2018 RESEARCH ANNUAL REPORT

WASHINGTON STATE UNIVERSITY

Support for WSU Research Starts Here

Washington State University President Kirk Schulz is leading the Drive to 25, a system-wide effort to elevate WSU to a top 25 public research university by 2030 by enhancing the University's achievements, capabilities, and reputation in research, education, and engagement. Raising our institutional profile through the Drive to 25 will open new opportunities for research, creative activity, and scholarship, creating additional public and private partnership opportunities and heightening the interest of prospective students. WSU's Office of Research works closely with University leadership across central units, colleges, and campuses, as well as with faculty, staff, and students to form partnerships that help us advance research with high public impact and realize our vision of the Drive to 25.

While we celebrate our faculty's research and the milestones achieved, we often overlook the unsung heroes who support our scientists and help facilitate their research: our research administration professionals. As vice president for research, I have the privilege to work with approximately 90 staff who support faculty and staff across the University in their pursuit of research and ensure that our scientists conduct research in a safe and ethical manner that is compliant with regulations and laws. The behind-the-scenes work from our staff allow WSU researchers to focus on advancing research with high public impact to address today's challenges.

As a result, WSU research continued to see growth. We set a WSU record of $356.9 million for total research and development (R&D) expenditures in FY2017, as reported by the National Science Foundation. We also continue to see growth in awards received by WSU with a total of $226 million for FY2018.

In this report, we highlight some of the exciting research, creative activity, and scholarship at WSU, as well as key individuals in the Office of Research that help make this work happen. This demonstrates the firm commitment of the Office of Research to support our faculty and staff system-wide as we pursue the Drive to 25.

To learn more about the life-changing research unfolding at WSU, please read on. Stay up to date on all WSU research and services offered by the Office of Research by visiting research.wsu.edu.

Sincerely

Dr. Christopher Keane
Vice President for Research

WSU Developing Self-Replicating Materials; $1 Million from Keck Foundation Paves Way

Washington State University scientists received $1 million from the W.M. Keck Foundation to develop molecular machines that self-replicate, producing pounds of 100 percent pure material.

Their research is the first step toward a new paradigm in manufacturing where everything from smartphones to life-saving cancer drugs could be designed one atom at a time to exact specifications and then grown out of a vat.

James Brozik, the Donald and Marianna Matteson Distinguished Professor of chemistry at WSU, and Kerry Hipps, Regents Professor of chemistry, will lead the three-year interdisciplinary project.

For the last 30 years, scientists have been fascinated by the idea of using scanning probe microscopy to build precisely designed synthetic polymer materials and devices from the ground up, one atom at a time.

However, the challenge with this approach is that it takes far too long to build anything useful. Atoms are extremely small. Around five million of them can fit side-by-side on the tip of a pin. At current rates, it is estimated it would take 31 trillion centuries to build even the simplest real-world devices with current technology.

Hipps and Brozik have come up with a unique solution. The researchers plan to use scanning tunneling microscopy to painstakingly arrange individual molecules onto specially designed metal surfaces, forming templates for simple, self-replicating polymers. Their goal is to make around 1,000 of these templates, which will be designed to exponentially reproduce exact copies of themselves from chemical feed stock, resulting in very large quantities of material quickly.

In the long run, the researchers envision their technology being linked up to something like a 3D printer. An operator would select a material or device to make on a computer and then an automated program would start replicating whichever templates are needed, building the device to exact specifications one atom at a time.

James Brozik and Kerry Hipps

The Office of Research Advancement and Partnerships

The Office of Research Advancement and Partnerships (ORAP) empowers faculty by creating opportunities and providing support to advance their research, scholarship, and creative activities. ORAP provides support for research initiatives and infrastructure, fosters faculty collaborations, supports a culture of productive grant writing, and helps enhance funding success by assisting with the development of grant proposals. Led by Dr. Geeta Dutta, ORAP also leads research expansion activities that include fostering research partnerships across colleges and beyond. The ORAP team, as well as the WSU Foundation Relations team, provided significant support to the formulation of this Keck proposal.

Research assistants Samantha Riedy, Regan Permito and Beth Lewis (front to back) review a cognitive performance test while preparing for a sleep deprivation study at WSU Spokane. Photo by Cori Kogan, WSU Spokane.

Sleep Study Targets Brain Processes Causing Poor Decision-Making

Funded by a $2.8 million grant from the Congressionally Directed Medical Research Programs, a team of researchers from WSU's Sleep and Performance Research Center will study how sleep deprivation affects decision-making. The study will specifically look at cognitive flexibility—the ability to change our thinking based on new information—which a previous WSU study found to be profoundly affected by sleep deprivation.

"Based on earlier findings, we suspect that an area of the brain known as the striatum is particularly important for these cognitive flexibility issues in people who are sleep deprived," said lead researcher Hans Van Dongen. "This suggests that stimulation of that brain area may help to improve decision-making under conditions of sleep loss."

To test this idea, the research team will develop a task to measure cognitive flexibility in rodents and use it as part of a sleep deprivation experiment in rats. Using optogenetics to control the activity of neurons in the striatum, they will be able to see where and how changes in the effects of sleep deprivation on the rats' cognitive flexibility occur.

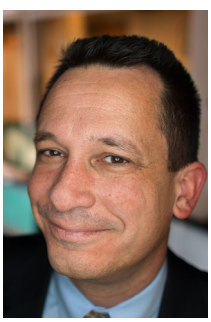
They will also conduct a human study in 90 healthy adult volunteers who will spend three days in the sleep laboratory, including one night of sleep deprivation. They will complete a cognitive flexibility task after the first night's sleep and again 24 hours later while sleep deprived. Prior to their second test, they will take an existing drug that works inside the striatum to fight the effects of sleep loss, or a placebo.

Together, the two experiments will offer critical insight into how sleep loss results in cognitive flexibility deficits and lay the groundwork for the development of new countermeasures to reduce the harmful effects of sleep deprivation on decision-making. This may ultimately benefit anyone working in around-the-clock, safety-critical settings.

The Office of Research Support and Operations

The Office of Research Support and Operations (ORSO) reviews and submits research proposals, and leads award and non-monetary agreement negotiations and related compliance, training, and data reporting operations. They also support Office of Research activities related to the Drive to 25, including the management of high-level committees like Conflict of Interest and Research and Arts. Led by Dr. Dan Nordquist, ORSO provides tools that make it easier for faculty to proceed through administrative processes and update researchers on federal, state, and WSU policies and guidelines governing the conduct of research.

Every grant submission at WSU passes through ORSO, where it goes through budget and other reviews. As an example, the ORSO team works closely with the Sleep and Performance Research Center to submit research grants to U.S. Department of Defense and other agencies.



Hans Van Dongen

Long-Term Cannabis Use Linked to Muted Stress Response WSU Study Shows

Carrie Cuttler, assistant professor of psychology, Ryan McLaughlin, assistant professor of integrative physiology and neuroscience, and colleagues in the WSU Department of Psychology examined levels of the stress hormone cortisol in both chronic cannabis users and non users.

Forty chronic cannabis users and 42 non-users participated in the study. All were required to abstain from consuming cannabis on the day of testing.

The chronic cannabis users and non-users were randomly assigned to experience either the high stress or no stress version of the Maastricht Acute Stress Test, a procedure for stress related research which combines elements of physical, psychosocial, and unpredictable types of stress.

During the no stress version, participants performed repeated trials of placing their hand in lukewarm water for 45–90 seconds and then counting from 1 to 25.

For the high stress version, participants performed repeated trials of placing their hand in ice cold water for 45–90 seconds. Between these trials they were asked to count backwards from 2043 by 17 and were told to start over when they made a mistake. Subjects were monitored by a web camera and the video feed was displayed on a screen directly in front of them.

All participants provided a saliva sample and were asked to rate their current level of stress before and after the stress manipulation. Before departing the testing facility, participants also provided a urine sample so researchers could corroborate self reported use with bodily THC levels.

The results showed that non-users in the high-stress condition displayed the expected increase in cortisol and self-reported stress relative to non-users in the no-stress condition. In contrast, sober chronic cannabis users in the high-stress condition demonstrated the same change in cortisol as cannabis users in the no-stress condition and they reported a smaller increase in self-reported stress.

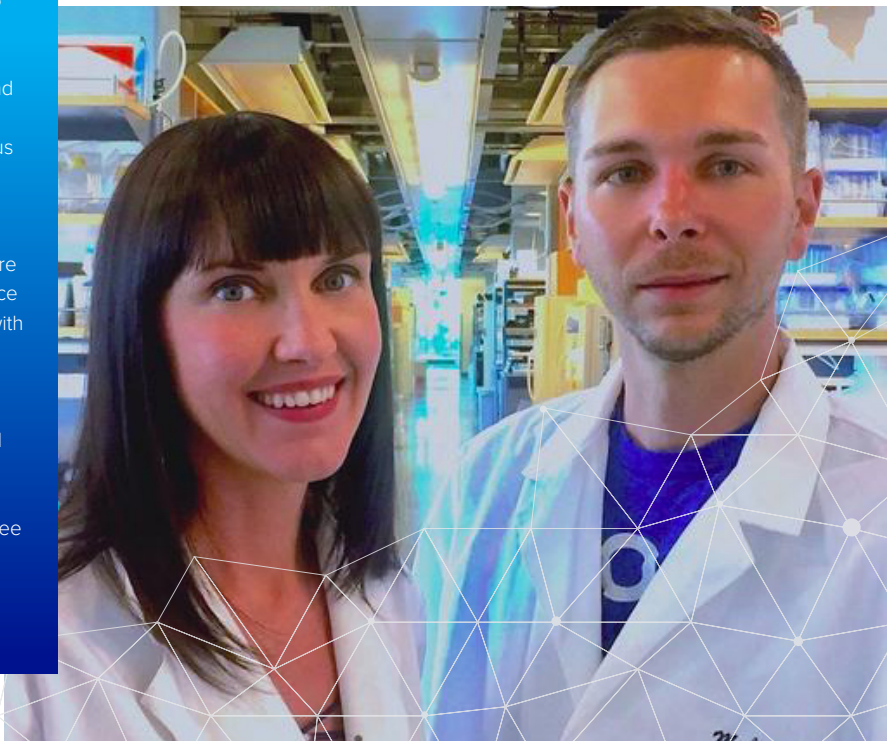
Cuttler and her colleagues' work suggest cannabis might have benefits in conferring resilience to stress, particularly in individuals who already have heightened emotional reactivity to stressful situations. However, the researchers emphasized the release of cortisol typically serves an adaptive purpose, allowing an individual to mobilize energy stores and respond appropriately to threats in the environment.

The Office of Research Assurances

The Office of Research Assurances (ORA) supports and promotes safe, compliant, and ethical research practices at WSU. Led by Mike Kluzik, ORA administers the programs and committees that oversee research with animals, biological agents, humans, and radiation. ORA also provides hazardous materials shipping services and administers the export control program.

ORA works closely with WSU cannabis researchers to ensure all research activities are conducted safely and in compliance with regulations. As an example, ORA has worked closely with Carrie Cutler and Ryan McLaughlin to ensure their research on long-term cannabis use is safe and compliant, and uses ethical research practices. Cutler submitted her research to the Institutional Review Board (IRB), a review board charged with protecting the rights and welfare of human subjects, and McLaughlin submitted his research to the Institutional Animal Care and Use Committee (IACUC), a review committee that ensures that all vertebrate animals involved in teaching or research at WSU receive ethical and humane care and treatment. ORA administers the IRB and IACUC.

Carrie Cuttler and Ryan McLaughlin



Dr. Felix Lankester vaccinates a dog in Tanzania as part of the Rabies Free Africa program.

The Office of the Campus Veterinarian

The Office of the Campus Veterinarian (OCV) oversees and administers high-level care to animals across the WSU system. Led by Dr. Nina Woodford, OCV provides a complete range of services including veterinary care, vivarium services, training and research, and safety support while assuring compliance with federal, state, and local guidelines for laboratory animal care. OCV collaborates with the faculty in their mission of quality research.

WSU Rabies Vaccination Teams Reach One Million Dogs in East Africa

Working with African governments and building on international and local partnerships, WSU's Paul G. Allen School for Global Animal Health is developing the next strategies for the elimination of rabies as a human health threat.

In 2017, WSU and partners in the Serengeti Health Initiative administered approximately 50,000 vaccines in East Africa. Since the inception of the project in 2003, Allen School researchers have administered more than one million vaccinations.

Rabies is preventable, yet it kills nearly 60,000 people worldwide every year; half of them are children. Rabies is the deadliest infectious disease known to man, with a case fatality rate of 100 percent.

By understanding the epidemiology of the disease, Allen School researchers are developing a new approach to empower communities to participate in rabies elimination. The work of WSU researchers Felix Lankester and Thumbi Mwangi are establishing rabies-free zones that will serve as a model for other regions challenged by the disease.

More than 99 percent of the people infected with rabies get it from the bite of an unvaccinated dog.

WSU is diligently working with the Global Alliance for Rabies Control, World Health Organization, Centers for Disease Control and Prevention, MSD Animal Health, and other international and local partners to eliminate rabies with the goal of no human deaths by 2030.

To further build the rabies elimination program in Africa, Allen School's Mwangi serves on Kenya's National Rabies Elimination Coordination Committee that designs and oversees the government's role in systematic and progressive reduction in rabies health burden toward elimination. Much of this initiative involves training health care workers to better identify, treat, and report suspected rabies cases. This community-based surveillance will result in improved data quality for future interventions. Mwangi is also designing mass dog vaccination initiatives along with public awareness campaigns about rabies and the work of other partners.

Felix Lankester

Thumbi Mwangi

Researchers Create Microparticles That Could Help Save Honey Bees

Honey bee colonies could be saved from collapse in the future thanks to a microscopic particle that attracts pesticides, as created by WSU researchers.

Researchers have developed a new material that attracts pesticide residue in bees. Over time, pollen tinged with tiny amounts of pesticides accumulates in a bee's body, reducing the lifespan of each bee in a colony.

The product, a powder, can be incorporated into a sugar solution that's fed to bee colonies. Each microparticle is the size and shape of a grain of pollen, making them easily digestible for bees. They're specially designed and formulated to be safe for beekeepers to handle.

A group named BeeToxx—comprised of undergraduate students mentored by Waled Suliman, a postdoctoral research associate in WSU's Department of Biological Systems Engineering, WSU's Derick Jiwan, and others—won second place in the Alaska Airlines Environmental Innovation Challenge. BeeToxx was one of four to win the Honey Bee Health Coalition's Bee Nutrition Challenge. Their proposal was chosen from among 20 submitted.

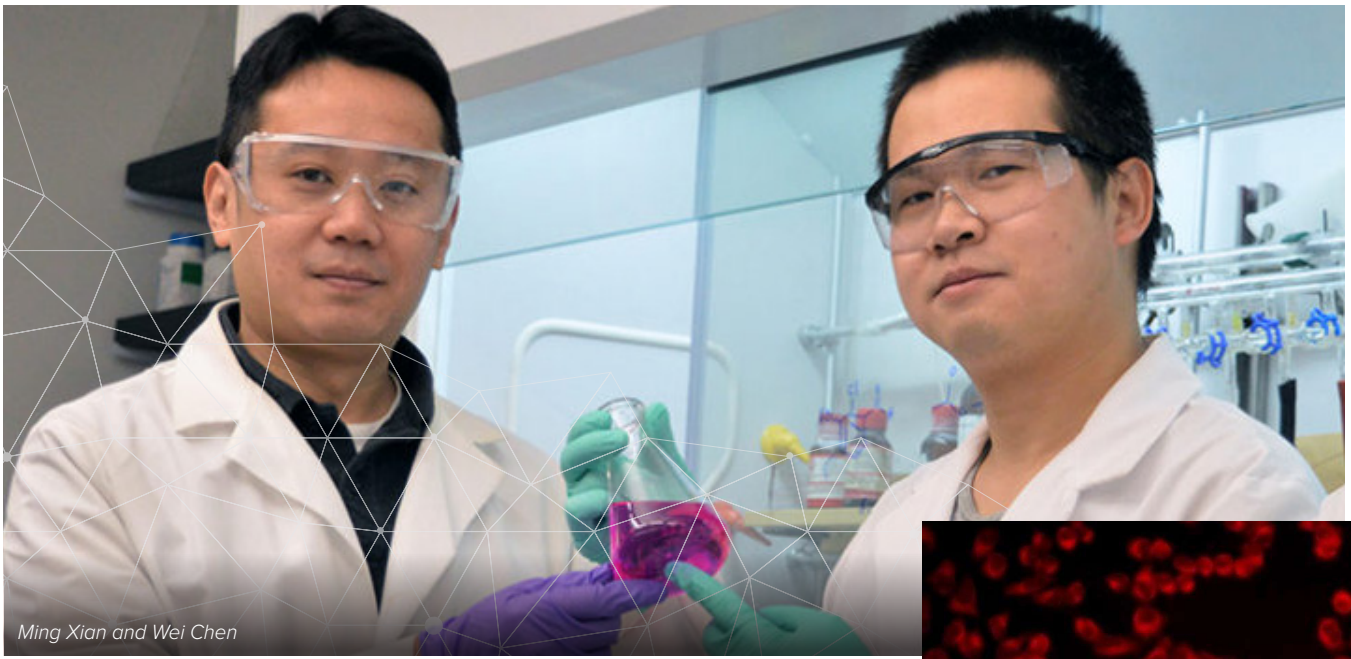
When consumed by the bees, the particles attract and absorb pesticide toxins. Then, they pass through the bees like any other food. Each particle only spends a few hours in their digestive system, which is enough to significantly reduce pesticide residues.

In fact, each particle of Suliman's technology can remove about 300 nanograms of pesticide residue—much more than bees can survive.

Suliman and Brandon Hopkins, assistant professor of entomology and manager of the WSU bee program, fed around 6,000 bees the microparticles in a sugar solution. Then they tested feces from those bees and found it contained the microparticles. In addition, the bees' colonies remained healthy, showing that the microparticles don't harm bees.

The Innovation and Research Engagement Office

The Innovation and Research Engagement Office (IREO) provides administrative support for faculty and external partners working to establish new research partnerships. Led by Dr. Brian Kraft, IREO highlights specific expertise across campus and links it directly to areas of interest for industry partners. IREO also fosters entrepreneurial activities at WSU through programs that encourage engagement and entrepreneurship. BeeToxx participated in WSU's I-Corps program, a National Science Foundation funded program that is managed by IREO. BeeToxx also received funding through the Amazon Catalyst program. IREO, in partnership with the WSU Center for Entrepreneurial Studies, worked close with BeeToxx to identify opportunities to make industry connections and identify business competitions to participate in.



Ming Xian and Wei Chen

WSU Chemists Develop Novel Dye for Bio-imaging

WSU scientists have created an injectable dye that illuminates molecules with near infrared light, making it easier to see what is going on deep inside the body. The new dye will help medical researchers track the progression of a wide array of diseases, such as cancer.

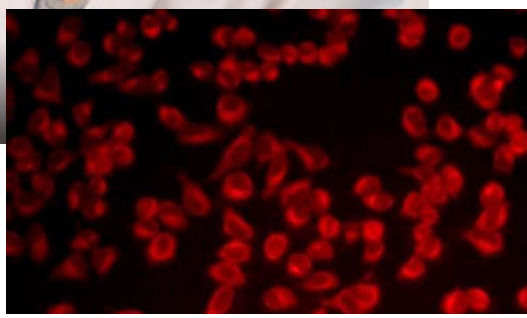
Ming Xian, the Ralph G. Yount Distinguished Professor of chemistry, and Wei Chen, an assistant research professor in the WSU Department of Chemistry, call the new dye Washington Red.

Fluorescent bio-imaging is the visualization of cells and other biological tissues marked with a dye that glows when activated by light.

Most commercially available dyes for bio-imaging fluoresce in the visible spectrum with wavelengths between 400–600 nanometers. Near infrared light, or light with a wavelength between 650–900 nanometers, is ideal for bio-imaging because it penetrates deep into tissues without damaging natural cells or causing them to fluoresce. Dyes that show near infrared light have proven extremely hard to make, however, and tend to be limited in application.

Xian's new Washington Red dye differs from these in several ways. The fabrication process is simpler and the dye is easy to quench, meaning that it is not going to shine near infrared until it has located and bonded to its target. Washington Red is also highly tunable. It can be modified to seek out and bond to a wide variety of molecules, gases, and other substances in the body.

Washington Red dye could be used to track the progression of a wide variety of diseases and to study specific biological processes, such as inflammation in the heart or the buildup of tumors cells, which could eventually lead to the design of new drugs and medical therapies.



Washington Red dye illuminates cellular hydrogen sulfide.

The Office of Commercialization

The Office of Commercialization (OC) supports faculty and student efforts to translate research discoveries into innovations ready for the marketplace. Led by Dr. Sita Pappu, the OC works with researchers to ensure innovations and discoveries are evaluated, protected where possible, and licensed by industry partners or start-ups. Xian worked with the WSU Office of Commercialization to file a patent for Washington Red dye so it can be used by researchers at other institutions across the country and world.

Research Stories with Impact FY18

The Office of Clean Technology

The Office of Clean Technology (OCT) provides representation for forums and groups aimed at developing solutions to environmental issues. Led by Dr. Michael Wolcott, OCT strives to address issues around air and water quality, biofuel and bioproducts development, advanced materials, sustainable infrastructure design, precision agriculture, and smart grid. OCT coordinates several centers, including the Center for Materials Research, Center of Excellence for Alternative Jet Fuels and the Environment, and the Institute for Sustainable Design.

OCT manages the WSU-PNNL collaboration, including oversight of the three joint WSU-PNNL Institutes, the WSU-PNNL Distinguished Graduate Research Program (DGRP), and joint appointments.

WSU, PNNL Strengthen Research Ties to Shape Future, Together

Embracing the power of partnerships, the Department of Energy's Pacific Northwest National Laboratory and Washington State University announced the formation of the WSU-PNNL Institutes—a collection of three joint institutes that will advance discoveries and innovation in nuclear science and technology, advanced grid, and bioproducts.

WSU and PNNL have a long history of collaborating on individual research projects, as well as providing hands-on educational experiences that lead to career opportunities. The formation of the institutes expands this collaboration and sets the stage for long-term impact.

Combining their expertise multiplies STEM-based learning and research opportunities in areas like technology, sustainability, and energy security. The partnership will lead to new discoveries, enhance quality of life, and bolster the regional and state economy. For WSU, this agreement is also another milestone in the ongoing efforts to create new innovative, entrepreneurial collaborations.

These institutes are designed to accelerate scientific and technological progress to find solutions to scientific challenges that neither partner can address individually.

Nuclear Science and Technology Institute
Understand and control how materials evolve in radiation environments to prevent the use of illicit nuclear materials, resolve issues in nuclear waste management, and advance next-generation nuclear energy.

Advanced Grid Institute
Create and implement a national-scale simulation platform and data framework to enable advanced grid controls and operations for complex power systems of the future.

Bioproducts Institute
Leverage cutting-edge science, engineering, and analysis to transform engineered plants and industrial, agricultural, and municipal waste into valuable materials and chemicals. The institute offers participants access to some of the world's most advanced analytical and characterization instrumentation. Researchers, faculty, and students will be able to access each other's unique expertise, specialized facilities, and state-of-the-art instrumentation to maximize scientific impact.

Genetic Explanation Found for Why Some Function Better Than Others While Sleep Deprived

WSU researchers have discovered a genetic variation that predicts how well people perform certain mental tasks when they are sleep deprived.

The research shows that individuals with a particular variation of the DRD2 gene are resilient to the effects of sleep deprivation when completing tasks that require cognitive flexibility.

Paul Whitney, professor of psychology and lead author of the study, along with colleagues John Hinson, professor of psychology, and Hans Van Dongen, director of the WSU Sleep and Performance Research Center at WSU Spokane, compared how people with different variations of the DRD2 gene performed on tasks designed to test both their ability to anticipate events and their cognitive flexibility in response to changing circumstances.

Forty-nine adults participated in the study at the WSU Spokane sleep laboratory. After a 10-hour rest period, 34 participants were randomly selected to go 38 hours without sleep while the other participants were allowed to sleep normally.

Before and after the period of sleep deprivation, subjects were shown a series of letter pairings on a computer screen and told to click the left mouse button for a certain letter combination (e.g., an A followed by an X) and the right mouse button for all other letter pairs. After a while, both the sleep-deprived group and the rested group were able to identify the pattern and click correctly for various letter pairs.

In the middle of the task, researchers told the participants to now click the left mouse button for a different letter combination. The sudden switch confounded most of the sleep-deprived participants, but those who had a particular variation of the DRD2 gene handled the switch as well as they did when well-rested.

The WSU research team developed new ways to help surgeons, police officers, soldiers, and other individuals who regularly deal with the effects of sleep deprivation in critical, dynamic settings cope with the loss of cognitive flexibility.

Centers, Institutes, and Research Instrumentation Cores

Centers, institutes, and research instrumentation cores support interdisciplinary research that builds upon WSU's strengths and supply state-of-the-art equipment to accelerate discovery. Centers, institutes, and research instrumentation cores manage the oversight of accountability and fiscal responsibility for Office of Research approved centers, institutes, and cores. The Office of Research sponsored centers, institutes, and research instrumentation cores are led by Dr. Geeta Dutta. The work described in this article used genome sequencing capabilities in the Laboratory for Biotechnology and Bioanalysis.

University Achievements FY18

WSU Tops USDA Research and Development Expenditures Two Years in a Row

Washington State University (WSU) ranked number one in U.S. Department of Agriculture (USDA) research and development expenditures for two consecutive years.

According to the National Science Foundation's Higher Education Research and Development Survey, WSU led the list of 350 universities nationwide in FY16 when our researchers expended $42.8 million in USDA research and development funding.

WSU topped the list again in the 2017 fiscal year, expending $50.9 million of USDA research and development funding. The expenditures in FY17 set a University record, increasing by $8 million over FY16's previous record.

WSU's USDA-funded researchers not only conduct studies to advance the state's agriculture sector but work to improve animal health and public safety, enhance food security and safety, develop bioproducts, and improve the nutrition of residents throughout the state and region.

The top FY17 USDA-funded, WSU-led projects included:

- The Northwest Advanced Renewables Alliance (NARA) conducts research to use forest residuals to create bio-based alternatives to petroleum-based jet fuel. Seattle-based Alaska Airlines was the first commercial airline to fly with this kind of bio-jet fuel in November 2016.
- A National Institute of Food and Agriculture (NIFA) food safety initiative on integrating biology, psychology, and ecology to mitigate antibiotic resistance in food animal production systems. The project used dairy systems to serve as a model for other animal production systems.
- A NIFA specialty crop initiative to reduce the impact of insect and disease problems in hops through the development of preventive and predictive strategies. Washington state's Yakima Valley is home to one of the most fertile and productive hop growing regions in the world.

The USDA's Agricultural Research Service (ARS) funds more than 800 research projects annually at nearly 100 research locations, many of them jointly operated by universities. At WSU, unlike most research sites, ARS scientists work side-by-side with WSU faculty in labs on campus.

WSU Precision Agriculture Program Ranked in Top 25 in World

Industry professionals have named Washington State University one of the 25 best colleges in the world for precision agriculture.

At WSU, the Center for Precision and Automated Agricultural Systems (CPAAS) and the Agricultural Technology and Production Management (AgTM) academic program are helping to solve one of the biggest challenges facing agriculture today–labor.

Editors of the journal Precision Ag Professional ranked CPAAS and AgTM among the top precision agriculture programs at four-year colleges and universities. The list was based on a survey of program leaders that weighed reputations in education, research, and extension. This ranking aids WSU's Drive to 25 effort to join the world's top public research universities.

Precision agriculture practices let crop scientists and breeders use sensors to understand variability in their crops, skipping the time-consuming process of monitoring and measuring research plots of wheat, for example, by hand. That can cut months off the process of developing hardier and healthier plants, ultimately helping feed a growing planet.

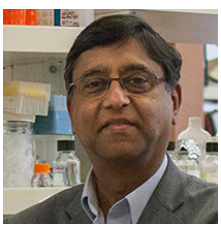
Faculty Recognition

Susmita Bose Named to National Academy of Inventors

Susmita Bose, the Herman and Brita Lindholm Endowed Chair and Professor in the School of Mechanical and Materials Engineering, has been named a fellow of the National Academy of Inventors.

National Academy of Inventors fellows are academic inventors who have demonstrated a highly prolific spirit of innovation in creating or facilitating inventions that have made a tangible impact on quality of life, economic development, and the welfare of society.

Her awards include the prestigious National Science Foundation Presidential Early Career Award for Scientist and Engineers, and PACE and the Richard M. Fulrath Awards from the American Ceramic Society. Bose has published over 250 technical papers, edited nine books, and holds 11 patents. Bose is a fellow of the Materials Research Society, American Association for the Advancement of Science, American Society for Microbiology, American Ceramic Society, American Institute for Medical and Biological Engineering, Royal Society for Chemistry, and Washington State Academy of Sciences. Bose's group research focuses on 3D printed and surface modified biomedical devices for drug delivery.

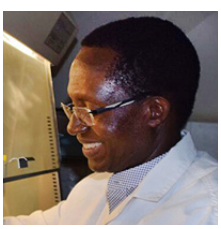


30-Year Battle against Plant Viruses Leads to Humboldt Award for Pappu

WSU virologist **Hanu Pappu** received the prestigious Humboldt Research Award. Pappu's research often explores viruses that threaten the profitability and sustainability of potato and onion crops, and floriculture industry.

The Humboldt Prize recognize a researcher's entire achievements to date, including fundamental discoveries, new theories, or insights that have had a significant impact on their own discipline. In addition, that researcher is expected to continue producing cutting edge achievements in the future. The awards are granted in a wide variety of disciplines, including social sciences, engineering, literature and more. Pappu's award is for the field of phytomedicine, known as plant pathology in the United States. The award is based in Germany. Winners must be nominated by German colleagues.

Pappu is the President Samuel H. Smith Distinguished Professor and the Carl F. and James J. Chuey Endowed Chair in the WSU Department of Plant Pathology. He also is a member of the WSU's Interdisciplinary Ph.D. program in molecular plant sciences.



Paul G. Allen School for Global Animal Health Professor Named to National Academy of Medicine

M. Kariuki Njenga, a professor in the Paul G. Allen School for Global Animal Health and a leader in the effort to address emerging zoonotic diseases, has been elected a member of the National Academy of Medicine (NAM).

Njenga is based in Kenya on the health sciences campus of the University of Nairobi. A member of Allen School faculty since 2015, Njenga's clinical training is in veterinary medicine with advanced training and research in emerging infectious diseases. Election to the NAM is considered one of the highest honors in the fields of health and medicine, and recognizes individuals who have demonstrated outstanding professional achievement and commitment to service. WSU, the University of California, and the University of Pennsylvania are the most highly represented colleges of veterinary medicine in the NAM.

Leading WSU's program supported by the Centers for Disease Control and Prevention (CDC), he focuses on enhancing the capability for disease surveillance and outbreak management for infectious diseases, including viruses such as Ebola and Zika.

Faculty Recognition

John Peters Named an American Academy of Microbiology Fellow

John Peters, director of WSU's Institute of Biological Chemistry, has been named a fellow in the American Academy of Microbiology.

This is John Peters's second such honor in three months—in fall 2017 he was named a fellow in the American Association for the Advancement of Science (AAAS). The American Academy of Microbiology represents the American Society for Microbiology (ASM), the world's oldest and largest life science organization. The mission of the academy is to recognize scientists for outstanding contributions to microbiology and provide microbiological expertise in the service of science and the public. Peters's work involves understanding energy use in living creatures at the microbial level.

WSU Physicist Receives DOE Early Career Award

Brian Collins, assistant professor of physics and astronomy, received one of just 59 national Early Career Research awards from the U.S. Department of Energy for 2017.

The five-year, $750,000 grant will support Collins and his team of graduate and undergraduate students in their research developing and testing new resonant X-ray scattering techniques that reveal how organic, carbon-based molecules assemble, orient, and conform into nanostructures.

The information they gather could help improve the design and performance of organic polymers: flexible, stretchable, biocompatible electronic materials that could be used to make everything from printable solar cells to brain implants that restore movement to paralyzed limbs.

The DOE Early Career Research award will enable Collins and members of his WSU research group to investigate how organic molecules assemble into nanostructures using the Advanced Light Source at the Lawrence Berkeley National Laboratory in California. The Advanced Light Source is the only instrument in the world capable of performing the novel X-ray scattering technique Collins uses for his research.

McCluskey Named Fellow of Agricultural and Applied Economics Association

Jill McCluskey, Distinguished Professor of Sustainability at Washington State University's School of Economic Sciences, was named a fellow of the Agricultural and Applied Economics Association (AAEA). The recognition of fellow is the AAEA's most prestigious honor. McCluskey is only the sixth faculty member in the history of WSU to receive the honor of AAEA Fellow.

During her 19-year career at WSU, McCluskey has published more than 100 journal articles on topics that impact society and industry. Her research includes how environmental quality affects neighborhoods, how consumers respond to new food technologies, and how nutrition labels affect consumers' food choices. Her major contributions include how collective reputations for quality, such as the reputation for Washington apples, affect commodity markets, and how dual reputations affect the wine market.

As past president of the AAEA, she helped members communicate their research to the wider world and pushed for a more diverse membership, encouraging women and minority members to assume more prominent roles.

Three Faculty Receive Prestigious NSF CAREER Research Awards

One professor from WSU Pullman and two assistant professors—one from WSU Vancouver and one from WSU Pullman—earned the prestigious Faculty Early Career Development Program (CAREER) awards from the National Science Foundation.

Kevan Moffett, assistant professor of environmental hydrology with the WSU Vancouver School of the Environment, will receive $690,534 over five years to study how the urban water cycle interacts with the heat generated by urban areas. Moffett will explore how lessons from natural science conducted in rural natural areas might apply to urban environments. She also will consider whether understanding urban heat and water balances could have applications for making cities more livable even in the face of global change.

Hassan Ghasemzadeh, assistant professor in the School of Electrical Engineering and Computer Science, received his award to improve wearable-based health monitoring technology. This five year, $516,000 grant will support Ghasemzadeh as he researches significant challenges with wearable technology that can potentially provide automated, cost-effective, and real-time health monitoring. Ghasemzadeh is working to improve algorithms, so that the monitors will remain accurate even when a different person uses the technology or when a different device is used. He also will develop algorithms that can adjust seamlessly to a variety of different sensors that smart technology might use to measure health—whether accelerometers, gyroscopes, or pressure sensors.

Andrei Smertenko, a professor in WSU's Institute of Biological Chemistry, will receive nearly $1 million over five years to study the cellular architecture of plants in the hopes of helping grow renewable resources faster. As part of this award, Smertenko is partnering with colleagues from WSU Native American Programs, Lewis-Clark State College, and Walla Walla Community College to do lectures and provide training for high school and undergraduate college students in his lab. Groups of students will visit WSU and learn about various research projects, working on interactive experiments like DNA analysis or using microscopes to view xylem cells, and generally communicating what Smertenko and his team do. The NSF allocated a total of $100,000 of the CAREER award for this public outreach.

Bawa Named an Oregon Hallie Ford Fellow

The Ford Family Foundation named **Avantika Bawa**, associate professor of fine arts, as one of five Oregon Hallie Ford Fellows in the Visual Arts for 2018. Bawa received a $25,000 unrestricted award for her excellent work and potential for significant advancement of her practice of art.

Bawa's practice is grounded at the intersection of geographic, architectural, and cultural differences in landscape, influenced by minimalism with an emphasis on reductive form, modularity, and experimentation with scale. She is particularly known for her dedication to researching and responding to sites, often through wall drawings, paintings, and repurposed functional objects to create temporary site-based installations. Her art is an exploration of site and space expressed through a minimalist vocabulary of drawing, sculpture, and installation.

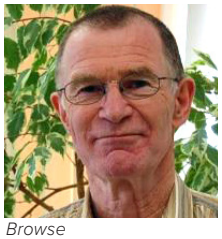
In the fall of the same year, she had a solo show at the Portland Art Museum that received international acclaim. The show highlighted her works based on the Portland's Veterans Memorial Coliseum, "a premier jewel of International Style modernism in the city."

Faculty Recognition

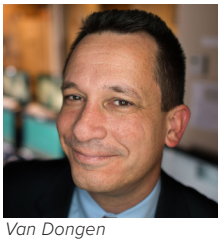
New Researchers Named to Washington State Academy of Sciences

Four Washington State University faculty have been elected to the Washington State Academy of Sciences in 2018. New members are accepted in recognition of their outstanding record of scientific achievement and willingness to work on behalf of the academy in bringing the best available science to bear on issues within the state of Washington.

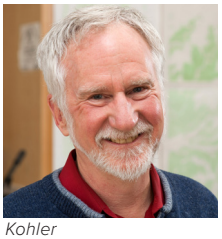
The four new WSU members are John A. Browse, Hans P.A. Van Dongen, Timothy Alan Kohler, and Yuehe Lin.



Browse



Van Dongen



Kohler

Lin

John A. Browse, professor of biochemistry and plant sciences at WSU Pullman, has made sustained and groundbreaking discoveries over the course of his 40 years as a plant lipid biochemist. He is internationally recognized for developing creative approaches to identify and characterize genes that control the biosynthesis of membrane and storage lipids.

Hans P.A. Van Dongen, professor of medicine at WSU's Elson S. Floyd College of Medicine and director of the Sleep and Performance Research Center at WSU Spokane, is one of the pre-eminent sleep researchers in the world and has built a state-of-the-art, internationally known facility from the ground up. The vast breadth of his work has had both immediate public health impact and has elucidated the physiology of sleep and its influence on human performance.

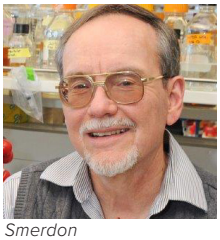
Timothy Alan Kohler, Regents Professor of anthropology at WSU Pullman, is an eminent archaeologist and evolutionary anthropologist specializing in quantitative analyses of prehistoric behavior set in climatically accurate paleoenvironments. He is well known for his work on cooperative behaviors, wealth inequalities and their consequences, and models of pre-Hispanic agricultural productivity at high spatial and temporal resolution in the Southwest United States.

Yuehe Lin, professor of mechanical and materials engineering at WSU Pullman and a laboratory fellow at the Pacific Northwest National Laboratory, is recognized for his leadership and contributions to the fields of bioengineering and biomedical nanotechnology. He is a leader in the development of nanomaterials, BioMEMS, and nanobioelectronic devices for disease diagnosis and drug delivery.

Researchers Named to Washington State Academy of Sciences Board

Two WSU faculty elected to serve on the academy's board in 2018 are John Roll and Michael Smerdon.

Roll



Smerdon

John Roll, professor and vice dean for research in the Elson S. Floyd College of Medicine at WSU Spokane, leads research focused on human behavioral pharmacology, the development and refinement of behavioral interventions for addiction and other psychiatric disorders, as well as technology transfer issues.

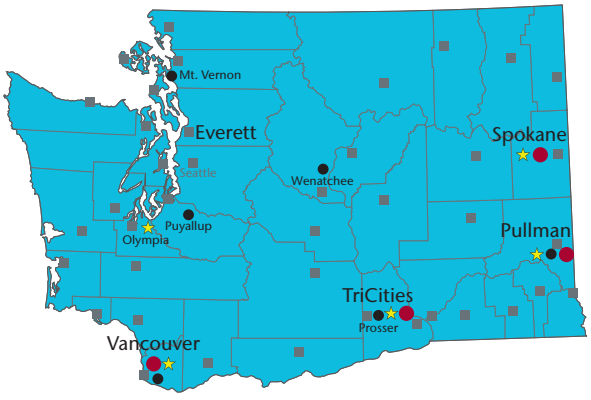
Michael (Mick) Smerdon, Regents Professor of biochemistry and biophysics at WSU Pullman, has been elected a Washington State Academy of Sciences board member for a second term. His research focuses on DNA damage and repair in eukaryotes, chromatin structure and function, and cancer prevention and treatment.

Yasinitsky Wins American Prize for Jazz Composition

Gregory W. Yasinitsky, Regents Professor and then-director of the School of Music, received the 2017–18 American Prize in Orchestral Composition, Pops Division.

Yasinitsky's composition, "Jazz Concerto for Piano and Orchestra," was selected over applications from across the United States. It is a third stream work, which blends classical music and jazz. The American Prize is a series of nonprofit competitions designed to recognize and reward the best performing artists, ensembles, and composers in the nation based on submitted recordings. It was founded in 2009 and is awarded annually in many areas of the performing arts. Winners of the American Prize receive cash prizes, professional adjudication, and regional, national, and international recognition.

Advancing research statewide



Washington State University faculty conduct research at campuses across the state. Extension offices in each of Washington's 39 counties turn research into action for local industry and communities.

- **Research centers, institutes, and core facilities -** More than 30 research centers and institutes bridge disciplines to answer difficult questions. Core facilities support investigations with instrumentation and services.
- **Research and extension centers -** Agricultural and natural resource research at four strategically located centers is supported largely by state and federal research grants and contracts. Public investment in these centers yields enormous returns in land productivity, disease-resistant crops, and the conservation and safer use of natural resources.
- **Libraries -** WSU serves the state with eight libraries at five locations: Pullman, Spokane, Tri-Cities, Vancouver, and Olympia.
- **Extension offices -** WSU Extension leverages research to find solutions to local issues.

Facts & figures

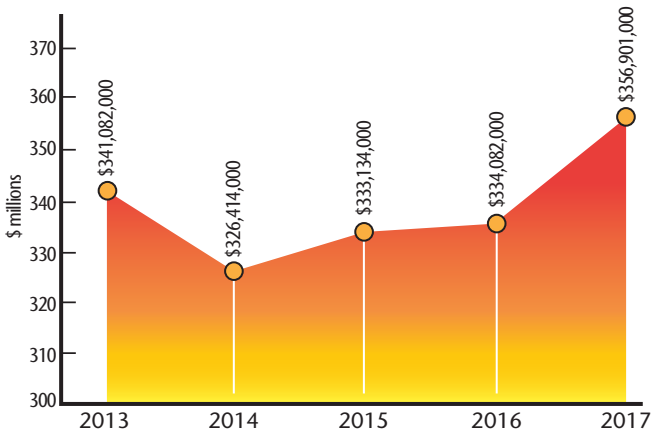
Total research and development expenditures

FY 2017 $356,901,000

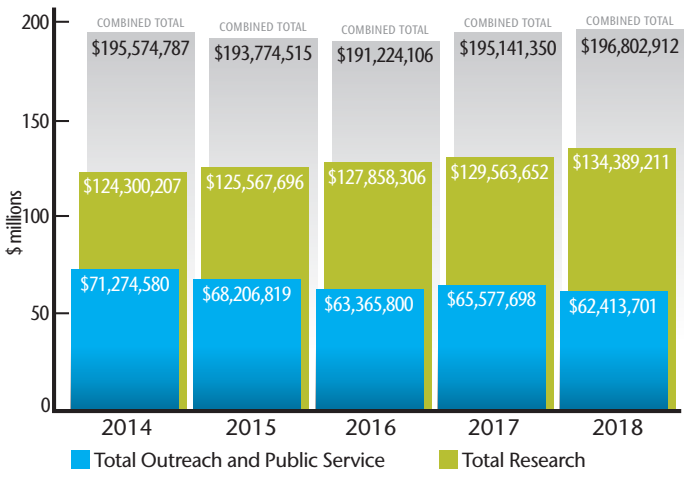
Sponsored project expenditures

FY 2018 Federal: $152,457,001
Non-federal: $44,345,911

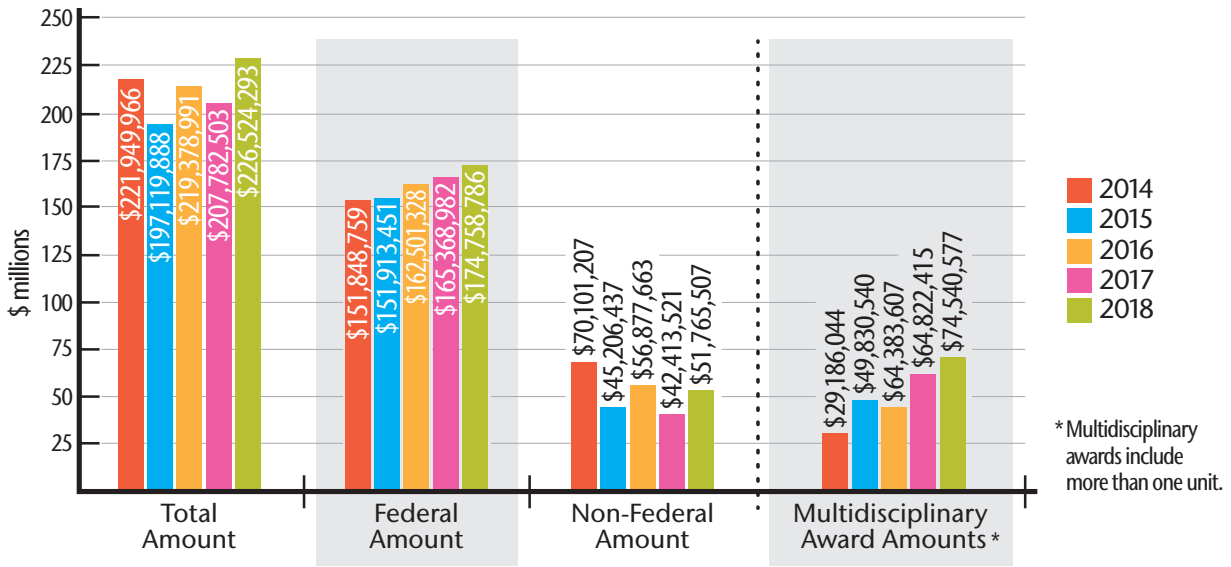
Research and development expenditures



Research vs. outreach and public service

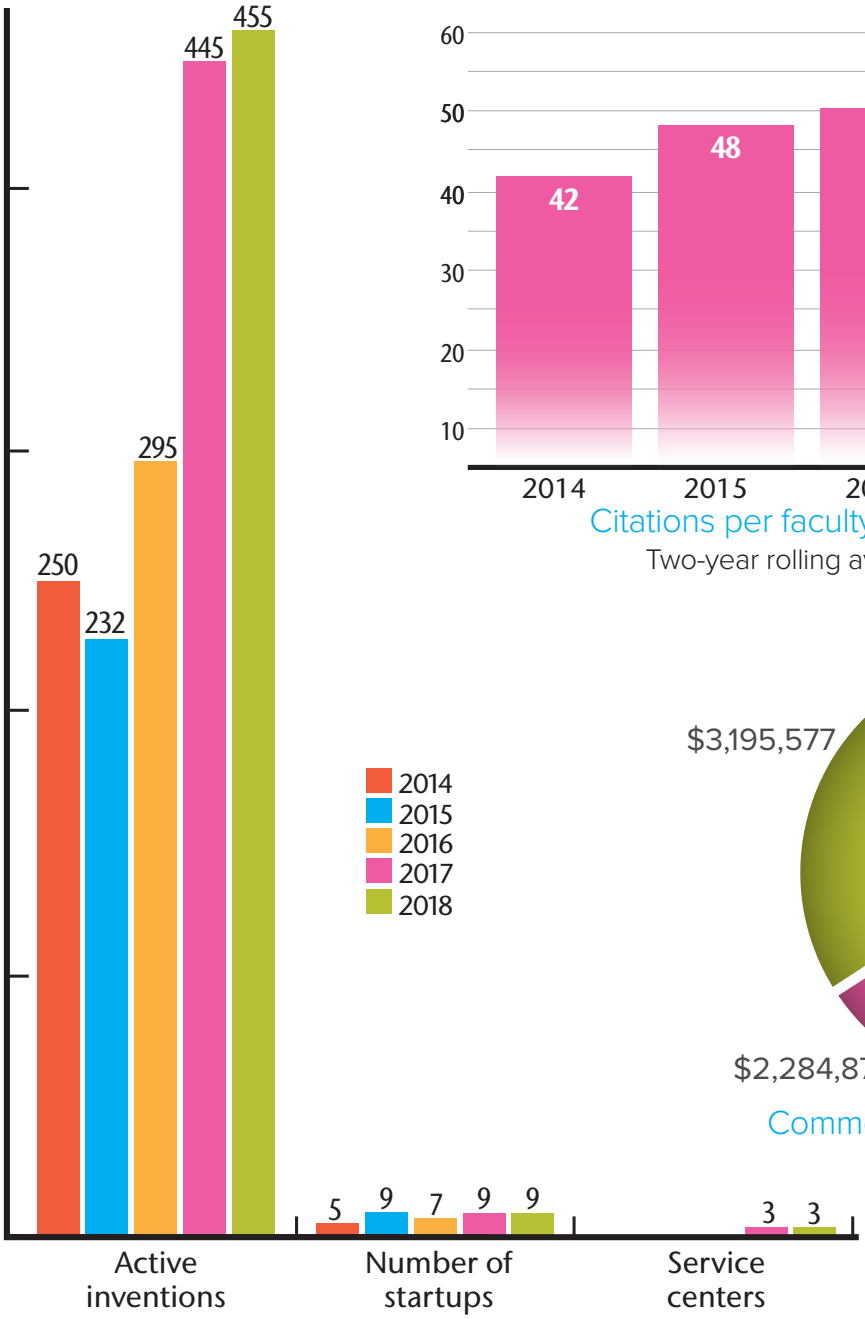


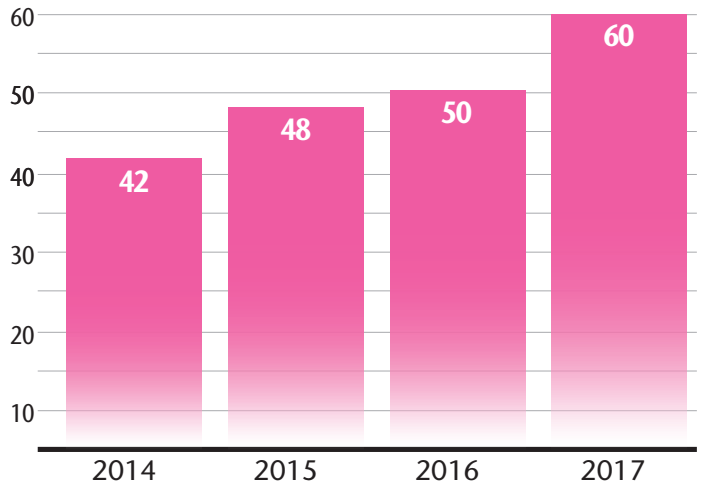
Awards Received



* Multidisciplinary awards include more than one unit.

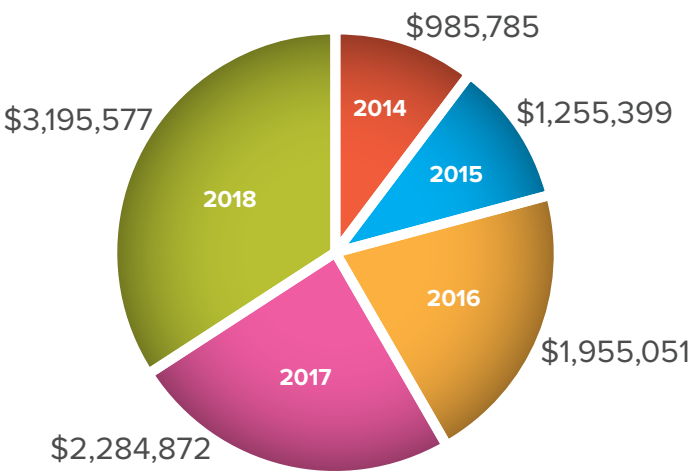
Commercialization on the rise FY14–FY18





Citations per faculty member

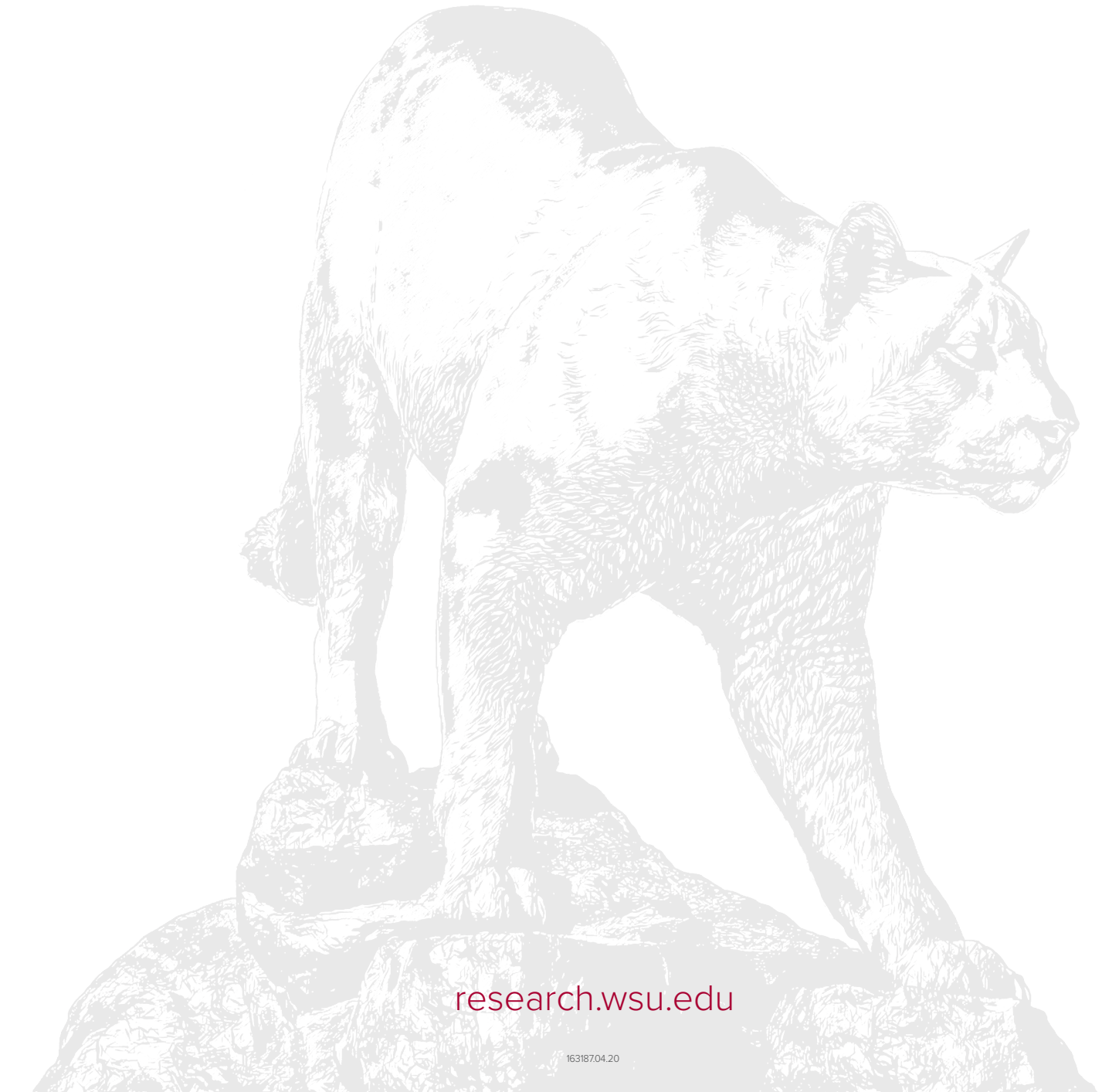
Two-year rolling average



Commercialization royalty revenue

WASHINGTON STATE UNIVERSITY

Everett | Extension | Global | Pullman | Spokane | Tri-Cities | Vancouver



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