

## Research Briefing

### BACKGROUND

Oregon State University is a leader in conducting research, producing knowledge and generating innovations that contribute to addressing global grand challenges, particularly in the university's three signature areas; training the next generation of scientists and scholars; and contributing to the economic growth and prosperity of Oregon and beyond.

This report summarizes the university's progress in reaching its research goals, describes special initiatives aimed at advancing the research enterprise, and discusses research-related opportunities and threats facing the institution.

### RESEARCH AT OSU

Research activity at OSU is grounded in the colleges, schools and departments, as well as in the centers and institutes. The Research Office (RO) is the central arm of the university organized to support and enable research and includes three main functional areas:

1. The *Office of Sponsored Research and Award Administration (OSRAA)* supports the full lifecycle of research administration, including proposal submission, award negotiation and acceptance, and management and closeout of awards.
2. The *Office of Research Integrity (ORI)* oversees compliance with federal, state and OSU regulations and policies, as well as with grant and contract obligations, supporting faculty on compliance issues on human subjects and animals, boat and dive safety, research conflict of interest, and responsible conduct of research.
3. The *Office for Commercialization and Corporate Development (OCCD)* develops intellectual property strategies, executes licenses and industry sponsored agreements, provides resources to support the launch of student, faculty, and community led startups, and drives innovation and entrepreneurship through its Advantage Enterprise program.

In addition, the RO helps to build collaborations, identifies and disseminates funding opportunities, manages resources dedicated to fund research equipment, coordinates "limited submission" opportunities and faculty outreach activities; assists researchers in navigating the complex environment of export regulations and international laws; and oversees 20 cross-university centers, institutes, and core facilities.

### RESEARCH AND SP4.0

SP4.0 captures the university's research mission most directly in Goal 1—*preeminence in research, scholarship, and innovation*. However, research is also a key contributor to the strategic plan's three other goals. Goal 2—*transformative education that is accessible to all learners*—envision faculty integrating research and teaching and providing experiential learning opportunities through participation in research. A key means of achieving Goal 3—*significant and visible impact in Oregon and beyond*—is delivering economic impacts that originate from OSU research and innovation. Finally, a high quality and supportive research environment is critical to the long-term success of tenure-track and fixed-term faculty (relevant to Goal 4—*a culture of belonging, collaboration, and innovation*).

**METRICS**

There are several metrics by which universities track success in attracting funding, conducting research, and generating economic impact. Below is an analysis of these key metrics and associated data that are used to track research performance and economic impact nationally.

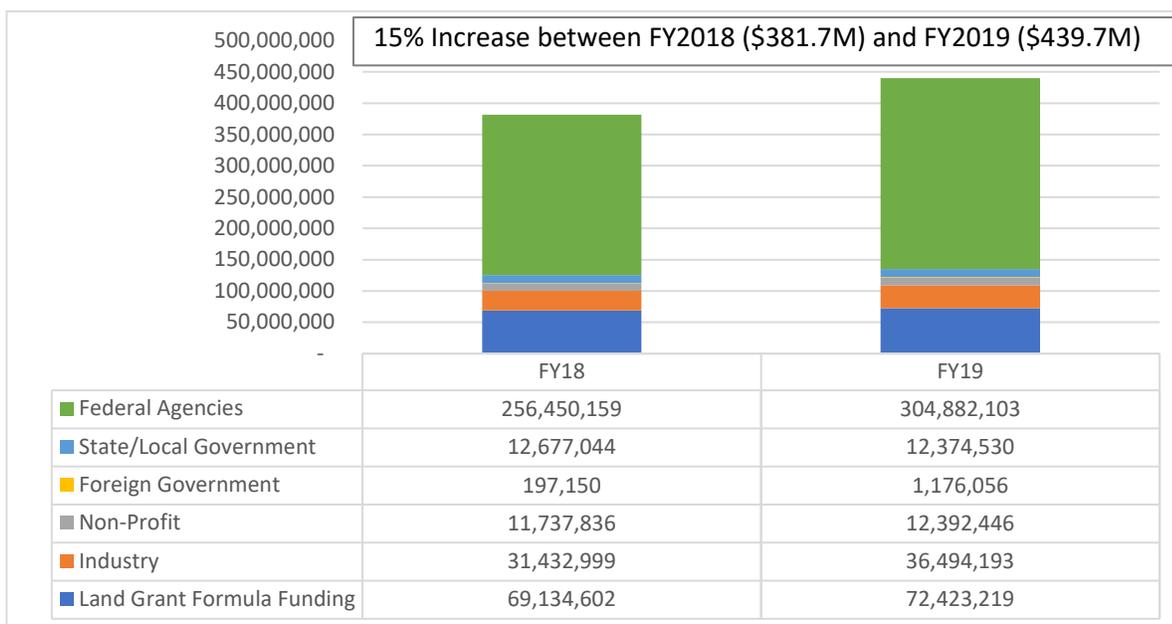
**Research Performance**

***Research and Development Awards and Expenditures***

OSU has seen increases in total research and development revenue over the past fiscal year. Progress is tracked by standard metrics that are used nationally. OSU recorded \$439.7M in research grants and contracts for FY2019, an increase of nearly \$58M (or 15%) over FY2018 (and an increase of 54.5% since FY2014). Federal funding of \$305M accounts for 69% of FY2019 research grants and contracts, an increase of \$49M, or 19%, from FY2018 (and an increase of 78% since FY2014). The remainder of OSU’s research funding comes from land-grant formula funds (17%), industry (8%), and nonprofits, state/local governments and foreign governments (a total of 6%) (see Figure 1).

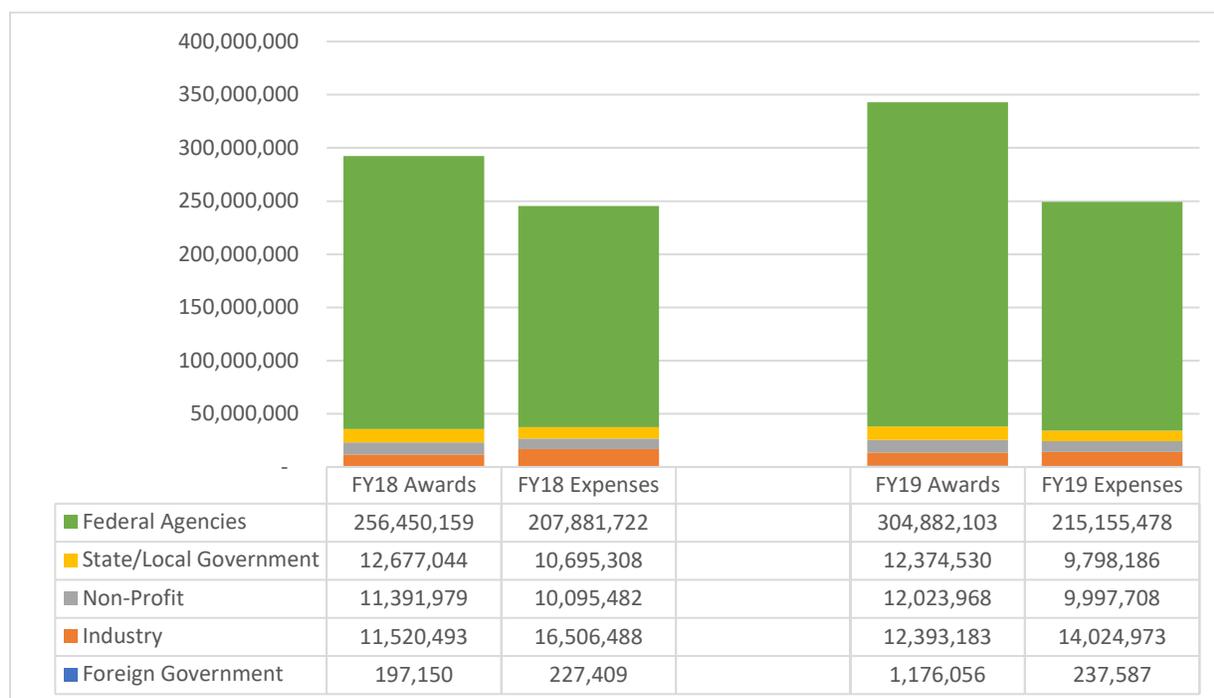
Although *awards* give a good indication of the current health of the research enterprise, *expenditures* are less skewed by large one-time awards (such as the Regional Class Research Vessel award, RCRV) that tend to be awarded in a few large increments, but expended more uniformly. The expenditure data show that the average growth rate in expenditures associated with federal awards over the last 6 years has been approximately \$9M per year. Roughly a third of the FY2019 expenditures are associated with awards from the National Science Foundation, with sizable portions from the US Department of Agriculture (~20%) and NASA and the departments of Energy, Defense, Health and Human Sciences (~5-10%) (see Figure 2).

**Figure 1. FY2018 and FY2019 Research and Development Revenue by Sponsor Type – includes all financials directly and indirectly related to research**



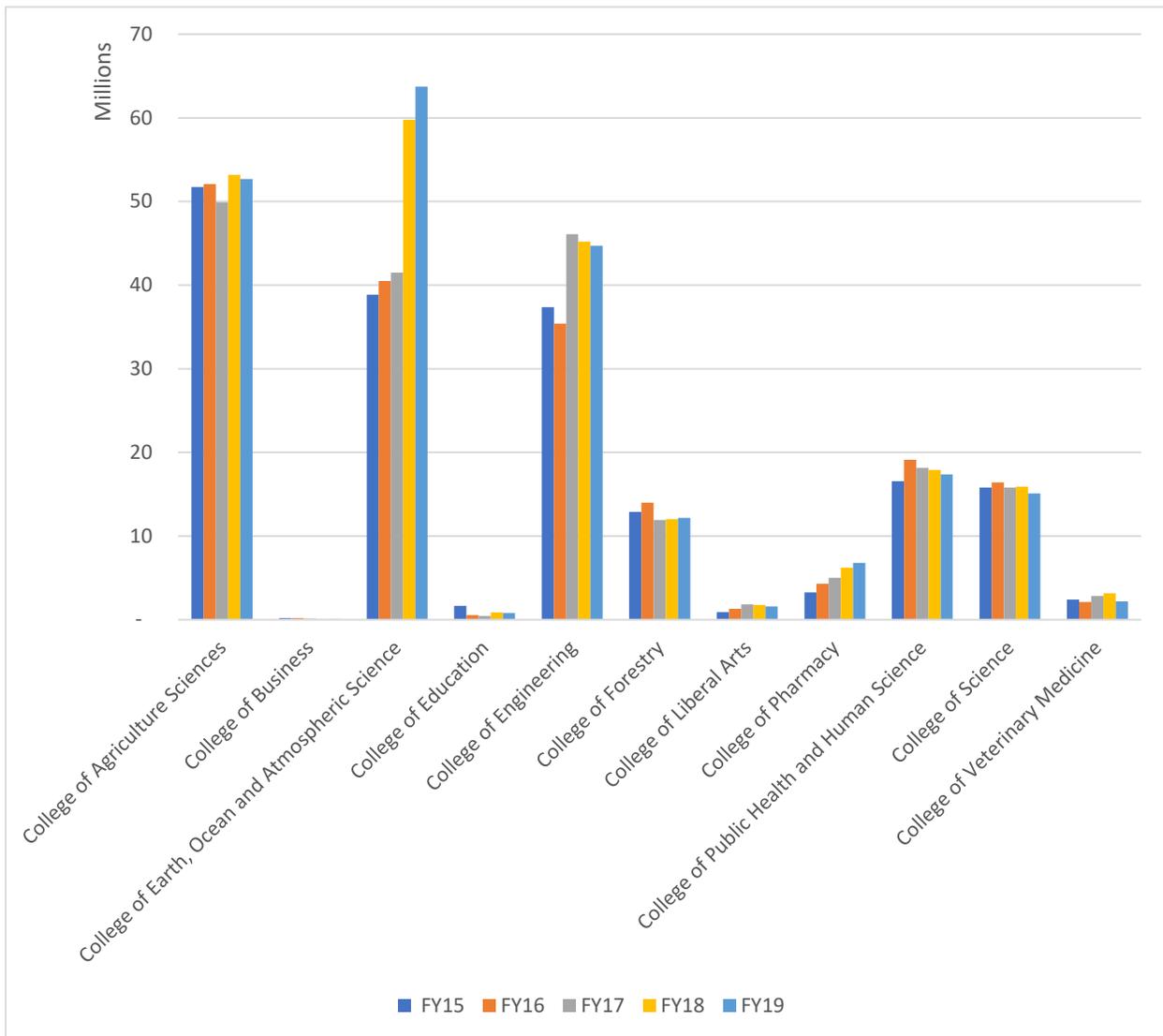
Source: Office of Research Annual Award Data. Note that this data includes sponsored project awards managed in the RO as well as Foundation gifts, testing, licensing revenues in support of industry research, Federal and State Land-grant formula funding.

**Figure 2. FY2018 & FY2019 Research Awards and Expenditures by Sponsor Type**



Funding trends over the last five fiscal years by college (Figure 3) indicate that colleges conducting the most funded research are Earth, Ocean, and Atmospheric Sciences (CEOAS); Agricultural Sciences (CAS); and Engineering (COE), with annual research expenditures in the range of approximately \$45M to \$65M. However, the colleges of Public Health and Human Sciences (CPHHS), Science (COS), and Forestry (COF) also have sizable programs in the range of \$12M to \$17M, with the remainder of the colleges reporting annual expenditures up to \$7M. Note that several colleges experienced significant increases in research expenditures in the past 5 years, including CEOAS, Engineering, and the College of Pharmacy (COP), with multiple large awards in the past year alone. In interpreting trends by college, it is important to recognize that external funding available to support research and creative work in the social sciences, arts, and humanities is extremely limited.

**Figure 3. FY2015-19 Total Research Expenditures by College**



*All restricted funds administered by the Research Office (includes Other Sponsored Activities). Does not include funds administered by Business Affairs or Business Centers (endowments, gifts, construction, financial aid, statewides).*

**Innovation and Economic Impact**

Progress in delivering innovation and economic impact is tracked using three main metrics: inventions, licensing revenues, and industry sponsored research awards. Results for FY2018 and 2019 for each college are shown in Table 1.

***Invention Disclosures***

The university tracks progress of faculty entrepreneurship and innovation in support of promoting economic growth and social progress using the number of invention disclosures. On average OSU research produces more than 70 invention disclosures with commercial potential each year. The trend in receiving invention disclosures had been fairly flat, but grew 10% in FY2018 and by another 10% in FY2019. The majority of this growth comes from the colleges of Engineering, Agricultural Sciences, Science and Pharmacy.

***Licensing Revenues***

The university also tracks licensing revenue leveraged per appropriated dollar for statewide public service programs, and revenue normalized with research expenditures, all viewed as an average over a five-year period. OSU licensing revenues equal 2.4% of research expenditures, compared to the national average of 1%.

***Industry Research***

The university tracks industry sponsored research, which increased 13.6% between FY2018 and FY2019 as well as internships and connections for students, industry access to services and testing, and gifts. In FY2019, combined industry revenue contributed over \$36M as grants and contracts, product testing, and licenses and royalties for the use of patented technologies. This is an increase of \$5 million or 16% over FY2018.

<b>Technologies Disclosed</b>	<b>FY18</b>	<b>FY19</b>
College of Agricultural Sciences	21	24
College of Business	-	-
College of Earth, Oceanic, and Atmospheric Science	1	-
College of Education	-	-
College of Engineering	37	29
College of Forestry	3	2
College of Liberal Arts	-	1
College of Pharmacy	8	15
College of Public Health and Human Sciences	2	-
College of Science	11	14
College of Veterinary Medicine	3	1
<b>Total</b>	<b>86</b>	<b>86</b>
Unduplicated Total	77	80
<b>Licensing Revenue</b>	<b>FY18</b>	<b>FY19</b>
College of Agricultural Sciences	2330305.93	2135811.43
College of Business	-	-
College of Earth, Oceanic, and Atmospheric Science	15933.26	-
College of Engineering	710928.61	1881686.69
College of Forestry	643016.34	67257.49
College of Liberal Arts	-	-
College of Pharmacy	300347.66	174795.65
College of Public Health and Human Sciences	7533.72	7315.55
College of Science	157955.56	88585.34
College of Veterinary Medicine	5000	-
Centers & Institutes	230165.86	35219.3
<b>Total</b>	<b>4401186.94</b>	<b>4390671.45</b>
<b>Industry Sponsored Research</b>	<b>FY18</b>	<b>FY19</b>
College of Agricultural Sciences	677537	1175714
College of Business	-	-
College of Earth, Oceanic, and Atmospheric Science	-	-
College of Education	20000	-
College of Engineering	3262488	3706261
College of Forestry	99749	250000
College of Liberal Arts	-	-
College of Pharmacy	16153	600113
College of Public Health and Human Sciences	49179	93489
College of Science	287489	10220
College of Veterinary Medicine	512852	142130
Centers & Institutes	411502	200000
<b>Total</b>	<b>5336949</b>	<b>6177927</b>

**Table 1. FY2019 and FY2018 Inventions, Licensing Revenues, and Industry Sponsored Research Awards by College**

## SPECIAL INITIATIVES & PROJECTS

The university prioritized the following actions in 2019 to strengthen its research endeavors.

### **Review of Processes, Policies and Efficiencies in Research Administration**

In FY2019, the RO began a major effort to benchmark its structure and operations against peers, review recommendations from existing external reviews, gather input from RO staff and university stakeholders, and incorporate feedback on the OSU research enterprise assembled through the SP4.0 development process. Significant progress has been made in improving processes and procedures to ensure administrative burdens on faculty are minimized and service to faculty and researchers is maximized. The RO conducted benchmarking and formal reviews, resulting in major reorganizations and personnel changes, which were implemented in both OSRAA and ORI, including changes in leadership, structure, and culture.

In OSRAA, various changes to processes and practices were implemented to minimize administrative burden on Principal Investigators (PIs), the college business centers, and RO staff, while still remaining compliant. For example, in coordination with other relevant offices at OSU and in consultation with outside partners to assure compliance, the implementation of facilities and administrative (F&A) costs on research grants were re-interpreted and moved to a simplified implementation, resulting in significant reduction in administrative costs. Other similar modifications to processes generated capacity to tackle more significant changes. A thorough evaluation of the budget and staffing needs resulted in the allocation of increased resources by the university for additional staff in OSRAA.

Work underway this year has also focused on how the university manages risk associated with research. In partnership with OSU's offices of the Controller and Audit, Risk and Compliance, the RO is engaging in more in-depth conversations on institutional risk to ensure compliant financial administration while also reducing administrative burden and the associated costs.

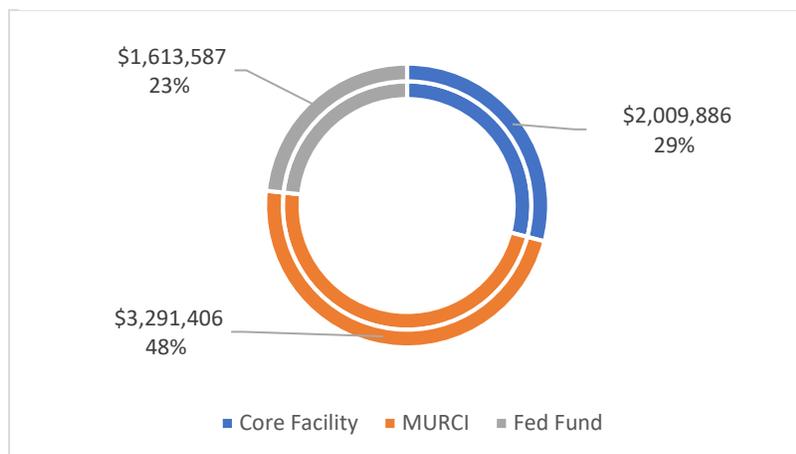
A thorough evaluation and reorganization of the Human Resource Protection Program (HRPP) and Institutional Review Board (IRB) was completed by bringing in an external consulting firm to evaluate practices and procedures. The office is in the process of implementing the consulting firm's recommendations to improve efficiency and partnership with university researchers, including adding staff positions and IRB alternate members to help reduce the backlog. Furthermore, the office began an audit of OSU's Research Conflict of Interest policy in collaboration with the Office of Audit, Risk and Compliance, drafted an export control policy, and created a new position to define policies and oversee practices around responsible conduct of research. Finally, the office completed an evaluation and reorganization of the Animal Program Office (APO) and Institutional Animal Care and Use Committee (IACUC), which has resulted in much-improved communication and collaborative problem solving.

Another major effort has focused on improving the climate and culture in the RO. This challenge was approached through a series of workshops and intentional and sustained conversations. This work has resulted in the development and articulation of four short-term priorities which emphasize the importance of adopting excellent partnering practices, both within the RO administration as well as with external university partners, developing sustainable solutions, and catalyzing research and innovation at the university while also focusing on making the RO a great place to work. These four priorities will continue to guide efforts to evaluate processes, identify efficiencies, assess staffing needs, develop our staff, match talent to task, and improve the office culture.

**Review of Centers and Institutes**

There are 20 university centers and institutes (C&Is) under the oversight of the Research Office. C&Is are established to provide faculty and students unique opportunities to build collaborations, conduct interdisciplinary research, and attract extramural support. Core facilities are also part of the Center and Institute portfolio at OSU and provide the spaces and labs to conduct cutting-edge research and enable student and faculty success.

**Figure 4. Research Office E&G Allocation by C&I type**



The support for Center & Institutes Education & General (E&G) Budget (\$9,602,318) can be broken down by type to show how much is allocated to core facilities (CF), Major University Research Centers and Institutes (MURCIs), and federally funded research centers (Fed Fund), distributed as shown in Figure 4. The majority of the support goes to MURCIs (48%). MURCIs are a subset of university research centers or institutes that are designated by the Board of Trustees, are funded and/or

report centrally, and are established on a continuing basis for the coordination, promotion, and funding of strategic university interests that transcend college and disciplinary boundaries.<sup>1</sup>

Until FY2019, the centers and institutes had been reviewed only occasionally and intermittently. In FY2019, the RO initiated a review of centers, institutes, and core facilities to assess their impact, efficiency, sustainability, and relevance to SP4.0 goals, working with the colleges and other partners as appropriate. Several of the facilities and centers have undergone an extensive formal review. A zero-based budgeting process is being implemented to ensure their financial sustainability and help consolidate resources. The Center for Lifelong STEM learning, the Center for Genome Research and Biocomputing, and Oregon Sea Grant underwent formal external reviews in the past year. In addition, OSU’s three mass spectrometry core facilities were reviewed in 2018 and the Electron Microscopy Core Facility underwent an internal audit and refinement of operational MOUs with the colleges in 2018 and 2019. For example, as a result of their review, the Center for Genome Research and Biocomputing is undergoing a university-wide strategic planning process to map out its mission and structure for the next five years, including plans for greater financial sustainability. These reviews and strategic evaluations will continue in the coming two years and inform possible changes to the MURCIs.

**Review of Research Facilities**

In FY2019, a third effort focused on assessment of the conditions of OSU’s research facilities and the allocation of available facility improvement funds. The condition of many of OSU’s research laboratories and facilities threatens to limit faculty research productivity and funding, potentially impacting our ability to recruit and retain top researchers. To better understand the status of research facilities, the office began an inventory of maintenance and renovation needs of some research facilities reporting to the Research Office. The university funded many

<sup>1</sup> For more information visit: [https://policy.oregonstate.edu/UPSM/06-010\\_research\\_centers\\_institutes](https://policy.oregonstate.edu/UPSM/06-010_research_centers_institutes)

improvements, including HVAC upgrades at the Mass Spectrometry Agricultural and Life Sciences Facility; facility improvements for the Autzen House, which houses the Center for the Humanities, improvements to animal facilities, and HVAC upgrades at the Radiation Center. In addition, the RO partnered with the Division of Finance and Administration (DFA) to ensure Hatfield Marine Science Center (HMSC) buildings and deferred infrastructure needs are included and planned for within the university's deferred maintenance needs list and plan. Furthermore, the renovation of Cordley Hall, reconstruction of Burt Hall research space (post fire), and the addition of the Marine Studies Building at HMSC will all substantially improve OSU's research infrastructure.

Finally, to help provide access to other equipment, the university signed a joint MOU with Oregon research universities that will allow internal rates to be used and foster collaborations among faculty and researchers.

### **Advancing Innovation-based Economic Impact**

In FY2019, a fourth effort focused on increasing OSU's economic impact through innovation, entrepreneurship and industry partnerships. OSU seeks to advance economic prosperity and social progress in Oregon and beyond. This past year, the Advantage program launched Innovation Days, an effort to increase Innovation and Entrepreneurship (I&E) activity by faculty researchers by highlighting available supporting resources, bringing in outside expert speakers, and holding small breakout group discussions on focused topics. The university also signed a joint intellectual property agreement with Oregon's research universities to remove perceived barriers around intellectual property ownership conflicts.

The university worked collaboratively with the Oregon Business Development Department and colleagues from Oregon Health and Science University, University of Oregon, and Portland State University to secure a one-time General Fund appropriation of \$10M for a new University Innovation Research Fund (UIRF). The UIRF will match competitive federal research awards, increasing the competitiveness of Oregon universities for large federal research funds, leveraging federal grants that require matching funds, and supporting innovation and research capacity.

Strengthening OSU's support system for innovation and entrepreneurship is a key action in SP4.0. The effort involves revising OSU's intellectual property, licensing, and revenue distribution policies; revising promotion and tenure guidelines; and strengthening incentives. OSU received a major NSF grant to lead a national conversation on this topic, and has already received support letters from our regional university partners, as well as from other research universities such as MIT and Arizona State University.

Lastly, the university is developing new, updated and improved metrics to promote engagement with industry and economic impact that better align with OSU's mission and emerging best practices from the Association of Public and Land Grant Universities and Association of American Universities. It is anticipated that these will be finalized and recommended this year.

### **OPPORTUNITIES AND THREATS**

OSU's goal of fostering and sustaining excellence and innovation in research requires continuous assessment and monitoring of national trends or events that might either enhance or hinder the university's efforts to help support the research enterprise. The following is a summary of opportunities driven by national trends, the major threats that might hinder efforts to achieve alignment with these trends, and the tactics being pursued to address them.

### **Diversify Funding Portfolio to Respond to Increased Competition for Funding**

The majority (69%) of OSU's research funding comes from federal sources, and of that, 46% is from the National Science Foundation. In recent years, agencies such as the Department of Defense (e.g., ONR, DARPA), the Department of Health and Human Sciences (e.g., NIH), and the Department of Energy (DOE) Office of Science, received significant increases to their R&D budget. In this environment, targeting these funding sources becomes critical. However, compared to our peers, OSU has limited capacity for investment into research development to help attract new and more funding. To address the SP4.0 goal of diversifying and growing OSU's research portfolio, two tactics are needed: 1. targeting specific agencies such as HHS, DOD, and DOE around key strengths; and, 2. developing a university-wide strategy for research development to compete with peer institutions.

*Targeting well-funded agencies:* When compared to other land-grant universities with research programs of similar size (and no medical schools), OSU's success with NSF stands out, as does the relatively small size of awards from agencies funding health research. Articulating a strategy to advance integrated health sciences at OSU is stated as a goal in SP4.0. The Office of the Provost, RO, and others are collaborating to formulate the strategy that will aid in increasing funding supporting health-related research. Also required will be targeted research development efforts and additional partnerships (e.g., with OHSU) to ensure that OSU researchers are competitive in this landscape.

Another potential area of growth relates to Department of Defense (DOD) funding. OSU does receive some DOD support, and increases in federal investment in DOD over the past few years may present an opportunity for OSU to increase funding selectively from this source. Initiatives through the Navy around wave energy, robotics, and environmental assessment, or through the Army Corps of Engineers related to navigation and access to ports and harbors may be especially promising. Any goal to increase DOD funding does need to be pursued carefully, given the additional investments that might be required in security measures and infrastructure, possible changes in practices related to confidentiality and disclosure, and the need to engage in targeted engagement with the agency.

Finally, in addition to focusing on open solicitations for research funding, targeting agencies also requires the RO and faculty to work closely with OSU's government relations and lobbying firm in Washington, D.C. to secure funding through the annual appropriations process. Joint efforts to date have translated into annual growth in the number of federal programs or activities that the Office of Government Relations advocates for on behalf of OSU. An example in recent years is the \$365M secured for the National Science Foundation to construct a three-ship Regional Class Research Vessel program, for which construction is being administered by OSU. Another example is advocacy for \$35M in federal funds to the Department of Energy to construct the nation's premier off-shore wave energy technology test facility, which is being built by OSU. Other examples just this past year include significant funding for marine robotics, renewable energy, ocean observing systems, and advanced manufacturing.

*Developing a competitive research development strategy:* National trends indicate a shift towards more strategic research development in response to federal agencies shifting funding towards large and complex projects. Agencies rationalize this new shift as a means to reduce agency administrative burden, produce greater return on investment, gain more political cover by funding national priorities, and minimize risk. To be successful in the new funding reality, OSU must view research development as a university-wide strategy, invest in time to identify and leverage a full range of internal and external stakeholders to increase competitiveness, and prioritize activities and services based on institution-specific goals and desired outcomes.

Increasing competitiveness requires OSU to capture and analyze faculty research and expertise data, provide interdisciplinary seed funding, facilitate proposal development and post-award support for complex projects, and build robust relationships with federal agencies. In particular, at NSF and at other agencies, more attention is being paid to funding large inter-connected programs that address important societal problems. An example is NSF's "10 Big Ideas" programs which focus on furthering understanding of problems with direct societal impact. Research on such big ideas requires collaboration among scientists from vastly different disciplines, including the natural sciences and engineering as well as the humanities and social sciences. Such research also requires large multi-year programs with multiple investigators from various disciplines, large cohorts of students and postdocs, and the requirement for coordinated project management. OSU is exceptionally well positioned to engage in research across disciplines because of the historically low boundaries between units across the university. The university is working on ways to provide targeted institutional support for OSU to be more competitive in this space.

### **Rethink OSU's Industry Engagement Strategy to Increase Economic Impact**

National trends indicate a clear necessity to expand the scope of industry partnerships and SP4.0 calls for a renewed focus on the university's economic development and innovation goals. Over the next two years, the RO will work with university stakeholders to strengthen OSU's partnering approach. Universities are well-positioned to partner with companies to advance corporate research and development goals and support the academic research enterprise. In addition, federal funding increasingly requires industry collaborations, often in the form of large awards requiring consortia or public-private partnerships, and state funding flows into programs that directly support economic development. As a result, partnership with industry is relevant to the continued success of the academic research enterprise. OSU's strategy will seek to provide industry access to talent, expertise, university networks and leadership in forming alliances and consortia, IP, incubators, accelerators, and venture capital funding mechanisms. As a first step, the university is collaborating with OSUF in the hiring of an industry partnerships coordinator within the Foundation.

### **Improve Research Facilities to Recruit and Retain Top Researchers and Students**

The condition of research laboratories and facilities is key to ensuring faculty productivity and funding success. The Facilities Renewal Program, and associated execution of the projects on the Ten-Year Capital Forecast, is critical to strengthening OSU's research facilities. In partnership with the academic colleges and the DFA, the RO has been assessing the condition of the research facilities (and equipment housed in them) to better understand maintenance and upkeep needs and costs. An MOU to extend internal user fee rates across facilities in Oregon's research universities fosters collaboration and will avoid redundant investment in high dollar, specialized instrumentation within the state.

Given the needs to enhance and care for the research infrastructure, the university is working to align equipment purchases and facility improvements while providing more flexibility for supporting researchers and decreasing administrative burden. This coming year, some Facilities Renewal Funds will be used to improve biosafety laboratory space, animal facilities, and address deferred maintenance needs at Hatfield.

### **Increase the Capacity to Recover F&A Costs to Re-Invest in Research**

As OSU rapidly grew its research base, equipment, and programs over the last decade, support capabilities and resources have been unable to keep pace. Exacerbating the problem is our deferred maintenance backlog. What this means is that OSU appears to conduct a high level of

research relative to the scale and quality of its infrastructure which, in turn, makes it difficult to secure increases in the university's federally approved F&A rate. That, in turn, reduces funding available to improve the infrastructure. This a major threat compared to peers. To address the threat, the university is working to ensure that all research space and other infrastructure is properly accounted for; it is investing in research facilities via the Facilities Renewal Program; it is reviewing the contracting channels currently used for supporting research activities to ensure appropriate F&A recovery; and it will be implementing a centralized business support model for core facilities on campus. The latter will help increase revenue by ensuring stronger marketing of fee-for-service products to external stakeholders, simplifying billing and collection processes, and assessing annual fees.

### **Navigate the National Security Compliance Requirements to help support faculty**

In recent months, the U.S. government has highlighted concerns about foreign influence in research by U.S. universities, the theft of intellectual property in federally-funded research, and conflicts of interest and commitment by U.S. researchers engaged with international collaborators. OSU highly values its collaborations abroad and openness to the best and brightest around the world, and likewise it will continue to be attentive to security and compliance with all applicable regulations. The federal concerns have created some uncertainty about the government's plans going forward vis-à-vis regulations. National academic organizations, along with the Office of Science and Technology Policy, have been strong advocates of universities working with federal agencies on solutions.<sup>2</sup> The university has established a university-level administrative working group to monitor this issue, suggest improvements to policies or practices as appropriate, and improve communications around policies and practices.

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<sup>2</sup> See <https://www.aplu.org/projects-and-initiatives/research-science-and-technology/science-and-security/>