faculty investigators.

Facilities and Administration Cost Recoveries Top $30 Million Mark

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Shared credit numbers represent each academic unit’s portion of the total amount expended on MU research. Full credit numbers, on the other hand, seek to assign a dollar value to the “productivity” of investigators working across disciplines, thus allowing the full value of a project to be reported multiple times for multiple units. Taken together, these numbers help demonstrate the dollar value of collaboration and interdisciplinary efforts at MU.

Federal Awards, Expenditures Continue Uphward Trend

Federal research funding showed robust increases in FY 2007, led by a boost in commitments to both new and ongoing MU investigations. Award totals from federal sources last year topped $110 million for the first time in MU history, while federal expenditures, also topping $110 million, set an all-time high for the third year in a row.

Sponsored Research Awards by Funding Agency and Amount

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Sponsored Research Expenditures, Shared and Full Credit

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Technology Management

Partnership Powers Advances in Natural Gas Vehicles

Researchers at MU and the Midwest Research Institute (MRI) are testing an alternative fuel technology that may revolutionize natural gas-powered vehicles.

Currently, natural gas vehicles are equipped with bulky, high-pressure tanks that take up premium cargo space. The new technology would enable gas to be stored in a smaller, low-pressure tank. What makes this possible is an MU discovery that fractal pore spaces (spaces created by repetition of similar patterns at different levels of magnification) are remarkably efficient at storing natural gas. The scientists, led by MU physics professor Peter Pfeifer, first “bake” corncocks into carbon briquettes that contain fractal pore spaces. They then use the briquettes to store natural gas in a low-pressure tank.

MU and MRI researchers are now testing a prototype tank in a pickup owned by the Kansas City Office of Environmental Quality. “This technology could make natural gas an attractive alternative fuel for smaller vehicles,” says MU Chancellor Brady Deaton. “The research partnership here exemplifies how scientists from very different fields can work together to conduct truly fundamental research in new materials with an industrial application.”

In Natural Gas Vehicles

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The test pickup has been on the road since mid-October. “Having a prototype of this technology operating in the day-to-day work environment is significant,” says James L. Spigarelli, president and CEO of the Midwest Research Institute. “It symbolizes the power of collaboration and the ability of MU and MRI researchers, working together, to make a scientific discovery and to transfer that discovery to a technology, in this case a fuel tank technology.”

OTMIR: A New Approach to Promoting Faculty Invention and Innovation at MU

The MU Office of Technology Management and Industry Relations was formed just over two years ago following a reorganization of the Office of Technology and Special Projects. Its goal, then as now, is to identify marketable technology resulting from research at the University of Missouri, legally protect it, and see that it benefits the public.

OTMIR’s mission also involves generating income for the University and its faculty inventors, developing and enhancing relationships with industrial partners and, in general, boosting our region’s prospects for continued economic development. As part of the plan for achieving these goals, the OTMIR management and staff have developed a three-pronged strategy:

First, OTMIR is working to provide an environment at MU that fosters intellectual discovery, creative problem solving and the dissemination and application of knowledge. Next, OTMIR is striving to offer superior support services to our research clientele and industry partners. Finally, OTMIR is bringing a range of new resources to bear in an effort to establish additional national and international partnerships. Communication is key to the success of these endeavors. Toward that end, OTMIR personnel spend a great deal of time in the laboratories and offices of MU faculty members learning exactly what expertise these scientists and scholars have to offer. The team also helps MU faculty researchers become more responsive to the needs of corporate partners, and to meet expectations of contractual agreements. In addition, OTMIR staff act as liaisons between University faculty and private industry, assisting both parties in understanding MU intellectual property and research agreement policies.

At present, OTMIR staff are actively managing more than 300 technologies developed by MU faculty researchers at several different stages of marketing. It’s an impressive number of projects for any university, let alone one that employs a minimal number of licensing associates.

Deans are just the first indication of what will be a dramatic increase in MU’s industrially supported research, a boost that will further enhance the University’s role in making important new discoveries and technologies available to the citizens of our state and nation.

Pharmaceutical Companies invest millions of dollars to test drugs, many of which will never reach the market because of side effects found only during human clinical trials. At the same time, the number of patients waiting for organ transplants continues to increase. In the past 10 years, this number has nearly doubled. Now, innovative work by an MU physics researcher might present new solutions to both problems with the help of a very special printer.

For the past four years, Gabor Forgacs, the George H. Vineyard Professor of Physics, has been working to refine the process of ‘printing’ tissue structures of complex shape with the aim of eventually building human organs. In his latest study, a research team led by Forgacs determined that the process of building such structures by printing does not harm the properties of the composing cells, and that the process mimics the naturally occurring biological assembly of living tissue.

The study is being published in an upcoming edition of Tissue Engineering and was funded by a $5-million grant from the National Science Foundation. Forgacs also has become involved with a company, Organovo, Inc., which is interested in licensing the technology. He plans to work with drug companies to provide them with tissues they can use to test drugs prior to human clinical trials.
INSTRUCTION & PUBLIC SERVICE

IPS Boosts Support in FY 2007

I nstruction and public service (IPS) activities, conducted in concert with scholarly and scientific research, comprise an integral part of the MU mission. IPS expenditures at the University reached $61 million in FY 2007, a total representing a significant increase over the FY 2006 total of $52 million. Newly awarded IPS funds rose to $18 million in FY 2007, an increase of 17 percent over last year’s total.

MU Extension, at $21 million, accounted for the lion’s share of IPS expenditures, while the College of Education, the School of Medicine, and the College of Agriculture, Food and Natural Resources together generated more than $20 million, or about 32 percent, of this fiscal year’s sponsored IPS expenditures.

Programs in environmental science, arts and science, and health professions combined for another 16 percent.

In FY 2007, the federal government remained the largest single sponsor of the University’s IPS activity, providing some 70 percent of total expenditures and 68 percent of newly awarded funds. State government and non-profit sources also remain an important source of IPS funding. Awards from nonprofit sponsors increased in a particularly noteworthy manner, jumping from just $2.4 million in FY 2006 to $8.9 million in FY 2007.

“[English Language Learning] is quite a specialty with its own methodology, and as the numbers of non-English speaking students grows, so does the need for specialized language instruction in Missouri’s schools. The MU College of Education will help address this need thanks in part to a $1.3-million award from the U.S. Department of Education. The grant will fund a five-year program to prepare Missouri teachers to teach English to students who do not use it as their native language,” said Roy Fox, chair of the Department of Learning, Teaching and Curriculum. “It’s a pressing need; the number of students in Missouri who did not speak English as their native language was 7,600 in 1998. In 2005, that number had increased to 20,000.”

MU Scholars to Promote English Language Learning

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“The program, English Language Learning in Missouri, will bring 20 teachers to the Columbia campus each year. Program participants will take two fall courses, two winter courses, two summer courses and a field-based practicum in order to be certified in Teaching English to Speakers of Other Languages.”

“English Language Learning) is quite a specialty with its own methodology, and as the numbers of non-English speaking students continue to increase this specialty will be in greater demand,” said Roy Fox, chair of the Department of Learning, Teaching and Curriculum. “It’s a pressing need; the number of students in Missouri who did not speak English as their native language was 7,600 in 1998. In 2005, that number had increased to 20,000.”
The University of Missouri-Columbia, established in 1839, is the oldest public research institution west of the Mississippi River. MU's mission in research and student education is to provide enhanced opportunities and challenges in the humanities, arts, sciences and selected professional fields. MU also aspires to achieve national and international prominence for its research and educational contributions. As such, we are committed to building on our research strengths in basic and applied biological and biomedical sciences, nuclear and related physical and engineering sciences, and selected social and behavioral sciences. We will continue to strengthen our leadership role in agriculture and journalism. And because of our large enrollment of undergraduates, MU will enhance the core disciplines required for all those seeking baccalaureate degrees, giving special attention to areas such as languages and mathematical sciences that provide the necessary foundation for a truly educated citizenry.