Undergraduate Research Opportunities Committee

Final Report

December 17, 2020

Committee: Shelby Anderson (Chair), Kelly Clifton, Sahan Dissanayake, Brenda Glascott, Mau Nam Nguyen, Jason Podrabsky, Todd Rosenstiel, Sonja Taylor, Derek Tretheway

"What is undergraduate research? An inquiry or investigation conducted by an undergraduate student that makes an original intellectual or creative contribution to the discipline."

Council on Undergraduate Research
(https://www.cur.org/who/organization/mission/)

Executive Summary

The 2018-2020 Undergraduate Research Opportunities Committee (UROC) was charged by faculty senate with exploring: 1) Current undergraduate research practices at Portland State University (PSU); 2) New initiatives, or development and improvement of, current practices to engage more undergraduates in research including students and mentors from disciplines perceived as overlooked in this area, such as the humanities; and 3) Activities and structures to sustain successful undergraduate research related practices over time at PSU.

The UROC synthesized information from a variety of sources and identified numerous strengths and challenges in undergraduate research opportunities at PSU. This effort made clear that there is already significant engagement with diverse undergraduate research opportunities at PSU. But the institution as a whole is not adequately supporting undergraduate research efforts. Most of what is taking place hinges on the work of a few highly effective PIs, or small research centers and groups, who operate independently with little outside support or connection to other teams working on similar projects, problems, and target student populations.

The committee identified six interrelated needs and associated recommendations that must be addressed to support and expand undergraduate research opportunities:

1) Improve student access, experience, and outcomes, particularly for BIPOC students, first generation students, and students from other underrepresented groups.

2) Centralize information and communication about UR at PSU to reduce faculty staff redundancies in effort, aid with recruitment, and create new opportunities

3) Address faculty workload issues around undergraduate research

4) Help students and faculty prepare for research and mentoring

5) Raise awareness of undergraduate research opportunities at PSU

6) Address undergraduate research funding deficits

PSU has an opportunity to distinguish ourselves from regional community colleges and universities through our undergraduate research offerings, to promote opportunities for our diverse student population, and to improve student success through engagement with undergraduate opportunities. But, to accomplish this, PSU must address the deficits and obstacles to undergraduate research identified by this committee.

1.0 Current State of Undergraduate Research at PSU

This report documents the Faculty Senate's ad hoc Undergraduate Research Opportunities Committee's (UROC) findings about the current state of undergraduate research at PSU and our recommendations for expanding this high-impact practice at PSU. While Portland State University sponsors a wide range of undergraduate research opportunities, the university could increase the impact of these opportunities -- and use them as a way to attract new students -- by increasing the coordination of undergraduate research and addressing the obstacles identified by faculty and university leadership.

Undergraduate research is a nationally recognized way to positively impact retention and graduation, and to create long-term opportunities/careers for students; several studies have demonstrated the impact undergraduate research experiences can have on BIPOC student success (see Collins et al. (2017) and Hurato et al. (2009)).

There is an opportunity for PSU to identify as *the* undergraduate research university in Oregon. This would be a powerful driver for recruitment, increase our retention and graduation rates, and support BIPOC students in achieving their academic and career goals.

2.0 Committee Charge and Overview of Activities

Between Fall 2018 and Fall 2020, the UROC was charged by the Faculty Senate with exploring:

1. Current undergraduate research practices at Portland State University (PSU);

2. New initiatives, or development and improvement of, current practices to engage more undergraduates in research including students and mentors from disciplines perceived as overlooked in this area, such as the humanities; and

3. Activities and structures to sustain successful undergraduate research related practices over time at PSU.

The UROC reviewed best practices in undergraduate research at other institutions and organizations (e.g. Council on Undergraduate Research) and researched the state of undergraduate research at official PSU comparator universities to inform our assessment of PSU undergraduate research practices. We then drew on various sources of data to better understand the status of undergraduate research at PSU. Source of information included previous research carried out by the Academic Quality Committee (AQC). We collated data on undergraduate research activities through analysis of Honors College data, exit data from various programs (e.g. Honors, REU, ISS), and information on undergraduate engagement with the annual PSU research symposium.

We initiated a survey of university leadership (administration, research PIs, leaders of centers and institutes) to assess the state of undergraduate research from the perspective of different units and to add leadership perspectives on undergraduate research to available data on faculty perspectives. We also sought to incorporate feedback from areas of scholarship not well-

represented on committee. Efforts in this area included requesting additional Senate members from humanities and arts (none were assigned); inviting feedback from college and unit heads across university through May 2019 presentation to the Academic Leadership Council; and conducting direct outreach to the College of the Arts (COTA). We coordinated with the student success effort out of the Provost's Office to collect data on student perspectives and experiences with undergraduate research by adding relevant questions to a student survey administered by the Provost's office.

In addition to the targeted information collection efforts outlined above, we solicited feedback on the final draft report from the Undergraduate STEM working group, and from the general faculty via an open workshop held in December 2020.

3.0 Best Practices in Undergrad Research

Undergraduate research is a powerful way to engage students in their education and is identified by the Association of American Colleges and Universities (AAC&U) as a high-impact practice, or activities demonstrated to increase student retention and engagement. The Council on Undergraduate Research (CUR) defines undergraduate research as "an inquiry or investigation conducted by an undergraduate student that makes an original intellectual or creative contribution to the discipline" (Mission). Undergraduate research experiences provide students with a strong connection to faculty and discipline and develop students' communication and analytical skills, preparing them for careers and/or graduate education. Over the last thirty years, more universities and colleges have recognized the significance of undergraduate research for student retention and achievement.[1]

Faculty are the sponsors of undergraduate research experiences, typically by involving students in their research, mentoring undergraduate projects such as theses, or by developing and teaching course-based undergraduate research experiences (CUREs). CUR has identified best practices for supporting -- and expanding -- faculty and student engagement with undergraduate research (CUR 2018). The basic conditions for supporting faculty in sponsoring undergraduate research include:

- Building mentoring of undergraduate research into faculty workload, so that this activity isn't taken on as an overload or "'add-on' to a normal teaching load" (Morrison et al. 7).
- "Rewrit[ing] tenure, promotion, and other review documents to clearly value mentoring and CURE development" (7)
- "Honor[ing] faculty-student collaboration with internal, targeted research funds" (7)
- Provid[ing] reassigned time for research-based curricular revision" (7)
- Establish[ing] prominent awards/chairs to honor mentoring" (8)
- Institutionaliz[ing] best practices in training, mentoring, and CURES (8)

[1] According to Morrison et al. (2019) undergraduate research was first embraced by private liberal arts colleges (1). Karukstis's (2019) history of the undergraduate research "movement" tracks its origins to innovative approaches to teaching the sciences at public universities in the late 19th and early 20th centuries. The National Science Foundation's Undergraduate Research Participation Program (1958-1981) catalyzed integration of undergraduate research experiences in the sciences. The Council of Undergraduate Research was founded in 1978 "to support and promote undergraduate student-faculty collaborative research and scholarship" (48). Joyce Kinkead has explained that "'[f]aculty members, intellectually stimulated by their own research and intrinsically interested in their own students' development, have been largely responsible for driving undergraduate research'" (qtd. In Karukstis 47).

- Integrat[ing] undergraduate research into mission statements and strategic plans (6)

One of CUR's recommended best practices includes creating "a central office of undergraduate research, which oversees campus-wide undergraduate research that include but are not limited to on-campus research symposia, summer research, student workshops, mentorship training, and disbursement of funds for student travel" (5). Such an office should be directed by a research/scholarship-active faculty with expertise and interest in undergraduate research.

4.0 Undergraduate Research Opportunities and Issues of Diversity, Equity, and Inclusion

Barriers to college success and completion affect Black, Indigenous, and Latinx students populations more acutely than their counterparts. Undergraduate research is a powerful high impact practice for rectifying one of the major factors fueling these persistence and completion gaps: the students' sense that they do not belong.

Black and Latinx students are much more likely to leave STEM majors than their white counterparts which also increases the likelihood of leaving college without a degree. Riegle-Crumb et al. (2019) report that "we see that both Latina/o and Black students have significantly higher rates of switching (about 37% and 40%, respectively) compared to White students (29%). Latina/o STEM majors (20%) and Black STEM majors (26%) are also significantly more likely to leave school without a degree compared to White STEM majors (13%)."

This is not only a problem in STEM. According to Riegle-Crumb et al. (2019), "Black and Latina/o students in both business and social science majors are significantly more likely than their White peers to leave school rather than persist to earn a degree in their chosen field." In the humanities, however, Black students are less likely than their white counterparts to switch majors.

Significant graduation completion gaps persist. For example, a 2017 National Student Clearinghouse study showed "a 24-percentage point gap in the completion rates of black and white students (42.7 percent and 66.8 percent, respectively) and 17.5-percentage points gap between Hispanic and white students (49.3 percent and 66.8 percent, respectively)" among traditionally aged students. The completion gap for students who start college at age 25 or older "was 12.3 percentage points (29.7 percent and 42.0 percent, respectively) between black and white students" and " 9.1 percentage points between Hispanic and white students (32.9 percent and 42.0 percent, respectively)" (Shapiro et al.).[2]

Scholars offer a number of theories to explain the persistence and completion gaps, but most theories include the impact of students feeling unwelcome or like they do not belong. Similar barriers can affect first- generation students, low income students, and women students.

Undergraduate research experiences have been shown to increase BIPOC students' sense of belonging. In their literature review, Collins et al. (2017) find that undergraduate research

[2] Asian-identified students had a completion rate 1.2% higher than white students.

experiences affect "underrepresented minority students" by "increas[ing] the academic and social integration of these students through engagement activities, including intensive faculty interactions (Clewell, Cohen, Deterding, & Tsui, 2005). For example, Hurtado et al. (2009) found that URM students engaging in undergraduate research experienced developmental benefits that extended beyond the research setting (e.g., into the classroom) through enhanced self-efficacy; access to key resources (e.g., professional development activities, support from staff); collaborative relationships with peers, graduate students, and faculty; and immersion in competitive social networks that fostered motivation to work harder and perform better."

Increasing availability of and access to undergraduate research experiences will not only target closing persistence and completion gaps, but will also increase the likelihood of underrepresented groups going on to graduate school and professional careers. Thus, specific investment in recruiting and retaining students from under-represented groups in a variety of undergraduate research experiences is necessary and important for fostering future diversity across disciplines. See Section 7.0 for recommendations aimed at fostering diversity, equity, and inclusion for undergraduates through research opportunities.

5.0 Comparator Institutions

As part of our efforts we explored how our comparator institutions are engaged in undergraduate research. We used the list of 43 institutions that PSU as identified as a comparators and searched their websites for information related to undergraduate institutions including whether they (1) highlight undergraduate research, (2) have an undergraduate research office, (3) conduct a undergraduate research symposium, (4) have grants and funding to support undergraduate research. We summarize the key quantitative data below and then describe a selected few examples. The full data set is available in Appendix A.

Among our 43 comparator schools
27 (63%) have an undergraduate research office
29 (67%) conduct an undergraduate research symposium/conference
19 (44%) Recognize undergraduate research (best student/poster etc.)
23 (53%) Provide some type of grants or funding to support undergraduate research
38 (88%) highlight undergraduate research on their website

6.0 State of Undergraduate Research at PSU

In 2017, the Academic Quality Committee (AQC) conducted a survey of PSU faculty that included questions specifically aimed at understanding faculty engagement with, and perspectives on, undergraduate research at PSU. There were a total of 415 respondents to the survey (41% of the total 1007 faculty): 27% full professor, 26% assistant professor, 25% associate (about 50% of the population), approximately 15% instructors and senior instructors (about 35% of the population), and approximately 50% female and 50% male (equivalent to the population representation). The survey included all colleges and schools with varying levels of representation in respondents (between 25-50%). Large programs and departments were well represented, while some small programs were not well represented (AQC 2017).

The survey identified faculty workload and criteria for promotion and tenure as the critical barriers to engaging with undergraduate research (George and Dolidon 2017); specifically, mentoring of undergraduates is not valued in promotion and tenure, which adds to the faculty experience of undergraduate mentoring as "add-on" work. Inadequate funding support, lack of undergraduate preparation, and lack of access were also reported as minor barriers to engaging with undergraduate research (George and Dolidon 2017). There was a high level of faculty support for working to reduce workload barriers to faculty engagement with undergraduate research, and for targeting university fundraising activities in support of undergraduate research (George and Dolidon 2017). The survey identified only moderate to low support for funding an undergraduate research office, or funding campus-wide initiatives that coordinated undergraduate research.

To build on the work already carried out by the AQC, the URO committee undertook a series of meetings with university leadership. The goal of these meetings was to collect data on obstacles and opportunities for Undergraduate research at PSU from the perspective of those most engaged with research/undergraduate research (see Appendix B for discussion questions). The committee gathered information from the Academic Leadership Committee, Build Exito, the Transportation Research and Education Center (TREC), the Honors College, the Institute for Sustainable Solutions (ISS),Homelessness Research and Action Center (HRAC), the Digital City Test Bed center, Louis Stokes Alliance for Minority Participation (LSAMP), McNair, S-STEM faculty, Research Experiences for Undergraduates (REU) PIs, and Provost Office staff focused on student success and other aspects of the student experience. These meetings generated valuable discussions about existing undergraduate engagement with various programs across campus, as well as the obstacles to undergraduate research across the university.

Discussions with research-oriented centers and groups reinforced the results of the 2017 AQC survey, as did the workshop on undergraduate research opportunities we hosted in December 2020, and online responses to our draft report (see Appendix D for more details): the primary obstacles faculty and staff face in terms of engaging undergraduates with research are 1) workload, and 2) lack of tangible recognition for mentoring undergraduates (e.g. in tenure and promotion and compensation for TT faculty, for review and promotion, workload, and compensation for NTTFs, etc.) (see Table 1). Other challenges identified by multiple programs include issues recruiting students, connecting students to appropriate mentors, student preparedness for research, and faculty preparedness for mentoring (Table 1). Recent research on PSU student preparedness for careers identified a need for more internships, lab opportunities, and real-world experiences in their fields (Klein 2020: 7).

Table 1. Summary of Relevant PSU Programs (See Appendix C for program details)

Program/Center	Undergraduates in Program 19-20 AY	Undergrad Funding Available (yes/no)?	Faculty Mentor Funding Available (yes/no)?	Program Identified Obstacles to UR at PSU
Build Exito	Yes (~400 students)	Yes	Yes	Retention, longevity of program post-NIH funding
Digital City Test Bed Center	No, plan for engagement in future	No, but potential	No	Lack of funding, faculty time, and tendency to prioritize graduate students when opportunities are limited
HRAC	Yes, but primarily grad students right now	No, but potential at small scale	Not directly, although funding available for faculty through research program	Faculty workload, undergraduate preparation for participation
ISS	Yes, internships and fellowships	Yes	Yes, but dormant (faculty fellows program)	Not enough faculty/faculty engagement; partner needs not aligned with undergraduate timelines, abilities, etc.; program access to students
TREC	Yes, through internships and grants to faculty that engage undergrads in research	Yes, internships, fellowships, involvement in TREC-funded faculty projects	Yes, through TREC "grant"	Faculty workload, student preparation, recruitment
Honors	Yes, (720-820 past five years)	Very limited. Can award 16 $250 grants for research expenses or travel related to research.	No	Faculty workload, program capacity, funding for student research and student travel
LSAMP	Yes	Yes	No	Recruitment, funding, mentoring and training (of faculty mentors), hard to identify appropriate PSU mentor
McNair	Yes	Yes	No	Some fields harder to find mentor (e.g. humanities), mentor/PI concerns about student preparedness, undergrad timeline and research timeline don't match

MCECS Undergraduate Research and Mentoring Program (URMP)	Yes, 7 students in AY19/20. 9 students in AY18/19. 13-14 students/year from AY 08/09 to AY17/18.	Yes, $500-1000/term	No	Limited.reduced funding. Annually funding from AY08/09 to AY16/17 was $30-35k with 50% funding coming from the Semiconductor Research Corporation Educational Alliance. Funding is now 100% MCECS Dean's office. AY19/20 funding was $12.5k. $20k allocated in AY20/21.
Computational Modeling Serving the City (REU)	Yes, 8/year (16 in altREU)	Yes, $6000 stipend for summer	No	General lack of support and leadership, obstacles to summer REU students engaging in campus life
Application of Microscopy and Microanalysis in Multidisciplinary Research (REU)	Yes, 10 undergrads/year	Yes, $4000 stipend for summer program plus a small amount of operational budget to support student research training activities	No	

While several programs work cooperatively (e.g. LSAMP, McNair, and Build Exito), most of the programs operate independent of one another. There is a lack of connection between researchers/research centers and other university programs or administrative offices (e.g. transfer experience efforts at the Provost's office not connected to research programs that work with transfer students, or with student success programs). More coordinated efforts around undergraduate research opportunities would positively impact the effectiveness of recruitment efforts, especially for BIPOC and first-generation students who are the least likely to seek out these opportunities without direct recruitment (e.g. Carpi et al. 2017; Lopatto 2007; O'Donnell et al. 2015).

In an effort to further understand the extent to which undergraduates are currently engaged in research at PSU, we collated information from a variety of disparate sources. Summary data from the library on student engagement in research week symposium presentations and/or undergraduate honors theses indicates increasing engagement in the Honors College and presentation of research between 2013 and 2018 (from 89 to 145 theses). Every Honors College student presents their thesis research publicly at the Honors College Thesis Symposium (held quarterly). There is relatively low engagement in oral presentations at the university's Student Research Symposium during research week, open to all undergraduate and graduate students (Table 2).

Table 2. Library data on student research projects

	Undergraduate Honors Thesis	Student Research Symposium Presentations*	Student Research Symposium Posters*
2019	146	9	29
2018	145	9	24
2017	145	12	26
2016	128	11	14
2015	98	11	16
2014	89	1	10
2013	n/a	19	13

* Presentation and Posters include both undergraduate and graduate students and many posters/presentations have multiple contributing authors including faculty members

A survey of undergraduate interest and involvement in internship opportunities conducted in 2018 (Rochester and Carlson 2018) provides additional, indirect, data on undergraduate research opportunities at PSU. Out of 2009 surveyed students, 13% had participated in an internship for academic credit, while 14.1% had participated in paid internships (Figure 1). The majority of internships involved volunteering with an organization to learn professional skills and experience (27.4%), with smaller numbers of students shadowing health professionals, conducting research in a lab, clinical setting, or in direct collaboration with a faculty member (Figure 1). Of the lab research experiences, 64.3 % of the students engaged with on-campus labs, 23.3% worked in off-campus labs, and 12.4 % worked in both on and off campus lab settings. Of the students who did an internship (N=931), the majority learned of the opportunity on their own (43.8%) (Figure 2); from a professor or instructor (29.0%) and from a friend or relative (24.5%) were the next most common responses (Figure 2).

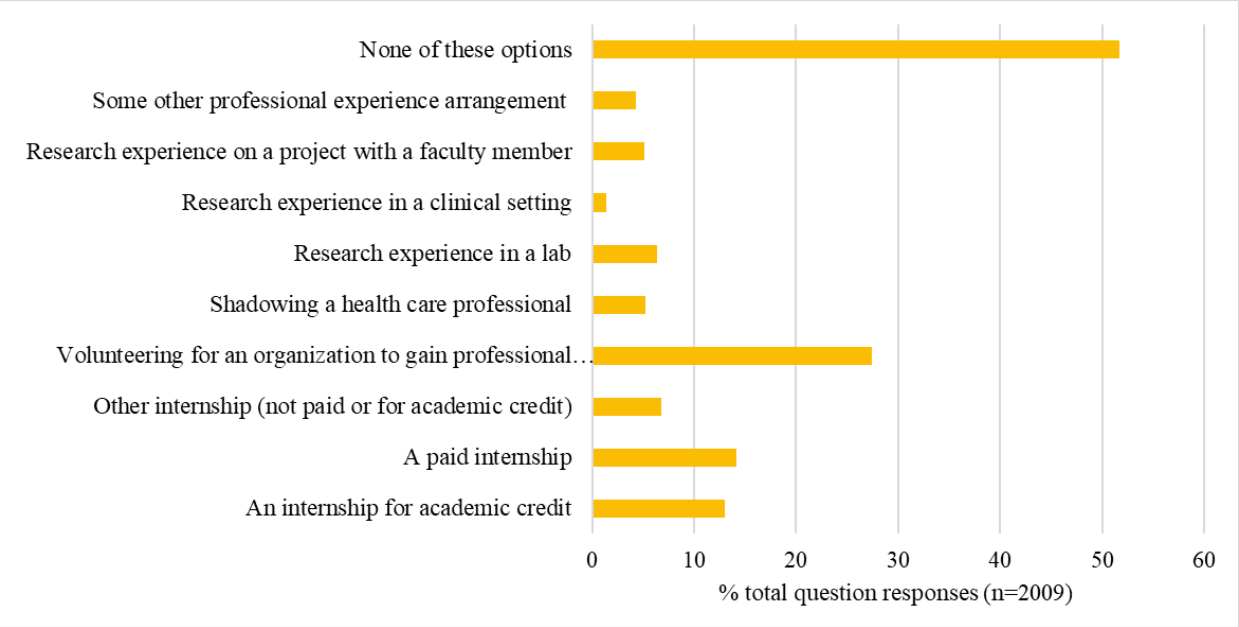

Figure 1. Student responses to the question "During all your time at Portland State University, have you participated in any of the following activities/arrangements in order to gain professional experience? This does not include experience in a capstone course. Select all that apply" (Rochester and Carlson 2018)

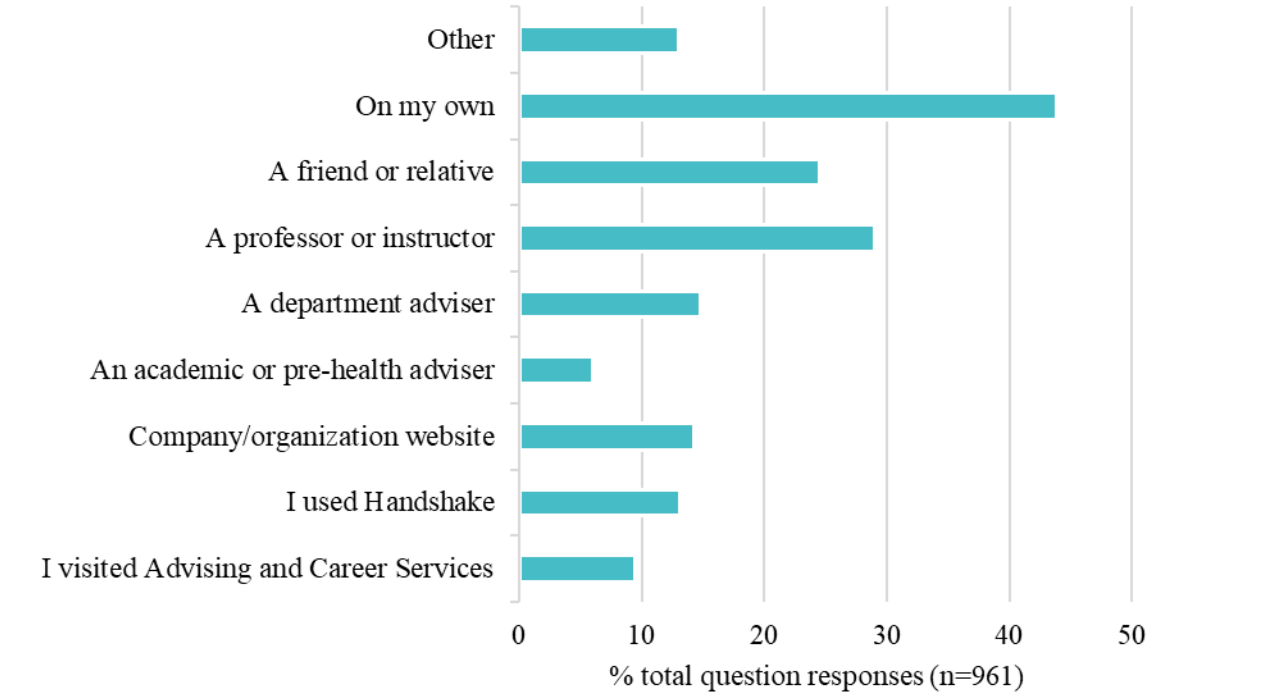

Figure 2. Student responses to the question "If student participated in any activities/arrangements: How did you learn about these opportunities? (select all that apply). (Rochester and Carlson 2018)

Students who participated in the programs that track or assess participant outcomes benefited from their undergraduate research experience. For example, ISS 2018-2019 participants reported a variety of positive outcomes (ISS 2019):

> *"The stipend had a major impact on my ability to participate in the internship. Far too often, internships are unpaid or underpaid, and interns are left with little income to pay for living expenses or school, or even transportation to their internship site."*

> *"The research skills I developed and the experiences I gained while working on this project are things that I feel will be helpful in both graduate school and in any career I decide to pursue after I complete my program."*

Build Exito supports undergraduate researchers from historically excluded groups in biomedical research careers. The PSU Build Exito program has encouraging retention and graduation rates, with 54% of 2015 matriculates graduating, and 35% of 2016 matriculates graduating. The majority of 2017, 2018, and 2019 matriculate degrees are still in progress (Exito 2019). Engagement in the program has positively changed student scholarly identity (Figure 3).

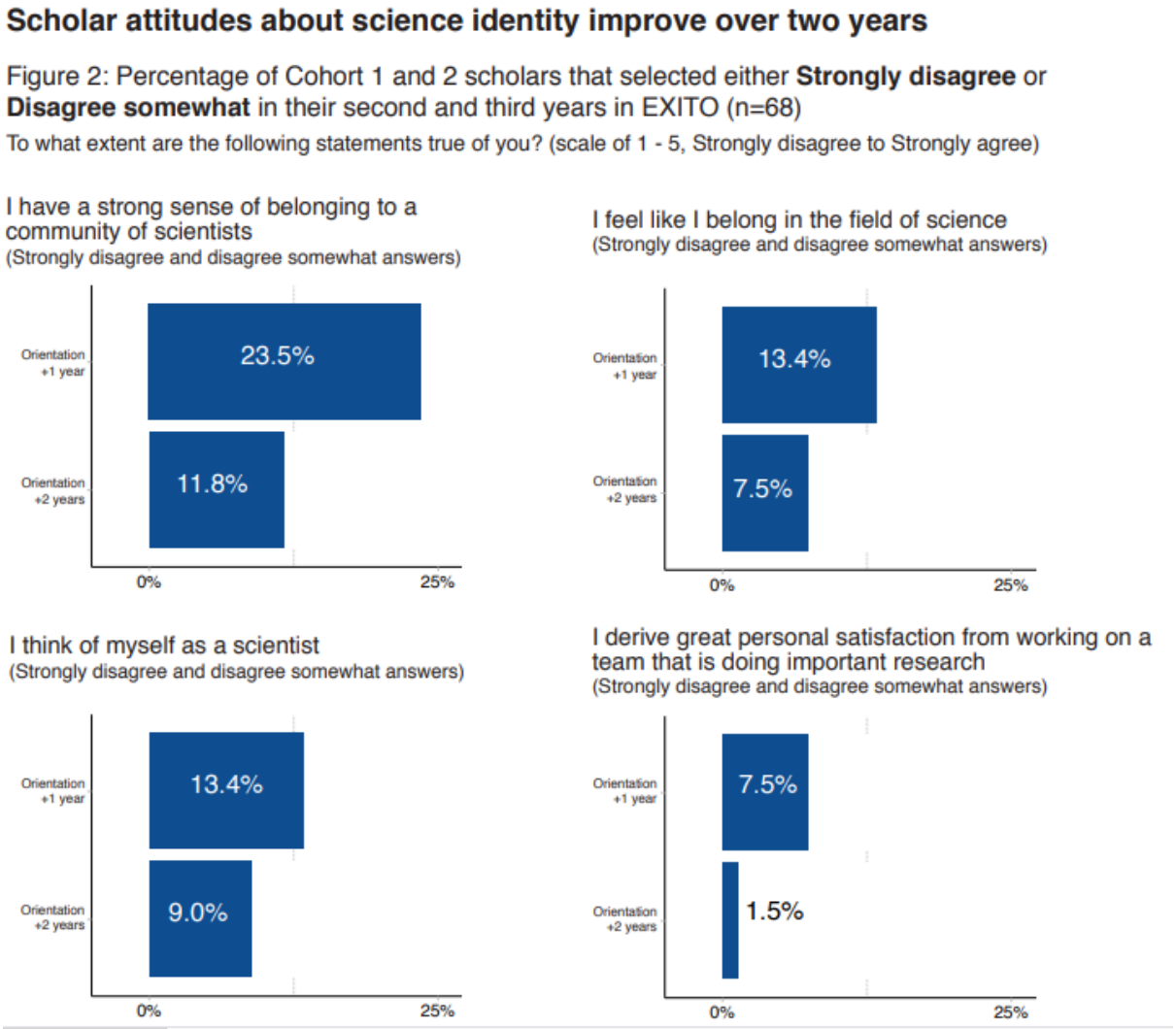

Figure 3. Build Exito scholars attitudes about science identity. (EXITO Evaluation Team, 2019 Yearly Report; reproduced with permission)

Embedded Undergraduate Research Opportunities in UNST

In addition to the programs we surveyed (Table 1), undergraduate research training and experiences are embedded in the University Studies curriculum. Freshman Inquiry and the dual credit counterpart Senior Inquiry both have undergraduate research experience embedded in their coursework. This is sometimes a formal research paper and sometimes an action research project. Students from Senior Inquiry have participated in the PSU research symposium and the program is currently looking into contributing to PSU scholar on an annual basis. Sophomore inquiry courses sometimes offer embedded research experience, most notably the sophomore inquiry courses attached to the Build Exito program, which serve as a gateway course. It would be productive to suggest partnerships with Build Exito that would broaden the scope/offering of gateway courses by incorporating some of the undergraduate research focused content into additional sophomore inquiry courses. Little is known about the undergraduate research experience in the junior cluster courses as they are primarily taught through departments. However, the junior clusters are an area of interest/focus for the current interim executive director of UNST and there could be opportunities for partnering on a more intentional practice of embedding undergraduate research experiences at the junior level. Several capstones incorporate embedded research experiences and a detailed list of research-based capstones was compiled many years ago, but it is no longer current. It would be fruitful to investigate more and possibly provide capstones with information about developing CURE projects in their classes. In sum, the foundation for a rich, meaningful, embedded undergraduate research experience is present in UNST and making that experience more intentional and weaving it more explicitly through all levels is an opportunity that our institution should invest in.

Current Efforts to Promote DEI in Research for Undergraduate PSU Students

Many of the existing programs centered on undergraduate research are specifically aimed at recruiting and retaining first-generation, Black, Indigenous, Latinx, and other students of color at PSU. LSAMP, McNair, S-STEM in biology, Build Exito, and the REUs all seek to provide opportunities for students from diverse backgrounds in STEM and other fields. Some of these programs already work closely together, but for the most part they operate without support from other programs and offices at PSU that are also connecting witt/recruiting BIPOC students (e.g. outreach to community colleges, summer bridge programs, transfer student advising, and support for BIPOC students with these important on-going programs that support).

Student Perspectives on Undergraduate Research Opportunities at PSU

We are currently lacking information on research engagement and opportunities from the *student perspective*. To amend this, we are working with the Provost's office to include several questions about undergraduate research on the annual student success survey. The committee questions did not make it onto the Spring 2020 survey, due to Covid; the Provost's office plans to coordinate the next survey with the committee to include questions on student experience and undergraduate research. We do have some data from Klein's (2020) recent survey of alumni to ascertain how their PSU experience prepared them for their chosen careers; this study indicated a need for better connections between course work and careers, and the need for more research opportunities for undergraduates.

Summary of Findings

PSU undergraduate research strengths include:

- Diverse, first generation PSU student population brings new insights and knowledge to research
- Undergrads are already engaged in research across disciplines.
- PSU faculty and staff across a variety of programs and disciplines already have considerable experience with undergraduate research
- There is incredible potential at PSU to grow existing programs and opportunities through relatively short-term efforts (e.g. increased advertising of opportunities, connecting people/programs with advisors, etc.)

PSU undergraduate research weaknesses include:

- There is a lack of support for faculty who engage, or want to engage, with undergraduates in research. Faculty workload is a critical obstacle to working with undergraduates on research.
- There is a lack of tangible recognition for faculty mentoring of undergraduate researchers, and this further contributes to workload issues
- Exiting funding or structures (Build Exito, UNST, REUs) may not always be around
- Undergraduate recruitment for opportunities is challenging
- The traditional mentorship model of research (for undergraduates and graduates) limits opportunities to a small number of students, increasing existing inequities for students from underrepresented groups. PSU has several programs focused on improving access to undergraduate research experiences, and/or on recruiting and retaining students from diverse backgrounds (e.g. LSAMP, McNAIR, Build Exito, S-STEM in Biology, etc.); however, it is also apparent that much more could be done in this area at PSU to support and engage students from underrepresented groups in research.
- Undergraduates are not always prepared to engage with research opportunities, and/or research activities do not always match undergraduate timelines (e.g. skill development, time to graduation, etc.). These timelines are especially compressed at PSU because of the high percentage of transfer students..
- Faculty are not always prepared to mentor undergraduates in research (e.g. more accustomed to working with graduate students)

- There is a lack of leadership and centralization in undergraduate research related activities, knowledge, and resources at PSU. PSU does not have a single place (online or in person) for students and faculty to find information and opportunities related to undergraduate research. This significantly undermines student and faculty ability to participate, collaborate, and leverage existing undergraduate research resources into new opportunities; it is particularly difficult for transfer students to connect with opportunities if they are not already part of a "bridge" program (e.g. through LSAMP).

- There is a lack of awareness across the campus of undergraduate research opportunities already available

To summarize, there is already significant engagement with diverse undergraduate research opportunities at PSU. But the institution as a whole is not supporting (or only minimally supporting) undergraduate research efforts; most of what is taking place hinges on the work of a few highly effective PIs or small research centers and groups who operate independently with little outside support or connection to other teams working on similar projects, problems, and target student populations. This is a missed opportunity for PSU to support student outcomes and to share with prospective students and donors what we do at PSU that differentiates us from regional community colleges and other higher ed institutions in Oregon. Note that our findings and recommendations (below) align with, and build on, those made by the AQC in 2016 and 2017, following their survey of faculty perspectives on research (Mukerjee 2016).

7.0 Recommendations: Elevating Student Success through Focus on the High Impact Practice of Undergraduate Research

The above weaknesses can be conceptualized as falling into six interrelated *needs* that must be addressed to support and expand undergraduate research opportunities at PSU. Specifically, there is a need to:

1) Improved student access, experience, and outcomes, particularly for BlPOC students, first generation students, and students from other underrepresented groups.

2) centralize information and communication about UR at PSU to reduce faculty staff redundancies in effort, aid with recruitment, and create new opportunities

3) Address faculty workload issues around undergraduate research

4) Help students and faculty prepare for research and mentoring

5) Raise awareness of undergraduate research opportunities at PSU

6) Address funding deficits

Two overarching issues stand out as both barriers to, and opportunities for, elevating student success through research opportunities at PSU: 1) the need to further support diversity, equity,

and inclusion in undergraduate research; and 2) the need for coordination, organization, and centralization of undergraduate research-related information and activities.

Promoting Diversity, Equity, and Inclusion through Undergraduate Research Opportunities:
We recommend that the following steps be integrated into PSU's approach to undergraduate research:

- Regular cultural competency and mentorship training with a DEI focus for faculty
- Targeted recruitment of first-gen, Black, Indigenous, Latinx, and other students of color into undergraduate research experiences
- Recruitment and retention of more faculty of color
- Institutionalization of proactive mentorship models, such as CUREs. In traditional mentorship models, students usually seek out mentors. Thus, the model inherently supports the students with the highest social capital, who are already fairly capable at negotiating the university experience.
- Expand CURE offerings at PSU. CUREs embed research in classes, going beyond teaching research skills to incorporating in-depth research experiences into the curriculum. Education research shows that this model increases both opportunities for students and student persistence, particularly persistence of under-represented students.
- Coordinate undergraduate research opportunities with the PSU Office of Global Diversity and Inclusion

Coordination, Organization, and Centralization

We strongly recommend building on existing faculty/staff expertise and experience with undergraduate research, by expanding or drawing on existing recruitment, training, and program structures to develop new opportunities for our undergraduate students. If a centralized office or program is established, it should be staffed and led by research-active faculty rather than staff and must include faculty and activities across the university, including the humanities and arts.

See Table 3 for our specific recommendations on how to accomplish the goal of expanding and sustaining undergraduate research opportunities at PSU.

Table 3. URO Committee Recommendations

Deficit Addressed:	Lack of Centralized Communication	Faculty Workload/ Recognition	Improved Student Experience/ Outcomes	Student/Faculty Preparedness for Research/ Mentoring	Raise Awareness	Funding
Recommended Short-Term (immediate-2 year) Actions:						
Develop an undergraduate research mission statement that aligns with the PSU Strategic Plan mission and vision	X		X		X	X
Include undergraduate research into Strategic Plan and university mission	X		X		X	X
Create or provide expanded access to existing workshops and trainings for faculty about best practices for mentoring undergraduate research.		X		X		
Leverage Research Week to do the following: Add workshops on research methods & ethics for student; engage various undergrad research focused entities in Research Week (where this is already happening, make the collaboration more visible to university); create student awards for undergraduate research (e.g. best poster, best presentation, most innovative, etc.) community)	X		X	X	X	X
Create awards for faculty mentors of undergraduate research at department and college/university level; align schedule for awards with research symposium in Research Week		X			X	

Deficit Addressed:	Lack of Centralized Communication	Faculty Workload/ Recognition	Improved Student Experience/ Outcomes	Student/Faculty Preparedness for Research/ Mentoring	Raise Awareness	Funding
Recommended Short-Term (immediate-2 year) Actions:						
Centralize information about existing undergraduate research and research opportunities (e.g. establish web page, create a university calendar or research events that includes undergraduate research opportunities)	X	X	X		X	
Increase awareness of the importance of undergraduate research by profiling students and faculty involved in undergraduate research in campus communications and through other marketing efforts					X	X
Incorporate undergraduate research into Student Success conversation			X		X	X
Improve communication between college advisers, transfer program(s), and undergraduate research programs (this will become easier if there is a centralized place for undergraduate research)	X		X			
Conduct additional workshops soliciting faculty/student input on undergraduate research issues as part of longer-term planning for an undergraduate research office/resource (See mid/long term actions).	X		X			
Host several PSU-wide undergraduate researcher events each summer, when there are a large number of REU, Build Exito, McNair, and LSAMP students on campus for research programs	X	X	X		X	

Deficit Addressed:	Lack of Centralized Communication	Faculty Workload/ Recognition	Improved Student Experience/ Outcomes	Student/Faculty Preparedness for Research/ Mentoring	Raise Awareness	Funding
Recommended Short-Term (immediate-2 year) Actions:						
Reduce barriers for REU and other summer research program participants at PSU (e.g. housing, gym access, building/lab access) to improve experience and outcomes for participants and ease faculty/mentor workload		X	X			
Highlight undergraduate research (students, mentors, programs) in marketing and fundraising activities	X	X			X	X
Work with OAI to incorporate undergraduate research into program assessment activities, and to create a centralized sharing space for faculty models of undergraduate research (e.g. CUREs, embedded research at different levels of curriculum)		X	X			
Collaborate across PIs, teams, and centers to do targeted recruitment of first-gen, Black, Indigenous, Latinx, and other students of color into undergraduate research experiences.	X		X		X	
Develop cultural competency and mentorship training with a DEI focus for faculty			X	X		
Coordinate undergraduate research opportunities with the PSU Office of Global Diversity and Inclusion	X		x			
Recruit and retain more faculty of color			X	x		
Create a standing committee on undergraduate research (or, explicitly address this via new Senate Research Committee)	X					

Deficit Addressed:	Lack of Centralized Communication	Faculty Workload/ Recognition	Improved Student Experience/ Outcomes	Student/Faculty Preparedness for Research/ Mentoring	Raise Awareness	Funding
Recommended Mid-Term (3-4 year) Actions:						
Build mentoring of undergraduate research into faculty workload, so that this activity isn't taken on as an overload or in additional to teaching load, e.g. X number of undergraduate research credits/advisees = 1 course buyout. Could accumulate over time.		X				
Create mini-grants, grants, or course buyouts for faculty to develop undergraduate research experiences and to incentivize on-going experiences. Potential sources of funding: OAI, RGS, Provost		X				X
Expand CURE offerings at PSU; provide faculty with course buy-outs to create CURES. Potential sources of funding: OAI, RGS, Provost		X				X
Create/enhance undergraduate identity as scholars, E.g. ePortfolios (also a high impact practice) and the pebblepad workbook tool, badges for undergraduate research attached to ePortfolios		X	X	X	X	
Explicit partnership between general education programs and departments around undergraduate research as a way to elevate student success; Support faculty work groups and collaborative projects			X			

Deficit Addressed:	Lack of Centralized Communication	Faculty Workload/ Recognition	Improved Student Experience/ Outcomes	Student/Faculty Preparedness for Research/ Mentoring	Raise Awareness	Funding
Recommended Mid-Term (3-4 year) Actions:						
Offer reassigned time to HON, UNST, and other interested units to learn about and adapt structures from Build Exito. E.g. Offer Sophomore Inquiry instructors the opportunity to adapt their SINQ into a gateway course for Build EXITO (explore possibility of funding through Exito for curriculum development)		X	X	X		
Independent study opportunities (counting as undergraduate research opportunities in arts/humanities) and research credit count as Junior cluster requirements (something we talked about as a possibility in UNST leadership meeting, need departmental collaboration).		X	X			
Improve messaging/communication around undergraduate research at PSU. Make it part of our brand/message about PSU					X	X
Designate funding for undergraduate involvement in research. University leadership direct Foundation to fundraise for undergraduate research.		X	X			X

Deficit Addressed:	Lack of Centralized Communication	Faculty Workload/ Recognition	Improved Student Experience/ Outcomes	Student/Faculty Preparedness for Research/ Mentoring	Raise Awareness	Funding
Recommended Long-Term (3-5 year) Actions:						
Create an office/program for undergraduate research, housed outside of a particular college/program.	X	X	X	X	X	?
"Rewrite tenure, promotion, and other review documents to clearly value mentoring and CURE development" (Morrison et al. 7)		X				
Adapt and expand BUILD Exito model.	X		X			
Office of Undergraduate Research and Honors collaborate on matching students with labs and other research sites	X		X			
Scaffold FRINQs and SINQs to support CURE in SINQ. Currently the BUILD EXITO Frinq is structured to get students ready for the BUILD EXITO Sinq that contains an undergraduate research experience.	X		X	X		
Office of Undergraduate Research and Honors collaborate on enrichment workshops and 1 credit courses related to research practices and research and careers		X	X	X		
Build undergraduate research into unit missions, assessment plans, and program review		X		X		
Have % of IDC go to departments for undergraduate research		X	X			
Ask programs/departments to set targets and a plan for hitting target, for supporting undergraduate research (e.g. through number of students involved)			X			

8.0 Summary

PSU is well positioned to be a nationally recognized institution for undergraduate research. We have a history and thriving culture of engaging undergraduates in a variety of research opportunities. Many disciplines and programs on campus have an applied focus, meaning that there is an emphasis on applying skills/degrees to specific careers and gaining real world experience while in school. We also have many students entering university after several years in the workforce; these undergraduates are a valuable asset to research activities and bring unique strengths to their research engagement. As a result, there is an ethic of "hands-on" learning across campus. As a result, PSU has an opportunity to distinguish ourselves from regional community colleges and universities through our undergraduate research offerings, to promote opportunities for our diverse student population, and to improve student success through engagement with undergraduate opportunities. But, to accomplish this, PSU must address the deficits and obstacles we identified. Considerable progress can be made simply by improving support, communication, and coordination across existing programs, projects, and efforts. Tangible recognition of existing staff and faculty efforts would do much to leverage the excellent work around undergraduate research opportunities already happening across our campus.

9.0 References Cited

Academic Quality Committee (2017). Faculty Survey.

Carpi, A., Ronan, D. M., Falconer, H. M., & Lents, N. H. (2017). Cultivating minority scientists: Undergraduate research increases self-efficacy and career ambitions for underrepresented students in STEM. *Journal of Research in Science Teaching*, 54(2), 169-194.

Clewell B, Cohen C, Deterding N, Tsui L. (2005) *Final report on the evaluation of the National Science Foundation Louis Stokes Alliances for Minority Participation program: Full technical report and appendices.* http://www.urban.org/publications/411301.html.

Collins, T.W., Grineski S. E., Shenberger J., Morales X., Morera O. F., Echegoyen L. E.. (2017). Undergraduate research participation is associated with improved student outcomes at a Hispanic-Serving Institution. *J Coll Stud Dev.* 58(4): 583–600. 10.1353/csd.2017.0044

Council on Undergraduate Research. (2012) *Characteristics of Excellence in Undergraduate Research*. https://www.cur.org/assets/1/23/COEUR_final.pdf

Council on Undergraduate Research. (2020) *Mission*. https://www.cur.org/who/organization/mission/

Exito. (2019) Exito Scholars: Graduation Rates 2019.

EXITO Evaluation Team, 2019 Yearly Report.

George, Linda and Annabelle Dolidon (2017). AQC Faculty Survey Data Summary.

Gregerman, S. R., Lerner, J. S., Von Hippel, W., Jonides, J., & Nagda, B. A. (1998). Undergraduate student-faculty research partnerships affect student retention. *The Review of Higher Education*, 22(1), 55-72.

Hensel, N. (ed.) (2012) *Characteristics of excellence in undergraduate research.* Council on Undergraduate Research. https://www.cur.org/assets/1/23/COEUR_final.pdf

Hurtado S., Cabrera N., Lin M., Arellano L., Espinosa L. (2009) Diversifying science: underrepresented student experiences in structured research programs. *Research in Higher Education*. 50(2), 189–214. 10.1007/s11162-008-9114-7

ISS. (2019) Sustainability Internship Program, Final Report, 2018-2019

Karukstis, K.K. (2019) Analysis of the undergraduate research movement: origins, developments, and current challenges. *SPUR* 3(2), 46-55.

Klein, C. (2020) Final report Provost Leadership Fellowship: Connecting Student and Career Success.

Lopatto, D. (2004). Survey of undergraduate research experiences (SURE): First findings. *Cell Biology Education*, 3(4), 270-277.

Lopatto, D. (2007). Undergraduate research experiences support science career decisions and active learning. CBE—Life Sciences Education, 6(4), 297-306.

Morrison, J., Barthell J. F., Boettcher A., Bowne D., Nixon C., Resendes K. K., and Strauss-Soukup J. (2019) *Recognizing and valuing the mentoring of undergraduate research, scholarship, and creative activity by faculty members: workload, tenure, promotion, and award systems.* Council on Undergraduate Research. http://cur.informz.net/z/cjUucD9taT0yODEzNjQ0JnA9MSZ1PTM4MjUyMjI2OCZsaT0yMTQ3MDYwNQ/index.html

Mukerjee, Anindita (2016). Academic Quality Committee Implementation Recommendations for PSU.

O'Donnell, K., Botelho, J., Brown, J., González, G. M., & Head, W. (2015). Undergraduate research and its impact on student success for underrepresented students. *New Directions for Higher Education*, 2015(169), 27-38.

Rochester, Nate and Matt Carlson (2018). 2018 PSU Student Internship and Employment Survey.

Riegle-Crumb, C., King, B., & Irizarry, Y. (2019). Does STEM Stand Out? Examining Racial/Ethnic Gaps in Persistence Across Postsecondary Fields. *Educational Researcher, 48*(3), 133–144. https://doi.org/10.3102/0013189X19831006

Shapiro, D., Dundar, A., Huie, F., Wakhungu, P., Yuan, X., Nathan, A & Hwang, Y., A. (2017, April). *Completing College: A National View of Student Attainment Rates by Race and Ethnicity – Fall 2010 Cohort* (Signature Report No. 12b). Herndon, VA: National Student Clearinghouse Research Center.

Appendices

Appendix A: Summary of Information on Undergraduate Research at Comparator Institutions

Appendix B: Leadership survey questions

Appendix C: Current Undergraduate Research Opportunities and Resources at PSU

Appendix D: Faculty/Staff Workshop and Report Data

Appendix A: Summary of Information on Undergraduate Research at Comparator Institutions

Institution	Undergrad Research office	Undergraduate symposium/ conference	Awards/ Recognition	Grants/ Funding	Google
California State University-Fresno	1 Division of Research and Graduate Studies	1 Hosted the 2019 CSU Symposium, focusing on teaching and learning	1 2017 Awardees	1 up to $1,000 grants/semester for students, required to work with faculty mentor	1 FSU
Cleveland State University	1 Office of Research	1 Symposiums through different departments	1 Undergraduate Research Award Program	1 Funding	1 CSU
Eastern Michigan University	1 Office of Undergraduate Research & Creative Activity	1 Annual symposiums	0 n/a	1 Funding	1 EMU
Florida International University	1 Office of Research	1 19th annual symposium	0 n/a	1 Undergraduate Research Opportunity Program for first/second year and transfer students	1 FSU
George Mason University	1 Office of Student Scholarship, Creative Activities, Research	0 n/a	1 OSCAR Student Excellence Award	1 Funding	1 GMU
Georgia State University	0 n/a	1 Undergraduate Research Conference	1 Faculty Undergraduate Research Award	1 University Assistantships, stipend of $2,500/yr	1 GSU Honors College
Indiana University-Purdue	1 Center for Research & Learning	1 Summer Poster Symposium	1 Annual Awards	1 Funding programs	1 IUPU

University-Indianapolis					
Kent State University	1 Office of Student Research	1 2019 Symposium Winners	0 n/a	0 n/a	1 KSU
Montclair State University	0 n/a	1 Student research symposium	0 n/a	0 n/a	0 n/a
Morgan State University	1 Student Research Center	1 2019 Annual Symposium	0 n/a	0 n/a	1 MSU
North Carolina A&T State University	1 Office of Research Undergraduate	1 NC Annual Symposium	1 Awards to top presenters at symposium	1 Project funding	1 NCSU
Oakland University	1 Michigan Center for Undergraduate Research	0 n/a	1 Provost Undergrad Research Award	0 n/a	0 n/a
Oregon State University	1 Office of Undergrad Research, Scholarships and the Arts	1 Summer Undergraduate Research Symposium	1 2018 Undergraduate Excellence	0 n/a	1 Office of Undergrad Research, Scholarships and the Arts
Rowan University	0 n/a	0 n/a	0 n/a	0 n/a	1 College of Science & Math
Rutgers University - Newark	0 n/a	0 n/a	0 n/a	0 n/a	1 Newark Rutgers
San Diego State University	1 Office of Undergraduate Research	1 Creative Collaborations Conference	0 n/a	1 Funding	1 Office of Undergraduate Research
San Francisco State University	1 Office of Research & Sponsored Programs	0 n/a	0 n/a	n/a	0 n/a

Tennessee State University	0 n/a	1 Annual symposiums	0 n/a	0 n/a	0 n/a
Texas A&M University - Corpus Christi	0 n/a	0 n/a	0 n/a	1 Funding through competition	1 TAMUCC
Texas Southern University	1 Office of Research	0 n/a	0 n/a	0 n/a	1 Office of Research
The University of Texas at Arlington	1 Office of Undergraduate Research	0 n/a	0 n/a	1 Funding	1 UTA
The University of Texas at El Paso	1 Campus Office of Undergraduate Research Initiatives	1 Symposium	1 2019 best poster awards	1 Fellowship assistance	1 Campus Office of Undergraduate Research Initiatives
The University of Texas at San Antonio	1 Office of Undergraduate Research	1 Research & Creative Inquiry Showcase	1 2019 Research & Creative Inquiry winners	1 Scholarship	1 Office of Undergraduate Research
University of Central Florida	1 Undergraduate Research Division of Teaching & Learning	1 Showcase of Undergraduate Research Excellence	1 2019 showcase winners	1 Funding	1 UCF
University of Houston	1 The Honors College Office of Undergraduate Research	1 Undergraduate Research Day	1 awards listed on Undergraduate Research day link	0 n/a	1 The Honors College Office of Undergraduate Research

University of Illinois - Chicago	0 n/a	0 n/a	0 n/a	1 Funding	1 UIC
University of Massachusetts - Boston	1 Office of Research & Sponsored Programs	0 n/a	0 n/a	1 Funding	1 UMB
University of Massachusetts - Lowell	0 n/a	0 n/a	0 n/a	0 n/a	1 Undergraduate Research Opportunities & Collaborations
University of Memphis	0 n/a	1 Works in Progress Symposium	1 Symposium awards	0 n/a	1 UM
University of Missouri - Kansas City	0 n/a	1 Annual symposium	0 n/a	0 n/a	1 UMKC
University of Missouri - St. Louis	0 n/a	1 Symposium	0 n/a	0 n/a	1 UMSL
University of Nebraska at Omaha	1 Office of Research & Creativity	0 n/a	0 n/a	1 Funding up to $2500	1 Research & Creativity Fair
University of New Mexico - Main Campus	1 University of New Mexico Office of Vice President for Research	1 Undergraduate Research Opportunity Conference	1 awards listed on undergraduate research opportunity conference link	1 Funding	1 UNM
University of New Orleans	0 n/a	0 n/a	0 n/a	0 n/a	1 College of Science Undergrad

					uate Research
University North Carolina at Charlotte	1 UNCC	1 Undergraduate Research Conference	1 Conference Themes Winner	0 n/a	1 UNCC
University of North Carolina at Greensboro	1 UNCG	1 Research & Creativity Expo	1 Awardees	1 Funding	1 UNCG
University of Oregon	0 n/a	1 Symposium	1 Awards	0 n/a	0 n/a
University of South Florida - Main Campus	1 USF	1 Undergraduate Research Conference	1 Conference Awardees	0 n/a	1 USF
University of Toledo	1 Toledo Honors	1 The Scholars Celebration	0 n/a	1 Funding	1 Toledo Honors
University of Wisconsin - Milwaukee	1 UWM	1 Symposium	1 Senior Excellence Research Awards	1 Programs/Funding Opportunities	1 UWM
Wayne State University	0 n/a	1 Conference	0 n/a	1 Funding	1 Wayne
Wichita State University	0 n/a	0 n/a	0 n/a	1 Funding	1 Wichita
Wright State University - Main Campus	0 n/a	1 Symposium	0 n/a	0 n/a	1 College of Science & Mathematics Research
Total	**27**	**29**	**19**	**23**	**38**
Percentage	**62.79**	**67.44**	**44.19**	**53.49**	**88.37**

Details on Comparator University Programs

Fresno State University

- There are undergraduate research grants (up to $1,000 each) available for students to apply. Students can design their own projects or work on professors' projects.
- Course-based Undergraduate Research Experiences (CUREs) are offered in the College of Science and Mathematics.

Cleveland State University

- There are undergraduate research grants for students. Funding of $20,000 is available for this program, and about 20 proposals will be funded a year. Students obtain funding to offset the costs associated with doing research undertaken in a CSU credit-bearing courses.
- Summer research program: Sixty-five proposals were funded across six colleges in Summer 2019.

Eastern Michigan University

- Undergraduate research stimulus program: Students earn $2000 to work on a project and faculty mentors receive $500 to support the work. Any student participating in a mentored research or creative project with tenure-track faculty may apply.
- Honors undergraduate fellowships: Students are awarded $1500 to work on special projects including mentored research and creative projects. Applicants must be members of the Honors College.

George Mason University

- The Undergraduate Research Scholars Program at George Mason pairs high achieving undergraduate students with faculty mentors to undertake original research or creative projects. It provides each scholar with a stipend for the semester or summer to enable them to participate in a research project and funds to the faculty mentor to cover materials, such as posters, lab supplies, and equipment.

Kent State University

- There is an office of undergraduate research.
- Undergraduate students who travel to conferences to present their research can obtain up to $500 per award. Conference attendees can obtain up to $250 per award.
- There is an annual undergraduate research symposium.
- Summer undergraduate research experience: $2,800 stipend and on-campus housing if needed. Faculty may be provided with a $400 stipend.

Montclair State University

- The STEM scholars program gives students the chance to do research in their freshman year in the Science, Technology, Engineering and Mathematics (STEM) fields.

- All students in the STEM scholars program take a seminar course each semester together. The seminars focus on professional development and networking within the STEM fields, field trips to different types of STEM professions and a guest speaker series. The final semester includes a STEM Scholars research project. The program also comes with a $2,000 scholarship spread over four semesters.
- They also define undergraduate research as follows: *An undergraduate research experience is an important complement in pursuing an education in the science and mathematics disciplines. It provides students with experiences useful in focusing and refining academic and career decisions, developing problem-solving skills, and integrating what is learned in the classroom. Student researchers develop and demonstrate skills such as the ability to work in a group and be a part of a team, meeting deadlines, oral and communication skills through presentations at local and national professional conferences, and preparing manuscripts for publications.*

Appendix B: Leadership Survey Questions

Questions for University Leadership:

We would appreciate your thoughts, from the perspective of your college or unit, on the following topics:

1. How do you define undergraduate research?
2. What does undergraduate research look like in your college or unit?
3. How does undergraduate research benefit students? Faculty? PSU?
4. What is PSU doing well with respect to undergraduate research?
5. What could PSU do to improve undergraduate research opportunities?
6. What are some obstacles to increasing undergraduate research at PSU?
7. What models outside of PSU provide good examples for how to promote undergraduate research?

Appendix C: Overview of Current Undergraduate Research Opportunities at PSU

REU Site: Computational Modeling Serving the City

Christof Teuscher teuscher@pdx.edu (Principal Investigator, Department of Electrical and Computer Engineering)

Jay Gopalakrishnan (Co-Principal Investigator, Department of Mathematics and Statistics)

https://www.teuscher-lab.com/reucomputing/; https://teuscher-lab.com/altreu/?fbclid=IwAR3sZSl1aNDuuqjCEkAjqlNTO_sNmg7Et1yvurdWoi6hLCKoP6yhoJihkyk

The focus area of our Research Experiences for Undergraduates (REU) site is computational modeling to serve and enhance the Portland metropolitan region as it grows and evolves. Students will be involved in cutting-edge, multi-disciplinary research projects and trained in computational thinking across different disciplines and communities. In doing so, they will gain an understanding of the potential and limits of these tools and how they can serve diverse urban communities. Portland State University (PSU), with its newly-funded Portland Institute for Computational Science (PICS), has developed a reputation as a national model for urban universities that enhance their region by working with partners to solve problems.

REU Site: Application of Microscopy and Microanalysis in Multidisciplinary Research

Jun Jiao jiaoj@pdx.edu (Principal Investigator, Department of Physics)
Erik Sanchez (Co-Principal Investigator, Department of Physics)

https://www.pdx.edu/research-experience/

This REU Site program focuses on the applications of microscopy and microanalysis in multidisciplinary research and provides opportunities for undergraduate students to participate in cutting-edge research projects. The participant recruitment is emphasized on underrepresented minorities, women, veterans of the US armed forces, students with disabilities, and nontraditional students.

Biology S-STEM: Shortlidge Biology Education Research Group

Erin Shortlidge, eshortlidge@pdx.edu

https://www.shortlidgegroup.org/research

Aim is to better understand best practices in teaching and learning in biology and other STEM fields. Currently studying the factors that influence experiences and outcomes from CUREs (Course-based undergraduate research experiences) for students, instructors, and faculty.

Build Exito

Carlos Crespos, ccrespo@pdx.edu

Thomas Keller (kellert@pdx.edu)

https://www.pdx.edu/exito/

EXITO is part of a major NIH initiative to develop, implement, and evaluate innovative research training models for undergraduates historically underrepresented in biomedical research careers. As the research-intensive partner, Oregon Health and Sciences University provides crucial guidance and expertise.

ISS (Institute for Sustainable Solutions)

https://www.pdx.edu/sustainability/institute-for-sustainable-solutions

Building practical solutions for more livable and sustainable cities.

TREC (Transportation Research and Education Center)

https://trec.pdx.edu/

An interdisciplinary research center that supports collaborative research and education on transportation related projects.

The Louis Stokes Alliance for Minority Participation (LSAMP)

https://www.pdx.edu/alliance-minority-participation/

The Louis Stokes Alliance for Minority Participation (LSAMP) at Portland State University. LSAMP is dedicated to supporting the success of underrepresented Science, Technology, Engineering, and Mathematics (STEM) majors. With support from the National Science Foundation and PSU Provost's Office, we provide mentorship, activities, events, and opportunities for students at Portland State University and Portland Community College.

The Ronald E. McNair Scholars Program

https://www.pdx.edu/mcnair-program/

The Ronald E. McNair Scholars Program works with motivated and talented undergraduates who want to pursue Ph.D. degrees. It introduces juniors and seniors who are first-generation, low-income, and/or members of underrepresented groups to academic research and to effective strategies for getting into and graduating from Ph.D. programs.

Maseeh College of Engineering & Computer Science Undergraduate Research & Mentoring Program

https://www.pdx.edu/engineering/undergraduate-research

The Undergraduate Research and Mentoring Program funds paid undergraduate research opportunities for students majoring in all Maseeh College undergraduate disciplines: Civil Engineering, Computer Science, Computer Engineering, Electrical Engineering, Environmental Engineering, and Mechanical Engineering. Additional opportunities may be available to students majoring in Chemistry and Physics.

Honors College

https://www.pdx.edu/honors/

The culminating experience for every Honors student is an undergraduate research or creative experience that produces an undergraduate thesis. Thesis research is conducted in students' majors or minors – one of the messages throughout Honor's curriculum is that research is embedded in fields and disciplines and that to participate in research, a student has to "apprentice" in that field or discipline. The first two years of the Honors curriculum is built to provide students with foundation skills in advanced academic literacies and in methods in the natural sciences, social sciences, and humanities to prepare them to undertake undergraduate research in their junior and senior years. The junior year is when students begin to practice undergraduate research in seminars, internships, and research experiences for credit. Senior year is when the students undertake their research project and write their thesis.

Appendix D. Faculty/Staff Workshop and Report Data

What does undergraduate research look like in your discipline?

- working in a research group in collaboration with fellow undergrads, but with responsibility for a specific aspect of a larger project
- Lab work (and literature and computational research during pandemic)
- in our program undergraduate research usually takes place through collaboration with McNair, Build EXITO, the University Honors program, or in fewer instances, through a student's initiative which may be supported by our program-specific Honors option
- students doing honors theses and McNair; in theory could be also working on research projects as RAs/collaborators (but i have not done this)
- Extensive reading of primary sources and secondary scholarship to shape interpretations of primary sources.
- I think it has great potential. Some faculty try to use course teaching to include certain research projects.
- Most often like hands-on laboratory or field work; occasionally computer work that can be performed remotely after training; e.g., image analysis, statistical analysis
- I'm not aware of many undergraduate researcher in Physics, less than 10 in the last 4 year. We have physics education research, crystallography, biophysics, and a number of experimental equipment designs under NDA.

What obstacles have you faced with engaging undergraduates in research?

- the undergraduates are just volunteers, they don't get any academic credit for their work, which in my research group typically ends up in a talk at the Oregon Academy of Science, or a paper as first author or co-author, the students are therefore restricted by courses they have to take for credit in order to fulfill BS graduation requirements
- Scheduling, financial support
- I've mentored several students in undergraduate research through McNair, the University Honors program, and my program-specific Honors option. None of these provide buyout to support this time, although one (McNair) provides a small stipend. This means this mentoring happens on top of an already heavy workload.
- funding; time
- Time and student preparation to read at advanced levels required for certain types of sources.
- Barriers to publishing research based on class… could get around if students are not research subjects, but part of the process.
- Being able to fund students is huge! So many of our students have to work. Faculty have to use outside grant funding to fund undergraduates, need institutional support to fund, maybe through ties and help students gain awareness. Build collaborative partnerships to increase funding opportunities. This could be difficult in humanities, arts, etc. The less funded research should still be considered valuable.
- What do students know about how to find undergraduate research opportunities? How do they figure out where to go? Students sometimes struggle finding these opportunities and we need to do more to make sure students know the importance of undergraduate research and how to go about getting opportunities. Students might be told no when they are looking for advisors in

honors thesis experience and that can be discouraging. Faculty say no often because of workload considerations… especially in this time of COVID it is almost impossible, but in normal times still seems impossible.

- Implement CURes. Please include the importance of these in the course.
- NTTF are discouraged from doing research and not factored into pay or time and this makes a loss for students because they don't have opportunities to engage in research opportunities. The more people involved in undergraduate research the better, but what is NTTF? There are research specific and teaching specific. Can undergraduate research be encouraged for P&T for NTTF?
- As a NTTF, I do not have any paid time to allocate to working with undergraduates. Nonetheless, many students in my department are desperate to find advisors for undergraduate honors theses as well as the occasional one-off project that is more suited to my own areas of expertise than any of our tenure track faculty. Consequently, I have supervised 2 independent study projects, 1 EXITO student, and 4 honors theses between 2018-2020. I declined 2 requests to supervise honors theses starting this Fall because I will be on leave in Winter and so would not be able to see projects through. Under normal circumstances, I would have taken on those 2 more.At the same time, while TT faculty may officially have time in their contracts for doing research, there is little reward for them to pursue research opportunities with undergraduates. Unless you can ramp up a large lab where postdocs assist in supervising PhDs who assist in supervising MS/BS students, it is impractical for many TT faculty to engage with undergraduates. Undergraduate engagements are often shorter term and do not as reliably result in publications or grants to the same degree as graduate student supervision does. Undergraduates are less prepared than graduate students (as noted several times in the report) because, hello, they are undergraduates! They haven't done research before! They need a lot of assistance, time, and direction. There is little incentive for TT to engage in this extra work that does not help them build their CV & get closer to tenure or promotion. Personally, I love working with undergraduate students and the projects I've worked on have been a highlight of my time at PSU! But, it has also resulted in a lot of long hours and overworking both during the academic year on top of teaching 3-courses in a term and/or during summers when I am technically off contract. But my only option besides overworking is to tell students no, which sucks a lot for them, especially those in honors college who feel that they have been promised the opportunity to develop a thesis by the university despite that the university does not actually take any material steps to ensure faculty availability or reward for their critical role in the honors thesis process. Also, it sucks for me, because working with undergraduates and getting some kind of intellectual outlet for doing research is very important to me! Even though it's not officially what I'm hired for, I cannot teach my classes in up to date ways and feel enthusiastic about it if I'm just a robot repeating the same lectures I gave the year before. I need continued intellectual stimulation and development just like TT faculty do, and undergraduate research projects provide just that kind of opportunity!
  Last, a simpler issue: the honors thesis process is too short. It is so hard to help a student learn how to do research, plan that research, carry out that research, and also write it up in a mere 20 weeks. The honors thesis really needs to be a year-long project, not just 2 quarters. And the summer term for it should be on the extended 10-12 week calendar not the condensed 8-week calendar. It's super stressful.
- The amount of guidance students obtain is limited. Not all students are interested.

- The primary obstacles have been 1) funding to support inclusion of diverse students who can't volunteer their time (owing to needing to work or family commitments), 2) limitations on my time, 3) limitations on graduate students' time (GAs often serve as the primary research mentors on a day-to-day basis). And of course lately 4) Covid-19 and associated limitations.
- I think there are at least three obstacles: little interest among the student population, little knowledge about research opportunities, and few opportunities.

What would help mitigate challenges to working on research with undergraduates?

- accept successful completion of courses such as PH 401 undergraduate research and PH 402 independent research as an elective that does count towards the required and elective courses for a BS in Physics
- Financial support for undergraduate research.
- It would certainly help to have some protected time for this work with undergraduates. It would also be helpful to have an infrastructure at PSU for supporting undergraduate researchers.
- more training/support around working on research with undergrads; grant $ to support this work, more time/buy out as the mentorship may take more time
- Targeted skill training at lower levels. the earlier students are asked to learn to read and work with academic scholarship and to develop the specialized tools necessary to work with complex cultural materials the better.
- Course releases and/or summer stipends for faculty supervising honors thesis projects that showed that the university valued the work required to support undergraduate research opportunities.
- Support NTTF to be PIs on grants by default, without needing exceptions from variously supportive chairs/unit leads, so that they could potentially fund work with undergraduates.
- Small research funding
- Building research into UNST requirements such as the Junior Cluster - in the same way that Erin Shortlidge (Biology) et. al's NSF S-STEM project has done.
- Centralized funding and discipline-specific mentor/mentee training.
- More interest would help. I wish we could generate more. We are trying to do that through the physics club, but it is difficult. We could use some help, some good ideas about that, specifically. Also, we could use more opportunities. It'd be great if we could work the research into courses, so that students don't need to seek out research opportunities, but experience them just by taking classes. I mean the intro classes. Some of that happens in upper-division courses.

How can we promote diversity, equality, and inclusion in undergraduate research opportunities?

- things are already good in that respect, the undergrads approach the faculty member about joining a research group, and it is is up to her or him to accept these students - nothing can be forced here
- Financial support, help with outreach.
- By investing in the colleges, schools, and programs that serve BIPOC, first-generation, and other underrepresented students.

- Build EXITO is a GREAT opportunity; paid opportunities; more targeted recruitment of under-represented students for these opportunities
- Recruitment to bring students here, and support programs to help keep them.
- Provide material support (course releases or pay) to faculty who work with undergraduate students from minority backgrounds.
- Updated required trainings for faculty -- not just in terms of how to mentor but also how to teach -- and some kind of oversight process. We have so many undergraduate courses that are decades behind best practices in terms of broadening participation. And our courses are the gateways to research for students. Why would students get more involved in school (i.e. by doing research) if the academic culture feels so unwelcoming and exclusionary?
- Small research funding
- Building it into required coursework.
- For STEM students, by adding capacity to our LSAMP Program, which involves a more sustainable model than EXITO. This is how OSU (who has its own LSAMP program) has made great strides in improving retention, graduation, and success of diverse STEM students... specifically through investments from multiple university units that have allowed this program to scale its work to serve more students. California LSAMP has a line item in the state budget; they use the state funds to extend the same services to DACA STEM students.
- Direct appeal. We have to heavily recruit from the populations we need. I don't' see why we cannot overwhelm the system with brute force statistics. A surprising number of problems can be solved that way.

Looking at the report, what do you see as the strengths and weaknesses of undergraduate research at PSU?

- Students can’t afford unfunded research/internship opportunities
- lack of recognition of research by undergrads in the PSU system, degree requirements, etc.
- Generally agree
- I'm thrilled that some of us are dedicated to supporting undergraduate research. It's an important pipeline for creating a future academic workforce that -- ideally -- reflects the diversity of student populations.
- For me, the weaknesses are discipline-based. The natural and social sciences have a more obvious path to undergraduate research experiences, provided funding and workload issues are addressed. In the humanities, it is different. I cannot imagine at this time getting time or funding to work with one or more students on research projects involving the close study of cultural artifacts, which would involve considerable time spent working with students on just reading the evidentiary material. Nor do I see a path to taking time out of regular course loads to design a course in which humanities research would be the primary goal.
- The report looks good on the whole, but I would suggest more focus on how NTTF and adjuncts fit into this picture -- and how we can be fairly compensated for work that goes beyond our current job descriptions. Together, we (NTTF and adjuncts) teach a majority of undergraduate credit hours and so we have a lot of contact with undergraduate students making us easy points of contact for them because they already know us! Also, because

our research expectations are reduced for promotion and tenure, we might be less fussed about undergraduate 'preparedness' for research and more ready to meet students where they are. Like, I haven't needed my undergraduate honors thesis students to perform at the graduate level so that I could get a publication out of it to list on my CV. I could work through the thesis as more of a learning opportunity for them, putting their needs before my own. They may not know what they are doing already -- I mean this is the point of undergraduate research, of course they are unprepared! -- but they are great learners, they are inquisitive, they are dedicated, they are hardworking, and they ask good questions. It's so much fun to help them learn to develop a research project!

- We see the value of undergraduate research.
- R2 schools are in a tough spot. Cannot draw the big researchers to the school, but cannot really lean on being a small college to attract the other pool of exceptional students. The strength of PSU is our urban location and diversity.

What should be the top three priorities for supporting and expanding undergraduate research opportunities at PSU?

- making achievements of undergrads count towards the electives that fulfill the requirements towards a BS in Physics
- Financial support for students, financial support for mentors, teaching credit for mentoring.
- 1. Address faculty workload, 2. Improve access to research opportunities for BIPOC, first-generation, and underrepresented students, and 3. Centralize information and communication about undergraduate student research.
- funding, equity strategies, faculty training/support
- access, workload, and coordination
- Grapple with the complex faculty workload & incentive issues.
- Encourage faculty CUR development; Match-making with community demands;
- Expand research, expand opportunity, expand interest.

Other Comments:

- As a member of the faculty that is from an "underrepresented" group, I know it was undergraduate research that laid the foundations for my PhD, and eventual hiring in a tenure-track position.