

# LEADING INDICATORS

2015 ANNUAL REPORT OF RESEARCH

**Oregon State**  
UNIVERSITY



# ENDURING Questions

Research advances human well-being

**W**hen I was an undergraduate at the University of Iowa, an opportunity to do research changed my life. I worked at a biological field station in Panama, leading a tropical forest census during the day and discussing science with sophisticated researchers in the dining hall at night. I came away inspired by their insightful research, and believing that it could help make the world a better place.

Research experiences are indeed transformative. Oregon State University excels at providing students — both undergrads and graduates — with extraordinary research opportunities. Research as a way of learning deepens our understanding and enriches our education programs. Students challenge themselves in labs, in the field and through partnerships with business and industry. They engage in a great scientific tradition that is guided by perception, imagination and transparency.

The rich history of research, creativity and innovation is directly connected to the quality of life that we enjoy in the United States. Discovery and invention arise from basic research — that is, the ability to ask “what if” questions. Research contributes to rapid advances in applied areas of economics, human health and resource management. Students are critical to the research and development mission of the OSU campus.

It is human nature to ask about how things work, how we came to be and why we are here. Our students learn that research provides tools to understanding these enduring questions.

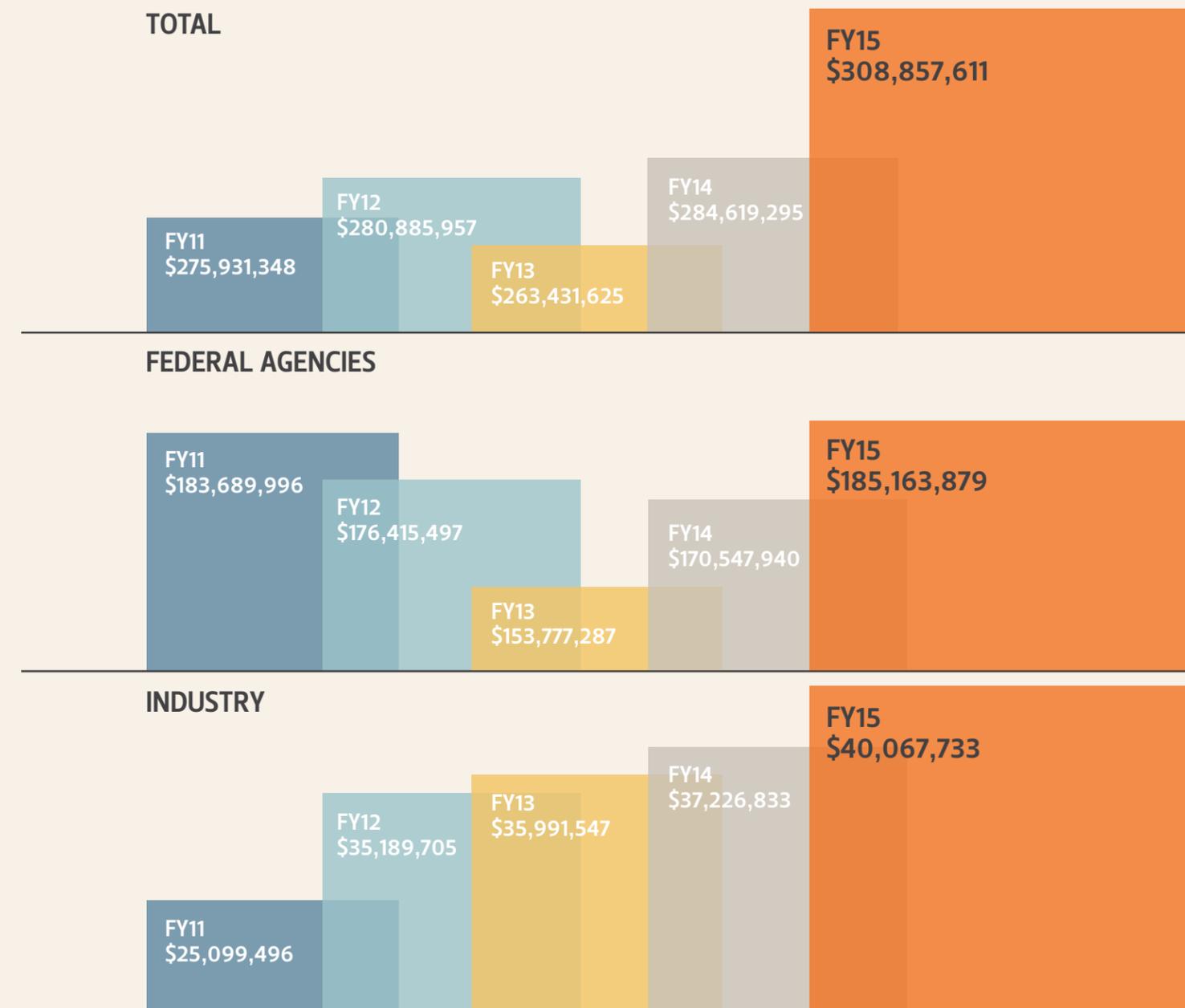


**Cynthia Sagers**  
Vice President for Research

On the cover:

A light sculpture reminds us that beauty stems from creativity in science as well as art. This polychromatic glow illuminates Oregon State's Linus Pauling Science Center. Artist Stephen Knapp lives in Boston.

## RESEARCH GRANTS AND CONTRACTS



Oregon State University research funding reached \$308.9 million, its highest level ever, in the 2015 fiscal year, which ended June 30.

A near doubling of revenues from licensing patented technologies and an 8.5 percent increase in competitive federal funding fueled research on a range of projects including advanced ocean-going research vessels, the health impacts of pollution and sustainable materials for high-speed computing.

“This is a phenomenal achievement. OSU research is solving global problems and providing innovations that mean economic growth for Oregon and the nation,” said Cynthia Sagers, OSU’s vice president for

research who undertook her duties on Aug. 31. “OSU’s research performance in the last year is amazing, given that federal funds are so restricted right now.”

The overall economic and societal impact of OSU’s research enterprise exceeds \$670 million, based on an analysis of OSU’s research contributions to the state and global economy that followed a recent economic study of OSU’s fiscal impact conducted by ECONorthwest.

Other statistics (monthly award data, awards by sponsor type, invention disclosures) are available at [research.oregonstate.edu/research-office-dashboard](http://research.oregonstate.edu/research-office-dashboard).



# MACHINE Learning

Autonomous systems gather momentum

**T**hey come by air, by land and by water: quadcopters, flying wings, walking robots, undersea gliders, driverless 4-wheelers and tractors. In the Northwest, these mobile machines will increasingly monitor farm fields, vineyards and wildfires; gather data under the ocean; look for landslides; and inspect bridges.

“This is a quickly evolving industry that already includes about 80 businesses in Oregon,” says Ann Schmierer, director of industry partnering. She is the co-leader of Oregon State University’s Autonomous Systems Research Group with Rob Holman, professor in the College of Earth, Ocean, and Atmospheric Sciences.

Last summer, 200 representatives of companies, agencies and research labs gathered at Oregon State for the first Autonomous Systems @ OSU conference.

They discussed recent technology advances and traded ideas for future collaboration. They heard from OSU scientists and engineers who are developing robots that walk like birds and pushing the boundaries of lightweight, efficient motors.

Oregon State was instrumental in establishing three Federal Aviation Administration-approved test ranges in Oregon. And OSU is one of 15 universities in the nation that comprise the FAA Center of Excellence for Unmanned Aerial Systems Research, which is headquartered at Mississippi State.

“Our researchers specialize in data analytics, sensing technologies, communications and robotic systems,” says Schmierer. “As this industry develops, OSU is providing the research underpinnings to support commercial use and adoption of these technologies.”

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# Citizenship ON THE LINE

Opportunities and obligations in times of crisis

**W**hat does it mean to be a citizen during war time? How do our historical responses to conflicts at home and abroad affect political decisions today? What guides our moral decisions as a nation? Through the Citizenship and Crisis Initiative, Oregon State researchers are engaging scholars and the public in these and other enduring issues across the state and nation.

“We seek to understand the context in which the contemporary world is situated, and for this, we rely on historical and philosophical knowledge, political science, religious studies, literary studies, ethnic studies, sociology, rhetoric, and more,” says Christopher McKnight Nichols, the initiative’s director and the author of *Promise and Peril: America at the Dawn of a Global Age*, published by Harvard University Press.

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With Oregon Public Broadcasting, the Oregon Historical Society, the Portland Art Museum and other partners, Nichols and his colleagues are exploring issues such as guns and the Constitution, civil rights, criminal justice and the changing obligations of citizenship.

In May 2016, the program will bring top U.S. scholars, such as Pulitzer Prize winning Harvard historian Fredrik Logevall, to Oregon State to participate in a national event: the Rethinking Grand Strategy International Conference. Nichols, who was elected to a lifetime seat on the Council of Foreign Relations last summer, says one outcome will be an edited volume on American foreign policy, diplomacy and international relations.

See more at <http://liberalarts.oregonstate.edu/shpr/citizenship>.



# TEAM Innovation

Researchers walk on the business side with I-Corps

**A**dvances in the lab can generate excitement among researchers, but getting entrepreneurs interested in new technology takes a special set of skills. Scientists and engineers who excel in their chosen fields are often outside their comfort zone in the business world, says John Turner of the Oregon State University Advantage program and College of Business.

To help researchers connect with businesses, Turner led the creation of the OSU I-Corps program, one of 26 such endeavors around the nation funded by the National Science Foundation.

“I-Corps provides access to training and expertise that can help scientists and engineers learn the language of business,” says Turner. “It’s a matter of changing their perspective. I-Corps fosters the commercial success of promising inventions.”

Three spinoff businesses — Waste2Watergy (microbial fuel cells), Beet (high-efficiency solar

cells) and Tendon Network (treatment for hand and wrist injury) — have participated in technology commercialization training sessions sponsored by the NSF.

“I-Corps really gave me confidence in our technology,” says Hong Liu, associate professor of biological and ecological engineering who co-founded Waste2Watergy with Yanzhen Fan, her husband and OSU colleague. “We started the company after attending the I-Corps workshop.”

Karl Mundorff, senior program manager for the division of business and engineering at Oregon State, mentors spinoff businesses and values I-Corps as an opportunity to determine the commercial viability of laboratory innovations. “We see the OSU I-Corps program as a way to take even more technology from the university to market,” says Mundorff.

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# Real-World CHECK UPS

Epidemiologists investigate community health

**W**hen you get sick, you go to a doctor for treatment. But when a community experiences high rates of heart disease, heat stress or low-birth-weight babies, the prescription can get more complicated.

Researchers in Oregon State University’s epidemiology program — the science of population health — tackle these and other issues: respiratory illness and air pollution, arsenic in water, heat illness in migrant workers and wellness in aging adults.

“We look at the factors that affect health at a community or population level,” says Viktor Bovbjerg, leader of the program in the College of Public Health and Human Sciences. “We are involved in controlled experiments and clinical trials, but at least as often, we study what happens in the real world.”

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For example, the number of centenarians is expected to increase ten-fold over the next century, according to the National Institute on Aging. And as lifespans lengthen, older people face increasing risks of cancer, cardiovascular disease and dementia. “There are a lot of unknowns about how to promote health in very old age,” says Michelle Odden, a cardiovascular epidemiologist.

“The main messages for my research are: 1) you shouldn’t treat an 80-year-old like you would treat a 50-year-old; and 2) perhaps more challenging, you shouldn’t treat 80-year-old Sophie like you would treat 80-year-old Mary. One size does not fit all when it comes to prevention in old age.”

Bovbjerg adds, “We uncover patterns that predict good or bad health outcomes for a population. That’s key to our work.”



Illustration courtesy of LEVER Architecture

## Innovative Wood Products for the Northwest

Cross-laminated timber (CLT) panels will provide a structural core in this architect's rendering of the winning entry in the National Tall Wood Building Prize Competition from LEVER Architecture of Portland. Dubbed Framework, the 12-story building is proposed for the city's Pearl District.

The DR Johnson Lumber Company of Riddle is the first manufacturer of structural CLT panels for the U.S. construction market. Oregon State researchers work with the company to demonstrate CLT performance characteristics in building systems so the panels can be certified for commercial use.

CLT is just the start of innovative wood products that could revitalize the Northwest wood-products industry. Scheduled to be built on Oregon State's Corvallis campus in 2016, the new Oregon Forest Science Complex will exponentially expand facilities for research expertise in wood science, engineering and architecture. See [bit.ly/1GmhGsC](http://bit.ly/1GmhGsC).



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