

Advancing Research and Scholarship at the University of Wyoming: A Focus on Society's Grand Challenges

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I. Introduction and Purpose

This purpose of this document is to propose processes and structure for engaging stakeholders at UW in planning for, investment in, and implementation of a University-wide research agenda for 2019 and beyond.

The purpose of this planning activity is to deeply engage the campus communities in identifying and planning for UW's pursuit of grand research challenges. Investing in and pursuing such transdisciplinary challenges will enable the University of Wyoming to assert leadership and be among leaders in select areas as it serves the state, region, nation, and globe. This activity will identify areas where investments in research capacity are needed, where incentives to promote vibrant partnering need to be created, where opportunities to align and identify academic coursework with Grand Challenges should be sought, and where opportunities for Grand Challenge research to have an economic impact are high. Girding all of this is the requirement that Grand Challenge research serves as a powerful platform for student education, and for educational outreach to citizens of Wyoming and the Mountain West.

A successful outcome will be an assessment and recommendations from a new Research Planning Council (RPC) for six to eight transdisciplinary Grand Challenge research areas. Some or all of them will be selected by the Office of Research and Economic Development and Academic Affairs for further detailed planning for transdisciplinary research centers or institutes, with resources provided to support this planning and initial investments in research capacity. Long-term goals for such centers include developing business models that engage federal and state sponsors, foundations and donors, private industry, and the state in supporting transdisciplinary research enterprises that are financially viable.

Broad faculty engagement to develop the RPC's recommendations will be central to the process. This will take place through open discussions, led by RPC members, about the research activities and perspectives on transdisciplinary research that are specific to each college and its departments. The process will also provide opportunities to give feedback on the RPC report before final decisions are made.

Fundamentally, pursuing this activity is meant to set the stage for creating new opportunities for faculty and students to lead and be among leaders in addressing questions of great societal importance, and for its citizens to benefit from this engagement. Impact will arise by generating

ideas that contribute to solutions to problems of practical importance, and that yield intellectual property that will be at the foundation of new businesses in Wyoming. The activity will create educational opportunities connected to today's most important questions. It will support a vision for a UW future enabled by the nimbleness that comes with UW's modest size, the university's Land Grant mandate to serve the state across a wide range of disciplines, UW's culture of partnership on campus, and its faculty's strong sense of Wyoming patriotism. With planning, targeted dedication of resources, and smart partnership between faculty, the administration, the Board of Trustees, and the UW Foundation, the University of Wyoming can become known nationally as a research leader and strong partner, one that excels and responds ably to rapidly evolving research developments important for Wyoming, the nation, and the world. Its research will become known for its unusually strong combination of scholarship and practical import. UW will do this while creating unparalleled opportunities for education through research.

II. Background

In the Spring of 2018, the UW Office of Research and Economic Development (ORED) published an Office of Research and Economic Development Strategic Plan, [*Breakthroughs in Research 2018-2022*](#) that aligns with the [*University Strategic Plan: Breaking Through 2017-2022*](#). That ORED plan is comprised of 5 goals with associated drivers, enabling forces and metrics that give high-level guidance for the research enterprise:

- Breaking through in sponsored research
 - Increase research supported by external sponsors in all fields in areas of statewide, national and global interest.
 - Raise institutional expectations and rewards regarding research intensity and external research sponsorship
- Breaking through to the marketplace
 - Facilitate intellectual property protection of ideas born from UW research, lead business development resources at the university, and work with the state and its initiatives to increase of the number and diversity of businesses launched
- Breaking through to new research horizons
 - Increase UW's capacity to respond to disruptive research developments that cannot be predicted, especially those that demand transdisciplinary responses and that are of national and global importance.
 - This demands practices that promote interdepartmental cooperation, including transdisciplinary programs and sharing of resources
- Breaking through to new research talent
 - Increase research opportunities for the UW campus and Wyoming community college students, enabled by a new office of undergraduate research.
 - Support increasing the number of underrepresented faculty who perform research and apply for grants that support growth in minority Student representation.
- Breaking through with excellence in research administration
 - Implement an organizational structure and practices that enable efficient, transparent research program administration and engages a broad range of stakeholders

In the time since the publication of ORED's strategic plan, significant momentum has been built in the areas of breaking through to sponsored research, breaking through to the marketplace, and breaking through to excellence in research administration. For example, UW has made hires to stand up its Institute for Innovation and Entrepreneurship, ORED has strengthened its support of technology transfer, and ORED is filling critical gaps in research support capacity. In addition, ORED and Academic Affairs have implemented and are optimizing a transparent, scalable process for awarding startup funds for research to promising new faculty. This is in the context of major investments and activities in the Tier 1 Engineering, Science, and Trustees Education Initiatives.

As a result, now is the time to begin development strategy and actions plans around the other three goals: breaking through 1) in sponsored research, 2) to new research horizons and 3) towards new research talent. By necessity, such work requires a strong partnership between the Divisions of Research and Economic Development and Academic Affairs. The purpose of this document is to outline principles, processes and structure for engaging stakeholders at UW in planning for, investment in, and implementation of break through research activities for 2019 and beyond.

III. A Focus on Transdisciplinary Research

That Wyoming and society in general are facing challenges for which solutions can only be found through transdisciplinary collaboration has been clear for a long time. That universities need to step beyond disciplinary bounds to examine and revise their approaches to finding these solutions has also been recognized at the highest levels. For example, the National Academies have addressed the necessity and challenges of transdisciplinary research in two studies, one in 2004, and another in 2014. The 2014 study, titled "Convergence: Facilitating Transdisciplinary Integration of Life Sciences, Physical Sciences, Engineering, and Beyond" focuses in part on lessons learned at research institutions from across the country in the intervening decade.

Institutional approaches - The challenge of meeting transdisciplinary research problems head-on has prompted a wide array of responses at universities. Many responses have been incremental. For example, some universities have instituted policy changes related to faculty performance, tenure, and promotion to ensure that transdisciplinary research is rewarded properly when an academic department's *de facto* interests may understandably be discipline specific. At the other extreme, complete restructuring of academic units have been undertaken. Arizona State's president led the complete *dismantling* of its previous departmental structure in favor of cross-cutting units and reward structure centered on societally important, transdisciplinary challenges. Between these extremes, many universities have promoted the formation of transdisciplinary research centers and institutes that draw upon expertise from across their campuses. Considerable effort has gone into identifying and working through obstacles, and adapting and developing policies and practices to make such enterprises work effectively within existing departmental and college structures. Concepts proposed here will be designed to lay the groundwork for establishing or reinvigorating such centers and institutes.

Examples of supported transdisciplinary research programs - Transdisciplinary research enterprises are supported at national policy levels, and this has found its way into national program priorities and funding. An outcome of this activity will include an initial assessment of

national sponsor participation in and support for proposed transdisciplinary research at UW. Examples include the National Science Foundation launching in 2017 a \$17.7M program in “Transdisciplinary Research in Principles of Data Science” (TRIPODS), which has funded 12 institutions. More recently, NSF issued a call for proposals for “Research Centers the Mathematics of Complex Biological Systems” (MathBioSys, 2018), as well as “Innovations at the Nexus of Food, Energy, and Water Systems” (INFEWS, 2018), not yet awarded.

Transdisciplinary opportunities also extend to the humanities, social sciences, and arts. Such research is a major focal point of the National Endowment for the Arts (NEA). Its five-year research agenda (2017 – 2021), emphasizes the interface and overlap of social scientific and behavioral research. This includes support from NEA for research labs focusing on arts, entrepreneurship, and innovation, as well as arts, health, and social/emotional well-being. The National Institutes of Health (NIH) supports regional coalitions of academic institutions, community organizations, service providers and systems, agencies, and other stakeholders focused on minority health and health disparities through its “Transdisciplinary Collaborative Centers for Health Disparities Research” program, linking STEM-based health sciences research and social issues. Many such centers exist nationally, often receiving funding of several \$M over three to five years.

To respond successfully to this research landscape, it is critical that the UW planning process be guided by the following questions:

- What are the transdisciplinary research opportunities that address Grand Challenges of high societal and economic importance to Wyoming, the nation, and the world?
- What foundational disciplinary research investments are needed to enable such transdisciplinary research?
- What inter-institutional research partnerships for UW need to be strengthened or initiated in order to fully lever the University’s capacity to lead in this research?

IV. Examples of Transdisciplinary Grand Challenges for UW

The transdisciplinary challenges to be supported will need to be of the highest order in both potential impact and complexity. In some circles, these are known as “wicked problems.” The provost of the University of Southern California described wicked problems as the “most intractable, multifaceted problems of our time” (<https://www.provost.usc.edu/initiatives/wicked-problems/>). These are problems central to issues that are, by nature, resistant to resolution. Given below are candidate examples that represent the expected scope of Grand Challenges that UW might choose. The list is purely illustrative. It is fully expected that faculty will develop candidate topics that exceed these in excitement, relevance, and potential impact.

1. Harnessing data for science, policy, and economic development
2. Water: predictive capability, management, and policy
3. Energy, transition to sustainability, and data-driven natural resource stewardship
4. Health care inequities driven by socio-economics and distance: Wyoming solutions and global application
5. Education inequities driven by socio-economics and distance: Wyoming delivery, and global application

6. Artificial intelligence: preparing educational institutions and citizens for disruption
7. Agriculture's future: the interface of economics with life, water, and evolving climate
8. Biodiversity, ecosystem evolution, and economics: Wyoming as a test bed for prediction, policy, and stewardship
9. The role of the arts in strengthening sense of community and supporting mental health and well-being in rural areas
10. Genetic manipulation: impacts and ethics for health and national security

Wyoming's unique character can serve as a powerful driver for research problems that will yield significant impact far beyond the state's borders. However, where Wyoming's attributes are not an obvious resource for a nationally or globally important Grand Challenge, it may still be in the university's and state's interest to invest. For example, existing infrastructure assets and/or excellence in research-oriented faculty, may drive an opportunity and imperative to contribute to multi-institutional, national efforts.

V. Establishing a Research Planning Council

The ORED is in the process of establishing two advisory groups, the Research Advisory Group of Associate Deans and Directors (RAGAD) and the Advisory Group of Research-Intensive Faculty (AGRIF). At the request of ORED, research intensive faculty and associate deans and directors are currently being identified by their college's or school's leadership. The main purpose of establishing these advisory groups is provide long term advice to ORED, including and beyond this activity.

For the purpose of the proposed research planning exercise, a Research Planning Council (RPC) will be formed by combining AGRIF and RAGAD. In addition, at-large representation to the RPC will include additional faculty as identified by the Council, an undergraduate student, a graduate student, Faculty Senate representative from the Research Committee, Staff Senate representative, and one member of the Board of Trustees subcommittee on Research and Economic Development. The RPC will be co-chaired by Ed Synakowski, Vice President for Research and Economic Development and Kate Miller, Provost and Vice President for Academic Affairs. The co-chairs will guide the RPC in addressing the charge described below.

VI. Charge, Process, and Deliverable for the Research Planning Council

Charge - The charge to the Research Planning Council has three elements:

- Element 1:* Identify up to six to eight transdisciplinary Grand Challenge research themes that will strongly inform UW future investments in research infrastructure and faculty hiring.
- Element 2:* Identify single-discipline research areas at the foundation of Grand Challenges that require investment in faculty or UW infrastructure
- Element 3:* Identify institutional partnerships to develop or strengthen in order to create new transdisciplinary research opportunities to create strong teams capable of confronting high priority transdisciplinary Grand Challenges. Partners may include other universities, national labs, industry, community colleges, Native American sovereign nations, international research organizations, and foundations

Process

Broad faculty engagement to develop the RPC's response to the Charge will be central to the process. While details will be defined through discussions with the RPC, the process shall include the following elements:

- Meetings open to the entire campus will be held by the RPC that focuses on each college separately. Their purpose will include allowing all faculty and the RPC to learn of the status of research overall within the college especially as it pertains to transdisciplinary challenges, and to exchange views on opportunities;
- UW departments will each be visited by RPC members, probably in pairs, to receive department-specific perspectives on transdisciplinary research, and on discipline-specific needs for filling gaps to enable such research;
- The process will provide opportunities to give feedback on the RPC report before final decisions are made, likely including a Town Hall meeting or meetings.

Deliverable: The Research Planning Council is to generate a summary report addressing the three Charge elements, including discussing the following:

1. *Summary high level descriptions of up to six to eight transdisciplinary research themes recommended for further development* - Include the following:
 - i. an overview of each theme, with a description of the challenge to be addressed;
 - ii. assessment of the potential of this theme of using Wyoming as a research and economic development platform in order to serve the following:
 - ✓ economic and societal interests of Wyoming
 - ✓ economic and societal national interests
 - ✓ economic and societal global interests;
 - iii. identification of the disciplines likely to be involved;
 - iv. a description of the unique role of Wyoming in supporting this research, if any; and
 - v. potential as a platform for student education through research
2. *Strengths and gaps analysis* - The report shall identify existing strengths at UW that will support pursuit of each theme, including faculty who have demonstrated success in acquiring sponsor support, faculty success in partnering across campus and outside, and infrastructure at UW that can be used in support of the pursuit of the theme

The report shall identify gaps that need to be filled to enable UW to lead or be among leaders, including faculty and post-doc needs, partnerships that would enable UW to join regional and national leaders in this area, as well as UW infrastructure needs
3. *Assessment of investment requirements in specific disciplines needed to address high priority Grand Challenges* – Building on the strengths and gaps analysis, describe needed investments in foundational disciplines. This can include investments in new faculty, UW research infrastructure, and partnership needed to credibly advance high priority Grand Challenge research needed and sponsor interest

4. *Description of the potential for using this research as a platform for student education* – Research at the foundation of some of society’s deepest challenges can enlarge and undergraduate’s view of what they are capable of in today’s complex society
5. *Preliminary assessment of sponsor and policy maker interest* – Considerations will include interest of federal and state funding agencies, as well as private industry. Resources for assessment may include studies of the National Academies, federal agency strategic plans, and studies and statements from the Office of Science and Technology Policy. Engagement with Congressional committee staff can also be revealing. Sponsor plans, National Academies programs, and state and federal policies provide measure of potential research vitality; also, together with private donations, it is a required if a Grand Challenge research enterprise is going to be partially or completely self-sustaining
6. *Alignment with UW initiatives and programs* – How will research in this theme lever investments made in other UW initiatives and programs? Will it capture the investment of more than one? Initiatives include the Science Initiative, Tier 1 Engineering, and the Trustees Education Initiative. Federally funded programs that provide leverage opportunities include EPSCoR program supported by NSF, and the COBRE and INBRE programs supported by NIH.
7. *Preliminary assessment of potential donor interest* – Engagement of the UW Foundation will be critical for this. Colleges already have fundraising efforts underway with the Foundation. Of high value will be assessing how these plans and activities intersect with the Grand Challenges, and how building upon them might add value to the proposed research activity.
8. *Preliminary assessment of existing, required, and highly desirable institutional partnerships* – Describe partnerships with universities, national labs, international research organizations, and industry that are in hand that make this Grand Challenge endeavor particularly compelling. Comment on potential partnerships that would fill gaps identified in the strengths and gaps analysis. Comment on investments required to enable new partnerships to be formed
9. *Broader impacts potential* - The report shall identify the broader impacts beyond progress in the specific area of interest that will likely be afforded by addressing this Grand Challenge. For example
 - a. regarding on-campus impact, describe how taking on this Grand Challenge will enhance UW’s research and educational infrastructure
 - b. describe the opportunities for citizen engagement in this area of research
 - c. describe how will it impact the strength and viability of industries in Wyoming
 - d. outline the potential economic benefit for the state and the nation
10. *Summary evaluation of the themes* - Rank the research themes into the following categories:
 - *Tier 1*: Essential for UW to pursue-a “must do,” considering societal and economic needs measured at the statewide, national, and global levels

- *Tier 2*: Important for UW to pursue-an important current or emerging area where we should consider realigning resources to pursue
- *Tier 3*: Areas UW should pursue if resources are available, but not a priority for resource realignment

Other considerations in delivering on the Charge

- *Contributions to the ORED Strategic Plan* - For each Grand Challenge theme, the RPC report shall comment on the potential of investment in this area to promote the goals of the ORED Strategic Plan, *Breakthroughs in Research*, namely, to promote breakthroughs in sponsored research, translate ideas to the marketplace, open up new research horizons, and develop new research talent. Please also provide recommendations for what is necessary in research administration to best promote these goals
- *Relation of research to the academic mission* - For each Grand Challenge theme, the RPC report shall rate the proposed work against the following considerations. This list is not exhaustive, but should consider:
 - potential richness of the enterprise as measured by the range of disciplines engaged
 - the value of this transdisciplinary work forming the basis of a transdisciplinary degree program, if it does not already exist
 - potential for using this theme as the basis for undergraduate education through research
 - academic course offerings that can be explicitly identified with this Grand Challenge
 - potential for measurable, high impact public outreach in Wyoming and the Mountain-west
 - incentives needed, as well as obstacles experienced, for faculty to conduct transdisciplinary research, including those pertaining to pre-tenured faculty and how their success is measured
 - UW research infrastructure capacity and investments needed to support this theme
 - *Capturing UW investments in economic development resources* - The Institute for Innovation and Entrepreneurship (IIE) and its Center for Business and Economic Analysis (CBEA) should be regarded as a resource for these assessments. Encouraged is engaging IIE and CBEA faculty and staff. Commentary on economic interests should include a preliminary assessment of potential impact due to intellectual property creation and business formation that may be spawned from this research.
- *Comment on the potential of UW/Community College research partnerships* - For Grand Challenge areas and their constituent disciplines, the RPC report shall comment on the potential of research partnership with community colleges. In addition to the research itself, consider how such a partnership can promote community college education through research through sharing of resources and establishment of relationships for transferring students. Resources can include facilities coming on-line in the Tier 1 Engineering Initiative, Science Initiative, Education Initiative, and research computing.

In particular, the report will comment on the potential and required infrastructure for a new UW/Community College Research Network that is being established by the Office of Research and Economic Development. The overarching goal is to promote education through research, making UW resources available to advance the education through research of students statewide, and to enhance research opportunities for UW faculty and students across the state

VII. Follow-up Activities

Anticipated is delivery of a report on the Charge to the Board of Trustees in the summer of 2019.

Final selection for further development of research Grand Challenges will be made by the Office of Research and Economic Development and Academic Affairs, considering the advice of the Research Planning Council and the deans. Development of detailed plans will be performed by a faculty-led task force specific to each Grand Challenge.

In the Fall of 2019, a schedule that includes a timeline for activities, deliverables, and the resource requirements for carrying out this follow-on planning activity will be developed and presented to the Office of Research and Economic Development and Academic Affairs for consideration. This schedule of activities will describe planned visits with potential partners at other institutions, visits of scholars to UW to inform the planning, potential near-term hires of post-docs to jump start this activity, and so on. Resources requested to support this activity may be for travel to various institutions, and support for visitors from potential partners or other experts in the field, will be provided through the Office of Research and Economic Development. Some buy-out of time for faculty leadership of the Task Forces will be considered. Also considered will be requests for post-doc hires that can enable jumpstarting new research activity.

The final product of this subsequent planning activity will be detailed proposals for new or reinvigorated Grand Challenge research centers or institutes that will be enabled by external federal and state sponsor support and support identified, in partnership with revenue identified in partnership with the UW Foundation. These proposals will be presented to the Board of Trustees for consideration.

VIII. Anticipated Timeline for Planning and Implementation

<i>Through January 2019</i>	Develop membership of Research Advisory Group of Associate Deans (RAGAD) and the Advisory Group of Research Intensive Faculty (AGRIF)
<i>Late January 2019</i>	Introduce high level concept of the planning activity to Board of Trustees
<i>February 5</i>	Introduce concept of this activity at Deans and Directors meeting
<i>February 12</i>	Kickoff meeting for Research Planning Council.

<i>February 13</i>	RPC initiates college and departmental visits
<i>February 19</i>	Update to Deans and Directors
<i>March 5</i>	RPC meets to assess progress, identify issues
<i>March 12</i>	Update to Deans and Directors
<i>April 9</i>	RPC meets to assess progress, make adjustments
<i>April 16</i>	Update to Deans and Directors
<i>May 6</i>	Research Planning Council finalizes recommendations and reports
<i>May 21</i>	Research theme candidates (aka “Grand Challenges”) are reviewed and approved by deans
<i>June</i>	ORED finalizes overall report to campus
<i>July 18</i>	Report to Board of Trustees
<i>September 2019</i>	Final selection of Grand Challenges for near-term investment for planning and initial support thrust areas is announced
<i>September 2019</i>	Seed programs are launched to jumpstart transdisciplinary research in select areas. Also, launch of seed programs to strengthen select single-discipline research that enables transdisciplinary goals
<i>Remainder of FY 2019</i>	Grand Challenge Research Center Task Forces are launched develop resource-loaded plans

Timing and subject of Town Hall meetings will be determined as the process matures.