

LEADING INDICATORS

2016 ANNUAL REPORT OF RESEARCH

Oregon State
UNIVERSITY



FEARLESS

OSU researchers break records — again

Photo: Alvin Katek

During my first year as the vice president for research at Oregon State University, I had the opportunity to learn much about the university's research enterprise and to be inspired by the work that takes place here every day.

My first and strongest impression from this past year on the job centers on our Oregon State faculty. Quite simply, they are fearless — fearless in tackling some of our planet's most pressing problems. From climate change and food security to renewable energy and earthquake resilience, OSU researchers are at the leading edge of their respective fields.

For the second straight year, Oregon State research funding set a new record. In the fiscal year that ended June 30, researchers earned \$336 million in grants and contracts. This accomplishment is testament to our faculty's expertise and dogged quest for discovery.

The culture of collaboration across disciplines distinguishes our faculty and contributes to

OSU's success. This unique community fosters discovery, creativity and innovation and inspires new scientists, engineers and teachers who come to Oregon State from around the world.

I hope you will enjoy reading Oregon State's "Leading Indicators: 2016 Annual Report of Research." In addition to our numbers, this annual report has information about discoveries involving the world's coral reefs, new approaches to cancer treatment and earthquake resiliency efforts.

Moving forward, the challenge for Oregon State is to do even better. I am committed to finding the resources and the support our faculty needs to continue its exceptional pursuit of knowledge.



Cynthia Sagers
Vice President for Research

On the cover: Lines converge and shift on this wall sculpture as a viewer's perspective changes. Artists Bill Washabaugh and Jeff Lieberman created *Constructive Interference* in 2015 for the new Learning Innovation Center at Oregon State University.

RESEARCH GRANTS AND CONTRACTS

Oregon State University research funding reached \$336 million in the fiscal year that ended June 30 — a second consecutive year of record-breaking growth and an increase of more than 60 percent over the past decade

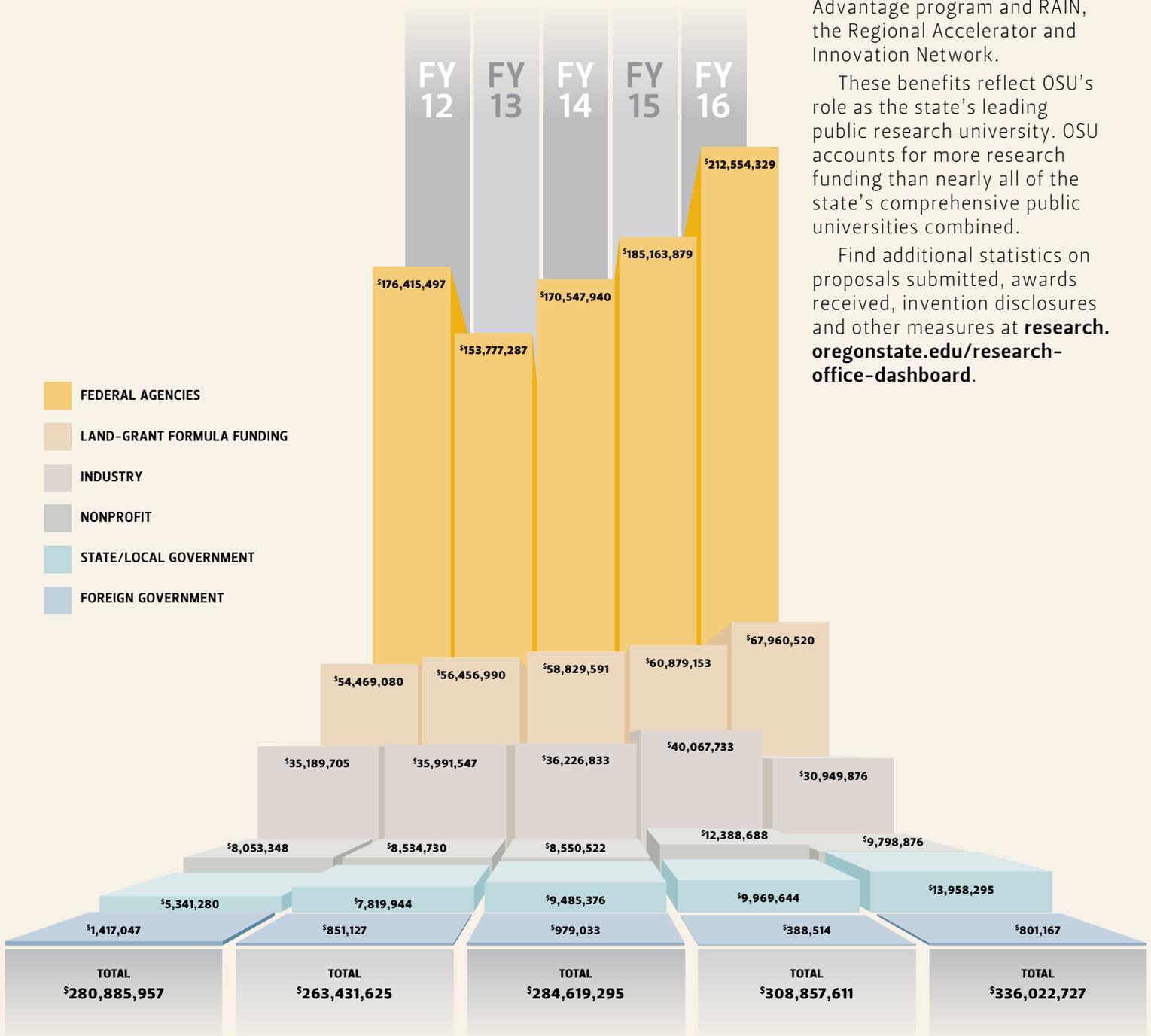
In 2006, the university garnered \$209 million from state, federal and private-sector sources. Since then, OSU has received research revenues totaling more than \$3 billion. In the last

year, Oregon State researchers brought in \$27 million more from all sources than they did in 2015.

Researchers leverage these funds to produce results that are finding their way into businesses, fueling economic growth. For example, two newly formed companies — Agility Robotics and e-Msion, Inc. — have grown out of OSU labs with help from the Oregon State University Advantage program and RAIN, the Regional Accelerator and Innovation Network.

These benefits reflect OSU's role as the state's leading public research university. OSU accounts for more research funding than nearly all of the state's comprehensive public universities combined.

Find additional statistics on proposals submitted, awards received, invention disclosures and other measures at research.oregonstate.edu/research-office-dashboard.





FEEDING FRENZY

An urban lab primes Oregon's food economy

Consider some of Oregon's most mouthwatering home-grown food innovations: Ruby Jewel ice cream sandwiches, Kombucha Wonder Drink, Chez Marie veggie patties. The success of these and other products from Oregon's diverse agricultural community stems in part from the expertise of an unusual urban incubator: Portland's Food Innovation Center (FIC).

This partnership between Oregon State University and the Oregon Department of Agriculture brings science, sensory testing, product development and food safety training to assist entrepreneurs and businesses in commercializing their products. In the center's kitchens and labs, FIC researchers and product-development specialists work with clients to combine culinary creativity with technical savvy. Since opening in 2000, the center has contributed to the development of hundreds of new food products.

"It's an exciting time to be working around food," says Dave Stone, director of the Food Innovation Center. "People are paying more attention to what's in their food, where it comes from, and how it's made. The FIC is positioned to help address the quality, sustainability and safety of foods from the Northwest and beyond."

Stone and his team welcome inquiries from entrepreneurs and food-product manufacturers. The FIC's services include ideation sessions for product development, product formulation, culinology, shelf-life testing, packaging opportunities, market analysis and the sensory and consumer testing of products.

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CIVIC DUTY

School of Public Policy helps communities make decisions

Policymakers face daunting challenges everywhere they look: health care, the environment, energy, the economy, public safety, transportation, housing. Concerns over taxes, civil rights and sustainability frame approaches to pressing issues and set the stage for political compromise.

To help solve difficult problems, researchers in the Oregon State School of Public Policy (SPP) work with communities, schools, nonprofit organizations and government agencies. They apply economic, political and sociological analyses to topics such as border enforcement, energy security and water distribution under a changing climate. In graduate and undergraduate projects, students work with faculty mentors to tackle social justice, homelessness, municipal infrastructure and other issues.

“Our clients consistently praise the quality of work done by SPP students and are impressed by the students’ commitment to finding innovative yet professional solutions to the myriad problems they face,” says Denise Lach, co-director of the school and professor of sociology.

The organizations served by the school last year include the Corvallis School District (unintended cultural bias in programming), the City of Creswell Municipal Airport (long-term strategic plan), the Eugene Water and Electricity Board (micro-grids for emergency power) and the OSU Sustainability Office (carbon action plan).

Through the SPP Policy Analysis Laboratory, students and faculty interview experts, listen to citizens, gather data, analyze options and offer recommendations. Among the topics they have tackled are fire-related forest management, environmental sustainability, energy siting, criminal justice, social services and regional transportation.

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TARGETING CANCER

Light, nanotechnology and the ocean offer new approaches to a stealthy disease

Photo: Michael Bonert

The complexity of cancer poses a persistent challenge to physicians and biomedical researchers. As it mutates and evolves, this stealthy disease outwits our attempts at control. For experimental and treatment purposes, Oregon State scientists are developing new tools based on the machinery of cancer cells and the ability of products from nature to put a wrench into cancer's DNA.

In Corvallis and at the Collaborative Life Sciences Building in Portland, researchers are working with promising anti-cancer compounds, including some made by marine organisms. Scientists are designing molecules that can lock onto cancer cells like a laser-guided missile and deliver a lethal payload. They are testing other compounds that cause cancer cells to fluoresce like a neon sign and to help guide a surgeon's knife.

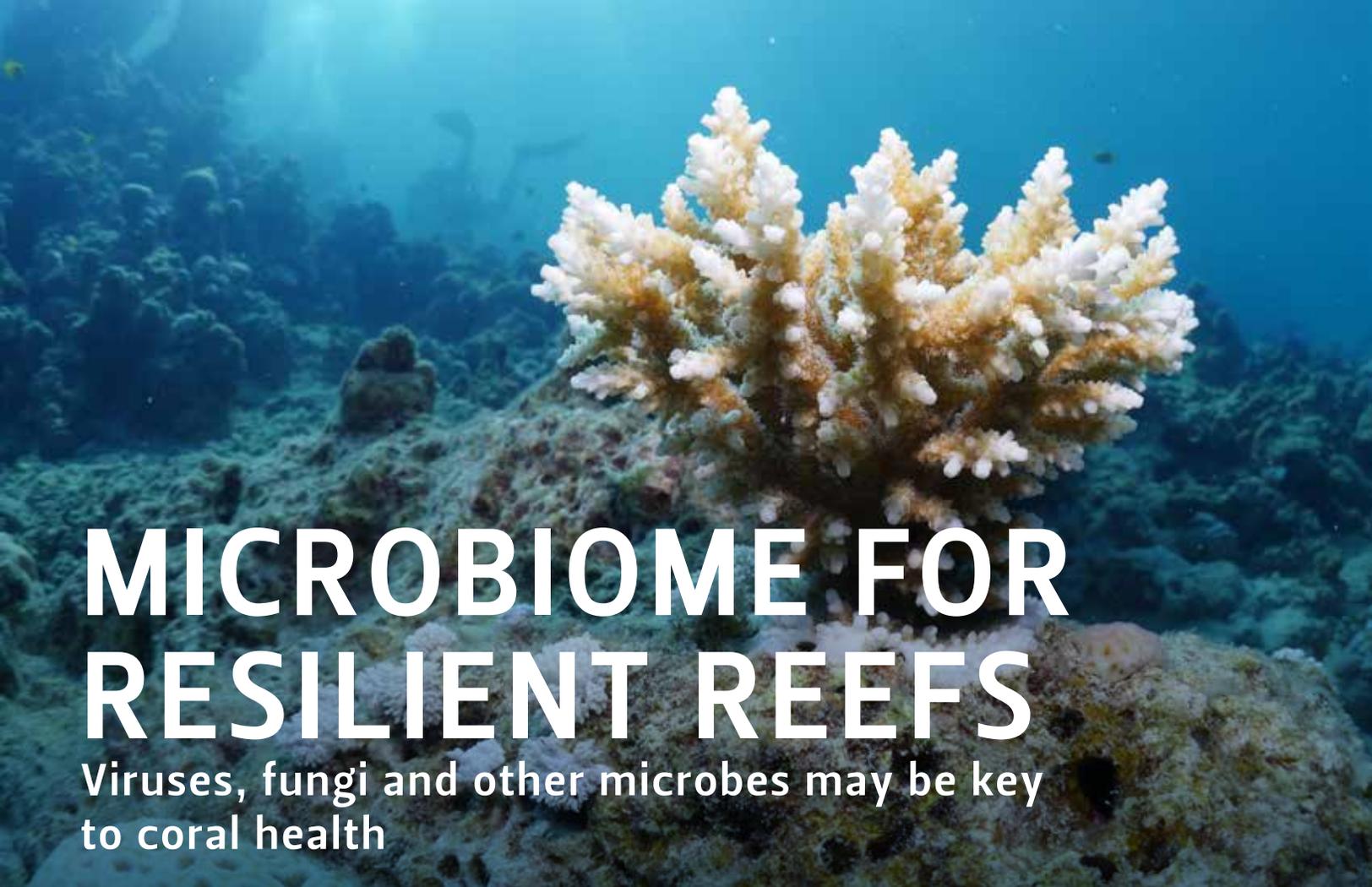
Meanwhile, colleagues are developing new drugs to treat glioblastoma, an all-too-deadly form of brain cancer, and teasing out early warning signs —

biomarkers — that can be detected in the earliest stages of disease. Studies in nutrition, the immune system and human behavior offer additional insights into cancer prevention and control.

“OSU has over 60 investigators in seven colleges and institutes that work on various aspects of cancer — from prevention and early detection to treatment and survivorship,” says Mark Zabriskie, dean of the College of Pharmacy. “OSU encourages and supports collaborative cross-disciplinary work, and this environment contributes to the breadth of our cancer research and the impact of these discoveries.”

This research benefits from access to a large collection of chemical compounds available through the Oregon Translational Research and Development Institute (OTRADI), allowing scientists at OSU and other Oregon institutions to assess new targets for cancer treatment.

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MICROBIOME FOR RESILIENT REEFS

Viruses, fungi and other microbes may be key to coral health

Underwater, bleached corals are hard to miss. The ornate structures — once lemon yellow, dark purple or mossy green — turn a ghostly white when coral animals expel the phytoplankton that normally provide them with food. While reefs can recover, repeated bleaching can be fatal. Nearly a fifth of the world’s reefs have already died. Scientists estimate that nearly a fifth of the world’s reefs have died in the last 30 years.

But a reef is more than coral and plankton. Other microorganisms play a role. Viruses and bacteria, fungi and archaea also live in the neighborhood, a community that researchers call the coral microbiome. Scientists know little about what these organisms do and how they affect the health of the reef.

With support from the National Science Foundation, Rebecca Vega Thurber, assistant professor in the Department of Microbiology, is analyzing coral microbiomes across the world. With samples from the western Pacific, the Caribbean, the Red Sea and other locations, she and her team of students and post doctoral researchers endeavor to understand how microorganisms interact with corals. It’s possible they might contribute to reef decline or help protect corals from the stresses related to pollution, storms, overfishing and ocean warming.

“Coral species differ in their susceptibility to bleaching and disease,” says Vega Thurber, “but these differences are only partially explained by the evolutionary history of corals.” Better understanding of the coral microbiome could lead to new methods for conserving reefs, which are vital to ocean biodiversity and to commercial fisheries.

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CASCADIA LIFELINES

Preparing for the next big earthquake

Photo: Mei MG

When the next Cascadia subduction zone earthquake hits, damage will be catastrophic. Buildings, bridges, pipelines, roads and other infrastructure — in addition to millions of people — are at risk. However, by understanding the forces at work and how structures will respond, the impacts can be minimized and lives will be saved.

That's why Oregon State University's Cascadia Lifelines Program has drawn the support of utilities, government agencies and businesses with a stake in repairing the damage and restoring services as quickly after the quake as possible.

"We aim to make our lifelines more resilient when the quake hits," says Dan Cox, director of the program and professor in the College of Engineering. "That means two things. Number one is to lessen the immediate impact of the event — figuring out how to keep road and bridges intact — and then to help businesses and communities recover as quickly as possible."

Researchers are identifying high-priority needs and conducting projects that lead to greater understanding of landslides, soils and the performance of bridges, buildings and pipelines under seismic stress.

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