

RESEARCH AND CREATIVE ACTIVITIES PROFILE

WINTER 2018



Southern Illinois University System
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CHICAGO & LAKE
COUNTY PROGRAMS



● SIU MEDICINE

● SIUe



● SIU
Southern
Illinois
University
CARBONDALE



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The general public is often curious whether it is worthwhile for faculty to engage in the pursuit of academic research. The underlying implication is that there is minimal importance in undertaking such scholarly inquiry – unless there is a tangible product or direct benefit to those making the query. As you might guess, this assumption shows that there is a lack of knowledge regarding what research is and the value that it brings to the institution and the larger society. Consequently, higher education leaders must find a way to more effectively communicate to external stakeholders the immeasurable benefits of faculty (and student) research.

Over the years, I knew that Southern Illinois University was a strong research institution with a well-deserved national reputation. However, only recently did the significance of its scholarly research really stand out to me. Specifically, in 2017 the Milken Institute ranked SIU as #72 in the country for technology transfer and commercialization. Notably, SIU outranked some very prestigious public/private universities – including Big Ten and Ivy League institutions.

In this edition of Research and Creative Activities Profile, we focus only on a select number of University research projects that represent the approximately \$83 million in grant dollars received annually. Thus, not only does SIU researchers' work enhance such areas as the arts, medicine, education, and the sciences, but externally funded grants comprise almost 10 percent of SIU's total annual budget. This allows the hiring of countless graduate (and undergraduate) students who commit to study at SIU solely because of the research conducted in a particular academic discipline.

In sum, the Profile helps answer the “value of research” question as well as shows the different types of research and its accompanying benefit. On behalf of our faculty and students, thank you for supporting the research mission of SIU.

A handwritten signature in black ink that reads "Brad Colwell". The signature is written in a cursive, flowing style.

Brad Colwell, Ph.D., J.D.

Vice President for Student & Academic Affairs

Southern Illinois University System

SIU RESEARCHER DISCOVERS CAUSE HIGHER FLOODS

By *Tim Crosby*

Flood control engineering along the Mississippi River during the last century has caused floods to increase in magnitude when they do happen, according to an article published earlier this year in a leading scientific journal that was co-authored by researcher Jonathan Remo.

In the article, published in the journal *Nature*, the authors argue that climate patterns, such as El Niño and others, also strongly affect flooding trends. But changing the river's channels, through confining it with levees, has greatly amplified flooding when it does occur.

Remo, associate professor of geography and environmental resources and director of the Environmental Resources and Policy doctoral program jointly run by SIUC and SIUE, co-authored the article on the study, which examined the physical record for the last 500 years of flooding along the river. The researchers focused on the river from Cairo, Ill. south to Vicksburg, Miss.

CENTURIES OF FLOODS REVEALED BY TREE RINGS AND SAND

The researchers used a technique known as paleoflood reconstruction to gain information about flooding from before records were kept, stretching back to 1500.

The methods involved examining sand left behind by the river in floodplain lakes during flooding events centuries ago. Using radio carbon dating techniques, researchers were able to tell the age of the organic material that accumulates on top of each new sand deposit left by a flood, giving them a relative date for each flood.

FLOOD CONTROL EFFORTS

SIU GEOGRAPHY FACULTY MEMBER CONTRIBUTES EXPERTISE

An expert in flooding and river management, Remo contributed further to the project by using knowledge gained from a nearly \$300,000 National Science Foundation-funded study that examined the flooding record left behind in tree rings along the Mississippi River and its principal tributaries.

His method involved taking core samples from trees that in some cases are more than 300 years old and examining the sample under a microscope. Once those flood years were established, they were compared to the carbon-dated sediment samples, further confirming the accuracy of the methods.

“Some of the trees date back to the latter half of the 1600s to the 1700s, many of them located in the Missouri bootheel,” Remo said. “When you look at the sample under a microscope, the years that involved flooding have different shape than other years.”

FLOOD CONTROL ATTEMPTS HAVE UNINTENDED OUTCOMES

Remo said during the last century flood protection engineering has increased the magnitude of flooding once those systems are breached because they make the water run higher.

“So the flooding is worse when it does happen,” he said. Remo said the study’s findings give policy makers and scientists a much better picture of flood variability along the Lower Mississippi River.

“I hope the information will help us ensure our flood mitigation systems are able to protect us from current and future flood hazards,” Remo said.



SIU MEDICINE

COLLABORATIVE INTERNAL GRANT PROGRAM BUILDS BRIDGES

An internal grant program is giving SIU scientists, researchers, and students the opportunity to build valuable collaborations with colleagues across the SIU System.

The idea began after Susan Morgan, PhD, SIUE associate dean for research and graduate studies in the Graduate School and professor in the Department of Civil Engineering, contacted School of Medicine (SoM) Associate Dean of Research Linda Toth, DVM (now retired), to discuss SIUE's NIH Biomedical/Biobehavioral Research Administration Development (BRAD) grant to support infrastructure for health-related disciplines. Toth suggested an internal grant program to increase faculty collaboration. The program was launched in 2016 with SIUC joining in 2017.

For the Collaborative Internal Grant Program, each campus can contribute up to \$10,000 in support for a chosen research project. At least two Primary Investigators from different campuses must be involved, but a project can have investigators from all three campuses and thus be eligible for \$30,000 total. A committee comprised of faculty from each campus reviews the applications.

“The three associate deans for research emphatically supported this initiative last year, and do so even more today.”

Don Torry, Ph.D and
SoM Interim Associate Dean for Research

Since the program was initiated, three teams have received awards:

- Traves Crabtree, MD, Department of Surgery at SoM, and Timothy York, PhD, in the SIUE Department of Electrical and Computer Engineering, designed a novel camera system for video-assisted thoracic surgery.
- James Daniels, MD, Department of Family and Community Medicine Quincy, SoM, and Lindsay Ross-Stewart, MD, SIUE Department of Applied Health, studied the effects of imagery-assisted virtual reality (IVAR) on geriatric patients after a hip or joint replacement.
- Daotai Nie, PhD, Department of Medical Microbiology, Immunology and Cell Biology, SoM, and Bill Neumann, PhD, Department of Pharmaceutical Sciences, SIUE, gathered new data on a sigma receptor subtype that has been found highly expressed in malignant cancer cells.

Neumann believes the NIH-style proposal template, review process and evaluation reports offer a trial run for external grant seeking. “It makes it very easy to turn the proposal into an external submission, which we have already done with the Department of Defense,” he said.

SoM Interim Associate Dean for Research Don Torry, PhD, is a fan of the system-wide program and the message it sends. “The three associate deans for research emphatically supported this initiative last year, and do so even more today,” he said. “All three offices feel that research is part of the mortar that transcends any differences, unites us together, builds internal collaborations and hopefully can further develop and synergize our research expertise between the campuses.”

FROM PASSIVE TELEROBOTIC PLATFORMS TO INTERACTIVE, TANGIBLE HUMAN ROBOT INTERFACES

“I have been part robot since May. Instead of legs, I move on gyroscopically stabilized wheels. Instead of a face, I have an iPad screen. ... I am a remote worker.”

This excerpt from *WIRED* magazine, September 2015, brought to light one of the ongoing and most challenging facets for humans using telepresence robots – the social experience, or lack thereof. The article described the frustration associated with the inability to socialize with coworkers – specifically not having arms and hands for interacting with colleagues through handshakes or gestures – and inappropriate “robot touching” (e.g. colleagues picking up the platform and moving it without warning).

KEY DEFINITIONS:

REMOTE USER:

The individual controlling the telepresence platform remotely

LOCAL USER:

Those in contact with the telepresence platform

“While telepresence robots are enabling new heights of remote communication, challenges still exist for both local users and remote users in creating the social dynamic of connectedness,” said Jerry Weinberg, PhD, associate provost for research and dean of the SIUE Graduate School.

“The ability to talk with our hands, something humans do so eloquently in conversation, enables us to connect and relate on a deeper level,” Weinberg said. “This intuitive, nonverbal communication is currently absent in the telepresence experience.”

With funding from a three-year National Science Foundation (NSF) Cyber Human Systems grant and a recent NSF Research Experiences for Undergraduates grant, Weinberg is collaborating

with colleagues to bring the tangible and social experiences that connect individuals in conversations to mobile telepresence platforms.

Weinberg, a professor of computer science, is working with SIUE alumna Jenna Gorlewicz, PhD, assistant professor of mechanical engineering at Saint Louis University; Mitsuru Shimizu, PhD, assistant professor of psychology at SIUE; and students from both universities.

An expert in human-machine interfaces, Gorlewicz and her students have designed a lightweight, ergonomic arm that can interact in typical social ways, specifically extending for a handshake, gesturing with hands and pointing. Using an Xbox Connect, Weinberg and his students have created software which enables the remote user to talk with their hands.

“We don’t want to add an additional technology barrier.” Weinberg said. “The Xbox Connect will pick up the natural movements of the remote user and, using a complex algorithm, translate them to the movement of the robot arm.”

Once the technology has been perfected, Shimizu will begin user studies to test the level of social connectedness. Testing will include human subjects interacting with the robot to determine how well the local user socially connected to the remote user through the enhanced robot interactions. Testing the reverse, where the human subjects control the robot, will determine how connected the remote user feels to the local user while using this technology.

“Our hope is that the social connection is both ways,” Weinberg said. “We hope our research will open up pathways for new levels of remote social experiences and enriched human-robot interaction among individuals in numerous settings across the world.”



Jerry Weinberg and Jenna Gorlewicz do a test run with James Slack, Saint Louis University Alum.

1 **DRONES MAY HOLD
KEY TO FIGHTING
CROP DISEASE IN
THE FUTURE**

With the demand for food higher than ever, farmers do not have time to struggle with plant diseases and crop failures. New solutions often emerge to improve these problems, but more progress is still necessary.

Farmers are experimenting with precision agriculture – using information technology for mapping and spraying. This technique frequently employs unmanned aerial vehicles (UAV), commonly known as drones, to ensure that crops receive exactly what they need for optimum health.

Lindsey McKinzie, a first-year graduate student studying plant soil and agricultural systems, is hard at work using drones to find new solutions. She spent this summer working with faculty to study the rate of diseases in row crop plots and experiment with the usefulness of UAVs.

By using drones to evaluate fields, the team at SIU hopes to make farms more efficient, cutting down on the estimated 30 to 40 percent of produce from cultivated plants that die each year from diseases.

The researchers use a rating system that estimates the severity of disease in a crop, using drones as their “eyes.” The process includes flying the drones over the fields and taking pictures of the plants. The team then compares the UAV data with the ground-collected data to determine the effectiveness of the drones, and later, to manage the health of the fields.



Photo by david beards on Unsplash

NIH GRANT FUNDS CHLAMYDIA RESEARCH

2

Microbiologist Derek Fisher and chemist Kyle Plunkett are teaming up to fight the scourge of chlamydia.

The two SIUC associate professors recently received a second round of funding from the National Institutes of Health, bringing the total to almost \$860,000 since 2014 for the research.

Fisher and Plunkett, along with SIUC graduate and undergraduate student researchers, are looking at a certain enzyme that “flags” proteins by adding a phosphate molecule to them, as well as an enzyme that takes that molecule away. Such interactions – called phosphorylation – if better understood, could potentially lead to new drug therapies or vaccines that would prevent

or better treat the sexually transmitted disease that wreaks havoc on younger people in the prime of their lives, resulting in infertility and in some cases life-threatening conditions.

Fisher and Plunkett aim to find a chemical means of interrupting the disease, which relies on the lock-and-key relationships between certain proteins and enzymes to grow and spread. The researchers are looking at how the bacterium first infects a healthy cell, as well as how it replicates after doing so, and how it transitions between its two forms.

3 COMPUTER SCIENCE STUDENT WINS AWARD FOR ANTI-PIRACY APP

You might say Ayush Kohli hunts modern day pirates, and his field of battle is cyberspace.

More than 85 percent of smartphone users have selected an Android operating system, which gives access to a multitude of applications – almost 3 million different apps, as of June 2017 – from the Google Play store alone.

But such a system provides opportunities for pirates, in violation of intellectual property laws, to cause mayhem by modifying popular apps from the unofficial marketplaces or by injecting malicious code into apps they upload to such marketplaces, or even the Google Play store.

Kohli, an SIUE senior earning a degree in computer science, has come up with what might be one of the best counter measures available: DecisionDroid, a supervised learning-based system that identifies pirated Android apps. His

work recently garnered him a third-place award from the Association of Computer Machinery’s (ACM) Student Research Competition world final, a prestigious, international event.

The world final featured the work of 17 ACM student research competition champions from different areas of computer science, who came from top universities, including the Massachusetts Institute of Technology, Harvard, Northwestern, Cambridge and the University of Southern California, among others. Kohli secured his place in this competition by receiving first place in the 2017 Student Research Competition in the Software Engineering area.

SIUE

1

A \$300,000 grant from the **Department of Justice through the Violence Against Women Act** has enabled SIUE to expand its efforts to ensure students, faculty and staff feel they have a safe space to learn about, discuss and report incidents of gender-based violence such as sexual assault, dating violence and stalking. Funds are supporting the SIUE Survivor Initiative, which has three goals:

- Prevent and reduce the incidence of sexual assault experienced by SIUE students
- Coordinate current and proposed efforts to respond to sexual assault committed toward SIUE students
- Increase awareness of and access to prevention information and victim's services

Jim Klenke, associate vice chancellor for student affairs; Lindsay Serrano, SIUE counseling services; Dustin Brueggemann, SIUE police lieutenant; and former faculty member Dayna Henry were the principal grant writers.

2

A \$287,690 National Science Foundation Research

Experience for Undergraduates three-year grant turned SIUE into a summertime hub for an innovative, interdisciplinary archaeological and ecological research project that aims to document deep-time anthropogenic impact in the Upper Mississippi River System. The project, "Exploring Evidence of the Anthropocene: Archaeological and Ecological Interdisciplinary Research Experiences for First-Generation Students in the Upper Mississippi River System," is led by principal investigator Carol Colaninno, PhD, assistant research professor in the SIUE Stem Center, and co-PI John Chick, PhD, director of the Great Rivers Field Station of the Illinois Natural History Survey, University of Illinois. Each summer, Colaninno and Chick mentor 10 undergraduate students as they participate in an immersive, eight-week research experience on the SIUE

campus and nearby Mississippi and Illinois rivers that guides students through the scientific process.

Researchers at SIUE are developing a new system to identify risk of cardiac events.

The American Heart Association granted SIUE \$154,000 in support of the research, which is being led by Jon Klingensmith, PhD, assistant professor in the School of Engineering's Department of Electrical and Computer Engineering, whose background is in ultrasound signal processing and coronary imaging. Co-collaborators include Maria Fernandez del Valle, PhD, assistant professor of exercise science in the School of Education, Health and Human Behavior, and H. Felix Lee, PhD, professor of industrial engineering in the School of Engineering. The team is developing a cost-effective system that could be widely deployed for accurate volumetric measurement of epicardial adipose tissue.

3



1

SIU CLINIC FIRST TO STUDY NEW HIGH BLOOD PRESSURE TREATMENT

Over 100 million Americans have hypertension, and more than half of those who are on high blood pressure medications still don't have their blood pressure under control. Doctors at SoM are conducting a groundbreaking clinical trial to test the effectiveness of a new device to lower blood pressure. The CALM-2 study is enrolling participants now.

The clinical study is designed to evaluate an investigational device as a possible solution for patients whose blood pressure is not controlled with prescribed medications. Participants in the study will be among the first in the world to undergo this investigational implant procedure, which is designed to reduce blood pressure after a single treatment. The catheter-delivered MobiusHD® device is inserted in the body in a similar way to heart stents.



Once in place, it reshapes the carotid artery and triggers the body's "baroreceptors" – specialized nerves that send amplified signals to the brain that may lead to long-lasting control of high blood pressure. Vascular Dynamics developed the device and is sponsoring the research.

SoM's Springfield location was the first site in the world to enroll a patient in the randomized clinical trial. John M. Flack, MD, MPH, professor and chair of SIU's Department of Internal Medicine and president of the American Hypertension Specialist Certification Program, leads the research team. Kim Hodgson, MD, chair of the Division of Vascular Surgery, performed the procedure.

2

TACKLING THE OPIOID EPIDEMIC

The national opioid crisis has far-reaching effects, and rural regions like the majority of SoM's service area are disproportionately affected by opioid addiction. During the past year, two SIU departments have been working diligently to help curb the crisis.

In partnership with the Office of Regional Programs, SoM's Department of Psychiatry has developed a curriculum for opioid prescribers in the 66-county region. Department Chair Kari Wolf, MD, and an advisory council have coordinated video-

conferenced training and continuing education credits for both live and taped training at various locations in the SIU service area. The video sessions, best practices and other resources for prescribers are available on SIU Psychiatry's Best Practices in Opioid Prescribing website. The IDHS Division of Substance Use Prevention and Recovery has provided an additional \$180,000 to continue



development of the Rural Opioid Prescriber Training Program. The new funding will be used to expand trainings through webinars, coalition building efforts, and substance misuse-focused town halls.

Dr. Wolf and the Department of Psychiatry are also collaborating with the Illinois Hospital Association, through a grant from the Centers for Medicare and Medicaid Services, to help prescribers across the state provide medication-assisted treatment to people addicted to opioids through an ECHO project. Physicians meet with experts at SIU every other Wednesday for 12 sessions to learn about managing psychiatric conditions and opioid addiction in their practice settings.

Wiley Jenkins, PhD, MPH, division chief of epidemiology and biostatistics for the Department of Population Science and Policy, is also coordinating two studies associated with opioid

addiction. The first study investigates the opioid and injection drug use epidemic in the southernmost 16 counties of Illinois. Funded by the NIH National Institute on Drug Addiction, the two-year research phase explores the nature of opioid injection and infectious disease risk among rural populations, and leads to the development of a three-year implementation phase seeking to both reduce disease transmission (e.g., syringe exchange) and increased disease identification and treatment (enhanced screening and referral to care). It is being conducted in conjunction with the University of Chicago and multiple downstate agencies. The second is a pilot study to determine how opioid misuse and HIV status (independently and combined) impact the types and numbers of bacteria that reside in the human mouth and subsequent oral sexually transmitted infection risk.



ALZHEIMER'S CLUES FROM GLUTAMATE

Alzheimer's is a devastatingly progressive disease that robs our loved ones of their memories and personalities. Presently 5.7 million Americans are living with Alzheimer's. By 2050, this number is projected to rise to nearly 14 million. Early and accurate diagnosis could save up to \$7.9 trillion in medical and care costs, according to the Alzheimer's Association.

There is increasing evidence that Alzheimer's disease lies on a continuum with dynamic neurobiological and pathological symptoms. As the disease progresses, targeting specific therapeutic windows for intervention may give patients the greatest benefit. Several studies have implicated glutamate dysregulation in Alzheimer's disease pathologies in the brain. The glutamate system influences synapse formation in early brain development, synapse

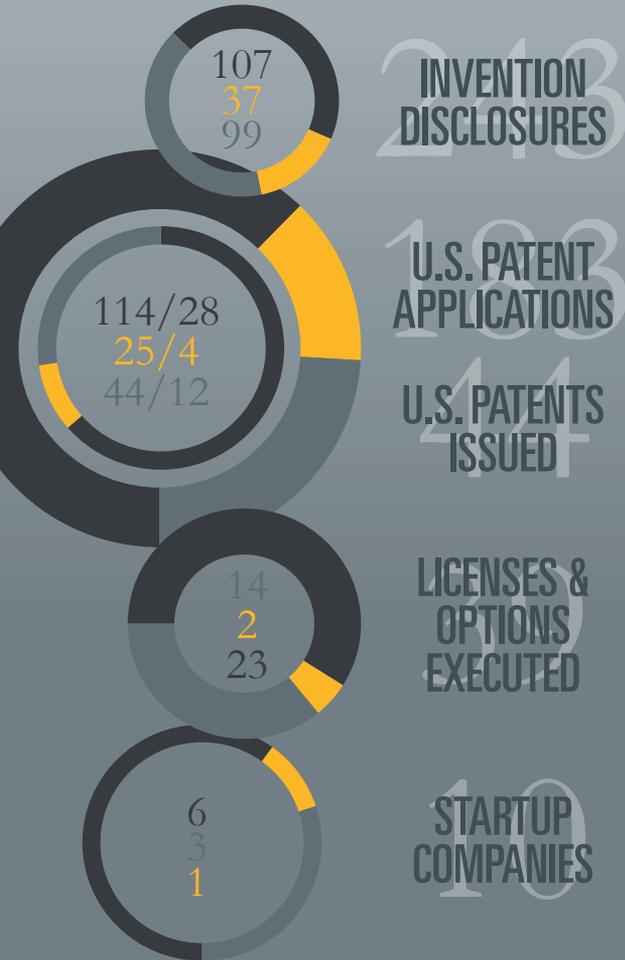
maintenance, and synaptic plasticity. The laboratory team led by Erin Hascup, PhD, assistant professor in the Departments of Neurology and Pharmacology, has shown that glutamate dysregulation is likely occurring prior to cognitive decline.

Hascup's group has received a \$2.9 million NIH grant to study how glutamate neurotransmission changes over the course of Alzheimer's disease progression. Co-Investigators Kevin Hascup, PhD, Neurology, Neurosciences Institute and CADRD, and Kristin Delfino, PhD, Center for Clinical Research, are contributing to the research. Their experiments will explore how specific protein changes cumulatively affect glutamate levels and brain activity. This new data could produce useful early biomarkers and therapeutic targets for fighting Alzheimer's.



TECHNOLOGY TRANSFER

Southern Illinois University (SIU) is among some elite universities when it comes to technology transfer. According to a report titled, “Concept to Commercialization: The Best Universities for Technology Transfer,” (Ross DeVol, Joe Lee, and Minoli Ratnatunga; April 2017), out of 225 universities, SIU is ranked 76 when comparing patents issued, licensees issued, licensing income, and start-up companies—outranking prestigious universities such as Michigan State University, University of Kansas, Auburn University, and University of Notre Dame.



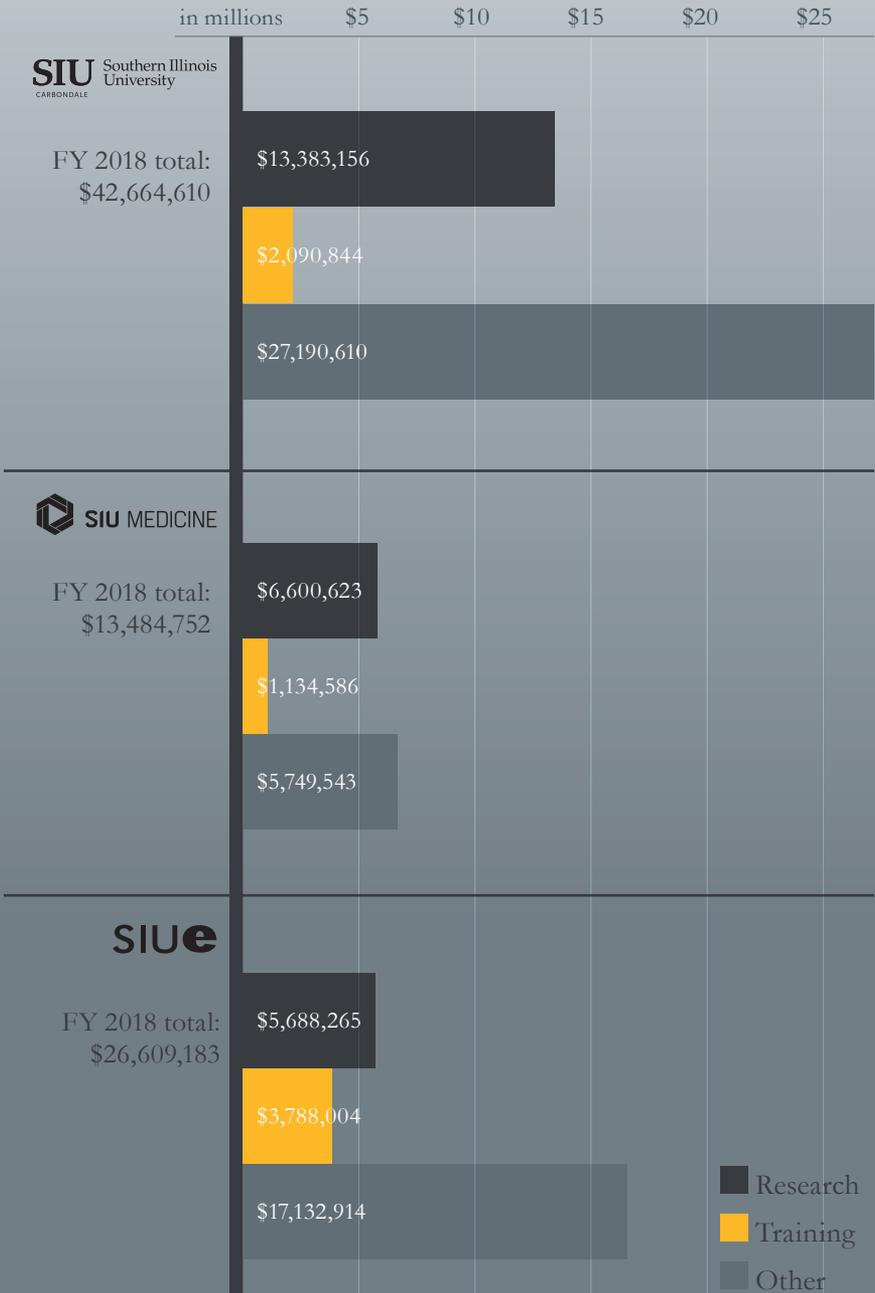
Across the SIU System, top-ranked research faculty spend countless hours exploring with graduate and undergraduate students—learning about the art of invention.

- SIU Carbondale
- School of Medicine
- SIU Edwardsville

The Technology Transfer data reflects a 10-year time period.

EXTERNAL AWARDS AND CONTRACTS

Fiscal Year 2018
Total dollars Awarded





TO LEARN MORE

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MEET THE SIU SYSTEM

With more than 1,000 faculty researchers spread across three main campuses, Southern Illinois University is an innovation and economic engine for the southern half of the state.

SOUTHERN ILLINOIS UNIVERSITY CARBONDALE

As a nationally-ranked public research university, SIU Carbondale embraces a unique tradition of access and opportunity. Recently, SIU Carbondale was ranked the 27th most entrepreneurial research university in the US by *Forbes* magazine and was designated as an Innovation and Economic Prosperity University by the Association of Public and Land-Grant Universities.

SOUTHERN ILLINOIS UNIVERSITY EDWARDSVILLE

SIU Edwardsville is a nationally-recognized university that provides students with a high-quality, affordable education. Built on the foundation of a broad-based liberal education and enhanced by hands-on research and real-world experiences, SIU Edwardsville equips students to thrive in the global marketplace and make Illinois communities better places to live.

SIU SCHOOL OF MEDICINE

The Springfield-based SIU School of Medicine is a publicly-assisted medical school focused on the health care needs of downstate Illinois. As an academic medical center, SIU School of Medicine trains caring and competent physicians, works closely with the School's SIU HealthCare clinical practice, and engages in innovative scientific research and community service projects.

ONE UNIVERSITY, MANY LOCATIONS, STATEWIDE IMPACT

The Southern Illinois University System – where learning comes first, where students are valued and encouraged to explore new ideas, and where progress is complemented by tradition.

The two institutions that constitute Southern Illinois University today – SIU Carbondale, with a School of Medicine in Springfield and partnership in the University Center of Lake County, and Southern Illinois University Edwardsville, with its School of Dental Medicine in Alton and its East St. Louis Center – reach not only from the Shawnee National Forest to the bluffs of the Mississippi River, but also through the flatlands of central Illinois to the shores of Lake Michigan.

With a total budget of approximately \$870 million, the university employs more than 7,000 faculty, staff and administrators who serve over 26,000 students. As a modern and comprehensive post-secondary educational system, SIU offers a broad range of academic programs that lead to associate, baccalaureate, master's, specialist's, and doctoral and professional practice degrees in 32 fields, including law, medicine, pharmacy and dental medicine.



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