College of Science, Oregon State University

Strategic Planning Process

Concept Paper: Community, Physical and Digital Infrastructure

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Sub-group Members

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Executive Summary

To be successful in our mission, the College of Science must invest in, support and promote our faculty, staff, advisors and students. We will strive to nurture a diverse community of science leaders, mentors, advisors and culture shapers through investments in people, infrastructure and digital resources. In this report, we discuss the results of the engagement sessions that were conducted during the strategic planning process as related to the present and future state of community, physical and digital infrastructure needs in the College of Science.

Context: Oregon State University

We have a commitment to teaching, research, and outreach and engagement, which allows Oregon State University to promote economic, social, cultural, and environmental progress for the people of Oregon, the nation, and the world. To achieve our mission, we have world class faculty & facilities and a strong commitment to engage in exceptional research, discovery, innovation, and engagement as well as integrate research and engagement as we deliver high-quality education as an affordable land grant institution. Concomitantly, to ensure the success of **O**ur people, faculty, staff, instructors, and students, we need resources, physical spaces, and world class facilities. OSU Strategic Plan 4.0 has 4 goals towards achieving mission and vision, which include:

Goal I. Preeminence in research scholarship and innovation

Goal II.Transformative education that is accessible to all learners

Goal III. Significant and visible impact in Oregon and beyond

Goal IV. A culture of belonging, collaboration, and innovation

This concept paper will focus specifically on the present state and forecast of infrastructure when it comes to the human, physical, digital, and technological infrastructure and aligns with Goal IV in SP 4.0 focused on building a culture of belonging, collaboration, and innovation so that we are distinctive in:

- Demonstrated commitment to diversity, equity, and justice
- Support for the long-term success of our tenure-track and non-tenure track faculty

- Support of the career progression and long-term success of our staff
- Deliberate approach to developing effective administrators and leaders
- Nimbleness in the face of rapidly changing forces in higher education

*Research, teaching, and public engagement infrastructure are discussed more specifically in other derived concept papers.

Context: The College of Science

Mission

Our infrastructure supports our faculty and staff with resources that enable them to be better and more inclusive teachers, researchers, and leaders. This includes but is not restricted to people, physical and virtual spaces, technology, digital enterprises, curricular, pedagogy, and human resource services, which all constitute our core infrastructure.

The CoS needs to continue to enable and grow the quality and availability of high-impact transformative student experiences across a wider subset of our current student population. Support structures in college for science students are strong and need to continue with a solid foundation built on demonstrated need and effectiveness and increased attention to the diversity of the students being served (e.g. their starting skills and knowledge, their ability to access).

The present state and new infrastructure within the College's control should be evaluated with a diverse, inclusive, and equitable (DEI) lens towards strengthening the College's broad reputation for collaboration, openness, and interdisciplinarity.

Vision

The infrastructure in the CoS encompasses resources and support for research, teaching, and public engagement and our people whether they be CoS students, faculty, instructors, or staff. CoS infrastructure directly supports the College's Mission, Vision, Values by:

- encouraging collaboration and mentoring
- fostering inclusivity
- enabling transformative student experiences
- globally recognized research
- teaching strong foundational knowledge in the basic sciences

- imparting specific transferable skills (e.g. communication, leadership and social responsibility) that are in demand by non-academic employers

through its thoughtful design, access, usage, and sustainability.

Values

- Our people—our students, faculty, staff, alumni—and their successes
- Fundamental research for a better future
- Collaboration to solve the world's problems and create opportunities
- Meaningful experiences that transform lives
- Outstanding teaching to engage learners
- Diversity to build the best teams to do the best science
- An inclusive community

Research & Teaching Infrastructure

Current State of the Art Physical Infrastructure and Support for Collaboration and Innovation in Research: Faculty and students recognize that clear strengths of the CoS are its innovative, collaborative, and foundational research and its great research facilities. Within the CoS, we have the best NMR facility in the Pacific Northwest, electron microscopy, mass spectroscopy, materials synthesis and characterization facility, the Unnatural Protein Facility, X-Ray Diffraction Lab and the Electrophysiology Facility. We also have several centers including the Pacific Northwest Center for Translational Environmental Health Research, the Oregon State Microbiome Initiative (OMBI), Center for Quantitative Life Sciences, John L. Fryer Aquatic Animal Health Laboratory, Oregon State Herpetological Collection, Oregon State Arthropod Collection, Survey Research Center, and our new North American Nanohertz Observatory for Gravitational Waves. In prior years, we also had the Center for Chemical Innovation Program and the Center for Sustainable Materials Chemistry (CSMC). More recently, funding from the M. J. Murdock Charitable Trust, we have Oregon State Continuous Flow Facility, an innovation center that is equipped with in-line scientific analytical tools and process units that will transform the discovery and synthesis of new molecules and materials by continuous flow (CF) methods.

In addition to support in the grant submission process, CoS have pilot funding through the SiRiS program which supports a range of collaborative research projects involving the college community and beyond to help faculty with their research mission. Our world-class

research faculty in CoS support experiential learning experiences through several different programs such as the SURE and URSA, which allow students to extend foundational knowledge in science beyond the classroom, build their scientific identities, and identify career pathways. Both these investments have helped faculty and students collaborate and innovate thereby meeting our research mission. The CoS should sustainably invest in existing areas while moving into new areas that maximize our strengths.

Current State of the Art in Teaching Infrastructure: The Student Success Center and the peer advisors are the "heart of the CcS" providing invaluable resources to help students adjust and succeed in STEM. Lastly, the CoS has many spaces, opportunities, and partnerships that allow faculty and instructors to do public outreach and engagement. In the face of rapidly changing forces in higher education and with a mission to serve Oregonians as a land grant institution, the CoS is adaptable through its online learning ECampus program, ranked 4th in the nation. The increasing demand for online learning, especially during the COVID-19 pandemic, led to increasing enrollment that offsets the decrease in enrollment on campus. The ECampus programs have sustained the CoS during its most difficult time. To facilitate and support innovative pedagogical development faculty and instructors in the CoS engage with the Center for Teaching and Learning, a center outside of the CoS, for pedagogical development and ECampus program coordinators to transform courses online.

TRACE is the most recent and excellent example of OSU and the CoS commitment to serving ALL Oregonians. Members of the CoS have significantly benefited from engagement with external partnerships. Examples include the Black Student Success Center, which helps students of color in key courses that they struggle with such as Chemistry and Math, as well as the STEM Research Center Inclusive Excellence Program, which helps faculty develop inclusive practices and culturally relevant pedagogy inside of the classroom. It is imperative that the CoS continues to engage and build new partnerships with other programs on campus that allow faculty to connect, learn, and innovate best inclusive practices in teaching particularly with students from diverse backgrounds.

Infrastructure that supports research, teaching, and public outreach and engagement is critical to advancing our mission innovatively, inclusively, and equitably across a complex and changing landscape. Bold investments in infrastructure will enhance quality and excellence in alignment with OSU's strategic priorities. Therefore, the CoS faculty would benefit from continued interactions and with the Center for Teaching and Learning, the

Black Student Success Center, the Cultural Resource Center, and the Office of Institutional Diversity to foster a culture of inclusivity, pedagogical innovation, connection to our changing student body, and gains in student success. The CoS should continue and expand its commitment to resources that advance student success such as the learning centers, learning assistants and SI tables as well as experiential learning experiences that help build strong professional and scientific identities in science. An investment in marketing and branding at the CoS and departmental level will help faculty, instructors, and administrators advance, promote, and highlight excellence in research and teaching to the public to change their perception of science, inform policy makers, and communicate the value of education at OSU to future students and their parents. Marketing and branding also allows us to generate a new revenue stream for investment as we build new relations with potential donors, investors, private foundations, and industry.

Developing the Next Generation of Leaders, Mentors, and Cultural Shapers

Like many colleges at OSU, development of leaders has been focused on the senior administrators (e.g. Deans, ADs) level with a combination of people management, diversity and leadership curriculums. What this does not address is the pipeline of future senior leaders or imparting leadership and transferable skills to our graduating students, who will be our alumni's and global leaders in science solving complex problems at the interface of interdisciplinary and transdisciplinary science.

Most recently the CoS leadership have encouraged faculty and instructors to participate in the Graduate School of Education Train the Trainer program that allows faculty to build and transfer their mentoring skills to junior faculty, post-doctoral researchers, and graduate students. Though in its initial stages, a mentoring culture is a strong step in creating a culture of belonging, academic coaching to support faculty and students in the CoS. The Dean's Advisory Council, College Leadership Team, and the College Equity, Justice, and Inclusion (EJI) committees are a few examples where faculty, instructors, and students (graduates and undergraduate) informally build leadership muscles as the try to shape the CoS. However, these leadership opportunities are not always accessible to everyone and there is no formal process to build professional development and transferable skills that effective leaders need, such as emotional intelligence, adaptability, negotiation, communication and active listening, project management, strategic and systems thinking,

team building, and inclusive leadership.[1] To plan for the impending change in the leadership landscape resulting from retirement and to make a shift towards more transdisciplinary collaborations that center on solving global challenges, crosscutting discoveries and innovations, the CoS must prioritize investment in professional development, transferable skills and inclusive leadership skills to fill equity gaps. With strong emotional and cultural intelligence, adaptability and innovation skills, Our people will be able to view processes and practices with a DEI lens, develop mutual respect for varying disciplines and collaborate more effectively across boundaries, and manage large-scale and interdisciplinary or transdisciplinary projects or programs.

Shaping future leaders in the CoS is not just for faculty, staff, and instructors. The leadership model also applies to how the CoS prepares the next generation of graduate global leaders. The National Academy of Science report on 21st Century skills for graduate students highlights the importance of professional development and transferable skills to MS and PhD students, who are seeking skills in leadership, communication, ethics, and social responsibility.[2] We have a responsibility to ensure we building strong scientific, professional and leadership identities with our graduates.

Equity, Access & Inclusion

Equity by its definition is fairness in the distribution of and access to opportunity for all individuals. The College has a steadfast commitment to embedding equity, access and inclusion within the design, access, use and sustainability of its infrastructure. This includes the following vectors of intent:

- Strengthening the pedagogy of science across the College so it continues to be more inclusive and effective for more students
- Recruiting, hiring and retaining faculty with diverse lived perspectives (e.g. URM, gender, sexual orientation) and who possess skills in both online and in-person pedagogy so that our faculty represents a broader set of diversity dimensions
- Improving the recognition of all forms of contribution for faculty in the tenure process, especially contributions by minoritized faculty.
- Reducing the impact of science on the increasing cost of college to improve student access.
- Innovating and strengthening student support resources with increased focus on recognizing the starting point of all students, specifically those that are

disadvantaged, increasing access to all student types (e.g. remote, working) and clarifying the entire suite of available resources.
- Making experiential learning experiences accessible to a broader set of science students by more broadly communicating opportunities and expanding rubrics to include students with differing backgrounds.

Lessons Learned from Our Community and Strategic Partners

Physical Infrastructure Challenges and Opportunities: Our physical spaces for learning, equipment, and technology for teaching science and performing research impact our ability to teach our students, enhance their learning, and build excellence in research. Our buildings are aging and there is lack of space for collaboration and learning. Research infrastructure needs in the College include to update buildings, labs and workspaces and to ensure that research facilities are sufficiently staffed and to balance between support for fundamental research and applied research. We need to keep investing in the research clusters and facilities that are our strengths, so they form the foundation for our research and training students and become the nexus for collaboration in and beyond OSU.

Human Infrastructure Challenges and Opportunities: With growth in enrollment on campus and Ecampus - both populations continue to be interested in experiential learning experiences and professional development of “soft skills” such as communication, teamwork, networking, and leadership incorporated into the existing curriculum and not new requirements added on to the existing load a student is required to take to graduate. These are similar needs stated by graduate students. Other resources that we heard in this space not already mentioned above and not already offered by the University include providing travel support, improving advising experiences, partnering with industry for internships, networking, mentoring. Furthermore, the COS community would like continued support from the Center for Teaching and Learning and resources that will advance student success such as the learning centers, learning assistants and SI tables.

To increase innovation in research and teaching, support diverse students, and minimize burnout, we need to build a representative faculty population with different diversity dimensions and skill sets. Invest in the faculty already here with PD around teaching via different modalities and across different student populations (online vs onsite and other

inclusive vectors like gender, race etc.). This is all on top of interdisciplinary spaces that foster collaborative partnerships between the CoS and others at OSU and beyond.

A strong marketing and branding plan and team is necessary for the COS to advance, promote, and highlight our research mission and excellence as well as continued engagement with the public.

Collaborative Infrastructure: A recurrent theme in the engagement sessions is increased support to foster interdisciplinary collaborations, both between units within the CoS and with other colleges. This includes but is not limited to the need for additional space and time for faculty to connect and network, mechanisms to encourage the sharing of research facilities between units, promotion of faculty efforts on interdisciplinary collaborations particularly in P&T and periodic evaluations, and resources such as buyouts. It's important to have seamless collaborative partnerships between colleges with transparent processes and policies that allow each group to see the benefits and contributions from collaborative work. Continued and increased pilot funding and grant support is needed to ensure that faculty has the resources to continue to advance the innovative research they have been conducting and build new efforts in collaborative work. It is important to have staff support to facilitate and to provide training in grant writing and the management of interdisciplinary research projects. Lastly, strategic partners also stressed the importance of building inclusive and integrative partnerships with the social sciences that allow faculty in COS to communicate the translational potential of research and its direct impacts to society

Physical, human, collaborative, and technological infrastructure that supports research, teaching, and community outreach and engagement will allow CoS faculty, instructors, staff, and students to innovate in research and pedagogy and connect with the broader community within OSU and with external partners.

Trends in Higher Education

National and International Trends and Projected Growth Markets

The Covid-19 pandemic demonstrated in a graphic way that there continues to exist wealth inequities and health disparities between various parts of our society. Remote modalities for education and work advantaged those who had the resources and situations that allowed for that mode of engagement. As we exit the pandemic into the next phase, higher

education sees several trends such as a new culture of remote vs on-campus experiences, changing demographics as higher education is seen as a path towards more advantage by more of our diverse society and the recognition that the problems facing society are more complex and global. This will require new infrastructure investments to continue providing a high-quality education to a changing landscape resulting in a science workforce and science researchers that are more collaborative and interdisciplinary in their knowledge, experiences and methodologies to solving problems. Lastly, the view of science in the public is also cause for concern as the COVID-19 pandemic clearly revealed.

Infrastructure challenges and trends that can affect or influence how CoS provides its services and conducts its mission

Existing and emerging trends faced by the CoS create challenges and unmet needs for both the human and physical infrastructure of the college. Threats that hinder our research excellence include (1) prioritization of instruction over research, which has led to the loss of tenure-track faculty, (2) decline in funding for hiring and retaining tenure-track faculty and for providing competitive startup packages, and (3) limited research facility and equipment decline. In face of the increasing student enrollment and ever-changing student demographics, our ability to maintain high education quality is challenged by (1) a shortage of tenure-track faculty and instructors to support more student credit hours, (2) waning centralized services to meet increased student needs, (3) limited teaching spaces for increasing enrollment, and (4) a need for more ECampus offerings. In addition, declining staff support to maintain our IT infrastructure and increasing cybersecurity threats affect how the college conducts its missions. Efforts should be made to mitigate these threats and challenges in order to unleash the full potential of COS to pursue its visions.

Key issues and opportunities for CoS

Overwhelmingly, the CoS community and its strategic partners support investing in **O**ur people with competitive start-up and retention packages, the physical infrastructure with spaces that are prepared for natural threats (e.g. earthquakes, pandemics), research excellence while being welcoming and inclusive spaces and collaborative infrastructure.

Strategic Themes for the Future

Our goal should be to Intentionally Prioritize Investment in Our People building a strong physical, collaborative, and leadership capacity infrastructure to achieve inclusive excellence in our mission.

Strategic Theme 1: Build Leadership Capacity to Carry Out the CoS and OSU Mission as a Land Grant University

- **Action Items**
  - Recruit and retain high caliber and diverse talent that can lead and enhance our research, teaching, and public outreach and engagement mission both on campus and ECampus
  - Strategically assemble teaching and research clusters to solve emerging shifts in higher education, technological advances, and to solve global challenges in climate, energy, and human health
  - Develop a leadership institute to support the next generation of leaders with professional development and transferable skills to shape a strong inclusive leadership and collaborative culture within the CoS and OSU
  - Create a tiered mentoring academy to help support people develop skills in mentoring practices
  - Conduct performance measurements towards metrics for success and provide continuous skills development to advance CoS mission and vision
- **Equity Lens:**
  - Examine current support structures and development opportunities for faculty (e.g. mentoring, development opportunities, leadership opportunities) with a lens towards making them more transparent and equitable towards early career and minoritized faculty
  - Create an inventory of support structures and opportunities available towards early career and minoritized faculty
  - Evaluate and track which faculty are provided with leadership opportunities within the COS and implement best practices to improve opportunities for early career and minoritized faculty

Strategic Theme 2: Construct a Culture of Collaboration

- **Action Items**

    - Create social and inclusive spaces (physical and virtual) and opportunities for collaboration, innovation, and networking within CoS, outside CoS, and externally outside OSU where members can build social cohesiveness, support diverse perspectives/lens/approaches to science, encourage adaptive flexibility to change, share and develop common goals, and exchange ideas
    - Encourage attitudes toward collaboration and reward efforts when the CoS community members form interdisciplinary and transdisciplinary collaborations in research and pedological innovations
    - Build technology infrastructure readiness by providing access to the necessary bandwidth, electronic communication, software and equipment, network linkages between remote sites/partners, and technical support for successful collaborations as well as members skills for effective communication during collaboration.
    - Strategically organize or provide opportunities people from different disciplines to come to gather to share their research or pedagogical innovations as well as assemble to solve a scientific, social, public health problem
    - Reward faculty efforts in interdisciplinary collaborations during periodic evaluations and P&T
- **Equity Lens:**
    - Examine our support and rewards structure for strategic interdisciplinary and interdisciplinary and transdisciplinary collaboration to identify who receives support and rewards
    - Create opportunities for collaboration that involve early career and minoritized faculty, graduate students, instructors, and folks outside of the CoS and other disciplines

Strategic Theme 3: Strategically Engage the Community and Align Fundraising to Meet Specific Needs

- **Action Items**
    - Offer training to faculty to learn build science communication and advocacy skills so that they are better able to communicate with potential donors, investors, funding raising campaigns, private foundations, and industry partners that would generate investment for physical (collaborative spaces,

student learning environments) and human infrastructure (scholarships, experiential learning opportunities)
    - Build Industry-academic partnerships to create a pipeline to industry and a source of support for student centered programs
- **Equity Lens**
    - Create a transparent and equitable process to increase endowments, and distinguished professorships and faculty scholars

Strategic Theme 4. Invest in Physical and Technological Infrastructure

- Invest in new collaborative or complement existing academic and research infrastructure (clusters, centers, institutes) that allow CoS to properly educate the next generation of scientific leaders and conduct research that converges to solve big challenges in society
- Establish new collaborative research buildings and facilities
- Maintain faculty-wide instrumentation programs or centers
- Increased support for IT and computational facilities to ensure they are adequately maintained and stay updated to support research and teaching
- Market and brand our research and educational value to increase our visibility nationally and internationally

References

1. Council, N. R., *Assessing 21st Century Skills: Summary of a Workshop*. The National Academies Press: Washington, DC, 2011; p 154.

2. National Academies of Sciences, E.; Medicine, *Graduate STEM Education for the 21st Century*. The National Academies Press: Washington, DC, 2018; p 202.