

## Response to November 16, 2023 UW Board of Trustees Request Regarding the Science Initiative

On November 16, 2023 during the public session annual report on the Science Initiative, Trustee McKinley requested that the FY 24 Science Initiative Budget be provided to the Board of Trustees. The budget, and an accompanying narrative, is provided below.

Science Initiative Unit	Programs/Categories	FY24 Budget
<b>SI Director's Office</b>	Admin Staffing and Expenses	\$465,400
<b>COEELESE- Center for Outreach &amp; Engagement, Experiential Learning, and Excellence in STEM Education</b>	Active Learning Training Programs (LAMP)	\$400,000
	Undergraduate Research Program (WRSP)	\$900,000
	Outreach & Engagement	\$226,000
<b>CASI- Center for Advanced Scientific Instrumentation</b>	Plant and Animal Facilities	\$1,226,000
	Instrument Facilities	
<b>Thematic Centers</b> (e.g. Controlled Environment Agriculture, Quantum Information Science, etc.)	PhD Scholars Program	\$932,600
	Innovative Seed Grants	\$600,000
<b>Total</b>		<b>4,750,000</b>

### Budget Narrative

**SI Director's Office** will include accounting and reporting staff to monitor all cost categories, create annual reports and communicate impacts. The Director will be a distinguished scientist to lead the effort, reporting to the VPRED, who will also be responsible for fundraising through private sources and facilitating federal grants.

**Center for Outreach & Engagement, Experiential Learning, and Excellence in STEM Education (COEELESE)** will be responsible for

- innovations in STEM learning in higher education, such as active learning,
- undergraduate experiential learning through research and related experiences and
- outreach and engagement with K-12 schools as well as Wyoming communities.

These programs have been implemented for many years and have demonstrated their usefulness in STEM education and outreach to Wyoming's students and communities.

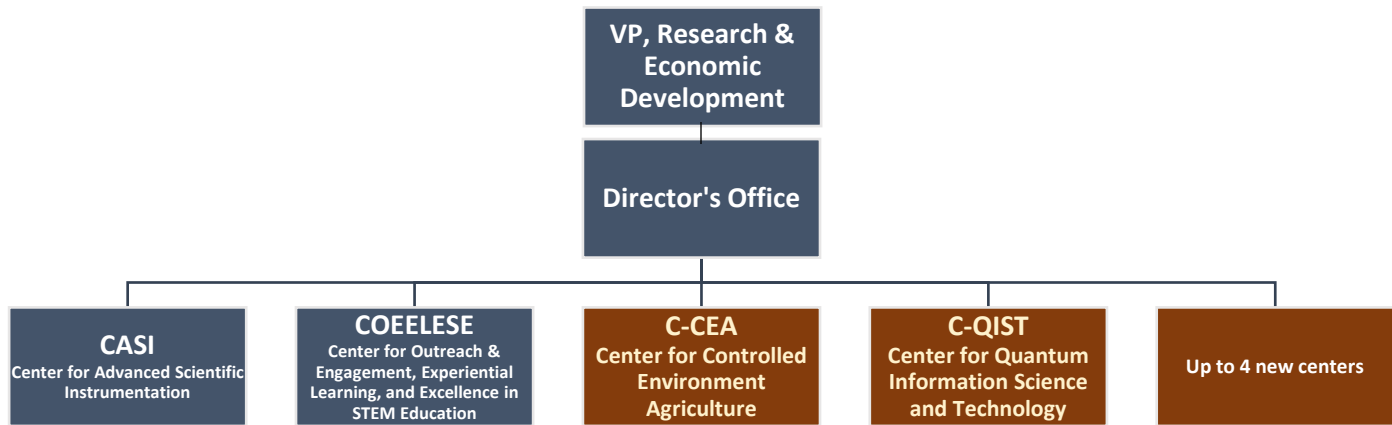
**Center for Advanced Scientific Instrumentation (CASI)** houses two types of facilities for enabling top-tier research in science and engineering. The original report commissioned by the legislature called this Center for Advanced Scientific Imaging; the slight name change reflects the need to broaden the type of instrumentation needed for the modern sciences in 2023 and beyond that a narrower set of imaging instrumentation envisioned in 2014. The CASI budget in FY24 will be used for operating all 'fee for service' facilities including imaging, spectroscopic and growth (plant and animal) facilities.

**Thematic Centers** are not physical entities but are teams of faculty from different disciplines addressing topics that are relevant to Wyoming's natural heritage, current economy, and future opportunities. This convergence of science will increase opportunities to get large grants and provide interdisciplinary training to PhD scholars consistent with the original vision. The original plan included PhD Scholars and seed grant programs "to stimulate research innovation and student training in emergent areas of science relevant to the Wyoming's

economy.” The PhD Scholars Program was proposed to draw the best doctoral students from the U.S. and worldwide, augmenting their training with strong research and teaching components. The Innovative Seed Grants program was proposed to “enable UW to attract and retain the nation’s best faculty in emergent areas of science relevant to the state of Wyoming.” To meet this original vision and to seed areas of science excellence, PhD and post-doctoral scholars will be recruited in the thematic centers selected competitively and the seed grants will be provided to these centers for facilitate convergence of sciences to address problems relevant to Wyoming, while still making plans for nationally competitive extramural large grants in those areas. This approach uses competitive processes for research area selection and scholars. Plans are already underway to provide strategic assistance and mentoring in preparation of complex large grants. This proactive management of thematic center teams will increase success in competitive funding.

Plans for implementing FY24 SI programs

UW’s Top Tier Science Initiative without an organization structure supporting its implementation will not be as effective in the long term as personnel and leadership change over time. Therefore, an organization with proper governance is needed to ensure the long-term success of SI investments. The Science Institute (which refers to the collective programming housed within the Science Initiative building) as shown below will allow effective and accountable use of Science Initiative Phase 1 resources to achieve the original vision in the same overall programs proposed in the past years. This organizational strategy as an Institute and centers will allow leveraging state investments for maximum benefit to the state and for achieving the original vision. Both the institute and thematic centers in this model are virtual, spread across the campus. The thematic centers (in brown below) are multidisciplinary teams of faculty that coalesce to undertake projects leading to large grants. They are temporary (~3 years) unless they receive extramural funding to support their center-scale activities.



Evolution of Science Initiative

In addition to responding to the direct request for the FY24 Science Initiaitve Budget, UW administration finds it important to provide clarity on how the Science Initiative has evolved to meet the needs and opportunities of today’s scientific landscape, while maintaining fidelity to the original legislative intent.

The Science Initiative as envisioned in FY14 was based on the directive of the Wyoming legislature “to lead the university toward a top quartile academic and research institution in areas of science pertinent to the economies of Wyoming and the nation, and other elements related to Wyoming’s quality of life”. As a result, Governor Mead charged a task force to prepare a report to chart a path towards achieving this goal. According to this report (pg. 10),

“The Science Initiative involves three central elements:

1. modern state-of-the-art *research centers* to house new facilities for imaging; advanced biological, chemical, and physics research; and astronomical exploration;
2. *active learning classrooms* and programs to fundamentally transform science education in the state; and
3. *programs to stimulate research innovation* and student training in emergent areas of science relevant to the Wyoming’s economy.”

These three key elements remain the centerpiece in the current plan. In FY24, the legislature funded Phase 1 of the Science Initiative. Though these key elements of the original vision of SI and the matrix for its success remain unchanged in the last decade, sciences have evolved and so did implementation of SI.

### **Traditional disciplinary boundaries are disappearing.**

The 2014 SI report focused on five science departments- botany, chemistry, molecular biology, physics & astronomy, zoology & physiology. However, science in these departments is increasingly connected to that in other science and engineering departments, as it is nationally. Recent National Academy studies<sup>1</sup> abound showing major changes in the national science landscape rapidly making science more interdisciplinary around complex grand challenges, and more computational. Funding programs at research agencies have been revamped to reflect these changes in the culture of science. This need for increased interdisciplinarity is exemplified by SI program participants during FY23. Learning Actively Mentoring Program (LAMP) served instructors teaching 32 subjects. The Wyoming Research Scholars Program (WRSP) supported undergraduate scholars from 22 different majors in five colleges. The FY22 budget allowed for funding of several seed grants of median size close to \$90,000; they included faculty from 16 departments in three colleges. Thus, in addition to the original focus on five core science departments, SI has evolved to serve all science and engineering departments at UW. ***In the future, an increased emphasis on interdisciplinary research is needed to foster emerging topics; some, like quantum computing, were not known, or considered important, in 2014.***

### **Science research landscape at UW and nationally is changing.**

In 2012 (as reported in the SI task force report), 25% of research activity was in the original five cores with total UW research portfolio of ~\$87 million. In 2022, UW reported \$139 million in research expenditures; 11% of these were in the original five core departments. Thus, research activities in many other departments have significantly increased, while the nature of science is rapidly changing to be more interdisciplinary and computational, as described above. Most of the current UW grants are single investigator or small team grants. ***For UW to further increase its research stature, multi-investigator, multidisciplinary teams from across UW need to be fostered to develop projects for competitive center-scale grants from major funding***

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<sup>1</sup> See for example Convergence: Facilitating Transdisciplinary Integration of Life Sciences, Physical Sciences, Engineering, and Beyond, National Academies of Sciences, Engineering, and Medicine. 2014. Convergence: Facilitating Transdisciplinary Integration of Life Sciences, Physical Sciences, Engineering, and Beyond. Washington, DC: The National Academies Press. <https://doi.org/10.17226/18722> and [Open Science by Design: Realizing a Vision for 21st Century Research.](https://nap.nationalacademies.org/read/25116) <https://nap.nationalacademies.org/read/25116> (President Seidel was a co-author of the study)

**agencies and industries, involving a broader cross-section of campus and bringing in more external funding.** Projects that do not achieve external funding will be sunset.

**Original program/center portfolio has changed to address new needs and available funding.**

In the SI task force report, K-12 outreach programs were not included. Since 2017, SI Roadshow was introduced for development of STEM class modules in K-12 classes. In 2023, STEM Days were introduced; STEM Days are opportunities for the Roadshow and other UW STEM outreach collaborators to travel to the school where students explore a variety of STEM activities by rotating through hands-on stations. The original report had proposed a Competitive Research Innovation program (CRIP), the spirit of which is embraced and enhanced with our current activities. However, the equipment support component of this program was not included in the subsequent budget requests, thus limiting it to a faculty innovation grant program (seed grants).

**Graduate education and opportunities for graduate funding have changed since 2014.**

In 2014, funds were requested to support PhD scholars with larger stipends with the expectation that UW's science departments will attract high quality graduate students to UW. At that time, UW had about 60 PhD students. Now it graduates 90 PhD students. In recent years, many graduate students have received prestigious National Science Foundation Graduate Research Fellowships. These scholars selected UW because of unique research opportunities we offer. Thus, ***actively recruiting PhD students in research areas that are unique strengths of UW's research (e.g. opportunity to work in Yellowstone-Grand Teton area or to use NWSC) will be a more effective mechanism for attracting high quality PhD students than passively providing SI PhD fellowships to high ranked students in traditional science majors.*** This strategy of providing interdisciplinary research opportunities in focused areas will also allow UW to be competitive in obtaining graduate training grants.