

UNIVERSITY OF WISCONSIN-MADISON FUNDAMENTAL DISCOVERY INITIATIVE

Introduction

The initiative from the Science Philanthropy Alliance group comes at an ideal time for the University of Wisconsin-Madison. We have a new Chancellor (Rebecca Blank), appointed in 2013, a new Provost (Sarah Mangelsdorf), and a new Interim Vice Chancellor for Research and Graduate Education (Marsha Mailick), both appointed in 2014, who collectively recognize the strength of the UW-Madison research enterprise. This leadership team also recognizes that basic research leads to innovations that can transform the world and is therefore keen to foster the development of new approaches for promoting and funding fundamental research on our campus.

The UW-Madison is in the planning phase for its next comprehensive fundraising campaign which it will launch publicly in late 2015 or early 2016. During the planning phase, the UW-Madison's research enterprise was identified as a top priority in this campaign and a fund for basic research has already been established at the University of Wisconsin Foundation. This campaign will align with SPA's desire to discover new knowledge through basic scientific research.

We outline below the details of a new effort, the *Fundamental Discovery Initiative*, which will be used as the centerpiece for interactions with philanthropic foundations inspired to advance basic research at the UW-Madison.

Purpose and Goal of the *Fundamental Discovery Initiative*

Basic science at UW-Madison includes all those research programs that seek to discover and investigate fundamental mechanisms and processes in the natural world and to develop methods and technologies in the service of this objective. Basic science requires novel and creative forms of support in order to promote true breakthrough discoveries that underpin the unforeseen applications to human health, technology, and society.

Funding of science in the United States has, over the last two decades, increasingly depended on a single, risk-averse model as implemented, for example, by the National Institutes of Health or National Science Foundation. The purpose of the *Fundamental Discovery Initiative* is to support basic research that is not presently funded, or is difficult to fund, through traditional extramural sources. Support will be provided for innovative, early stage, basic research projects that are (1) too early in development for traditional funding avenues, (2) too ambitious in aims for disciplinary review panels, (3) too risky in terms of outcomes for extramural support, (4) situated too far outside of traditional disciplinary expertise to be a viable candidate for extramural funding, or (5) lacking obvious and immediate translational implications or practical benefit.

The earliest and most creative phases of research, which provide the foundations for much of what sustains subsequent science, is in dire need of funding support and our strategy is to align with SPA resources, in combination with novel and highly creative campus programs, to achieve this objective. Our goal with the *Fundamental Discovery Initiative* is to energize and amplify basic science by working with both the UW-Madison scientific community and philanthropic foundations to support high risk and high reward basic research.

Institutional Capability

Basic research has been a strong part of the UW-Madison research legacy. A hallmark of fundamental research is that it is difficult to know its true impact until years after the discovery. For example, Howard Temin's discovery of reverse transcriptase in 1970, for which he received the Nobel prize in 1975, came from studies of an obscure chicken virus. This discovery overturned the prevailing dogma regarding the flow of genetic information in cells and provided the foundation for modern molecular genetics and the biotechnology industry. John Van Vleck, a 1977 Nobel prize recipient and considered the founder of the modern theory of magnetism, was a pioneer in the development of the quantum theory of matter. His applications of quantum mechanics changed physics and chemistry, deepening our understanding of atomic systems from single molecules to crystalline solids. This work provided the foundation for solid state physics, which has changed our world.

Current UW-Madison faculty have made more recent discoveries, the implications of which are only beginning to be understood. Jamie Thomson found ways to isolate both primate and human embryonic stem cells and discovered that they could be induced to become varied cell types, which has led to the burgeoning field of regenerative medicine. The physics groups under the leadership of renowned scientists like Sau Lan Wu, Francis Halzen and Wesley Smith are making fundamental breakthroughs on the experimental and theoretical frontiers of particle physics.

We long have championed scientific innovation on this campus through a variety of internal grants, competitions, and initiatives. These include:

- an annual peer-reviewed competition for research support conducted by the Office of the Vice Chancellor for Research and Graduate Education (VCRGE), which awards more than \$8 million annually to faculty to support cutting-edge research;
- a new VCRGE research grant competition initiated in 2013 that provides seed funding for unique, interdisciplinary projects;
- the Wisconsin Institute for Discovery, an interdisciplinary center established in 2006 within the office of the VCRGE, which began by focusing on five themes of scientific research identified through a university-wide competition, and already has brought 12 talented new faculty to campus;
- a campus-wide "cluster hire" program that recruited 130 new faculty leading to research collaborations on cutting edge interdisciplinary topics.

All of these initiatives have received sustained support from the Wisconsin Alumni Research Foundation (WARF), an independent entity founded in 1925 that serves as the university's intellectual property and licensing arm. These initiatives provide evidence that the Office of the Vice Chancellor for Research and Graduate Education is well-positioned to competitively assess novel research ideas and they illustrate the UW-Madison's continuing and substantial commitment to, and expertise in, managing the funding of novel, fundamental research. As a result of this effort, the UW-Madison has placed among the top five US universities for research expenditures for the past 25 years.

In addition, the UW-Madison has several strengths that provide an optimal environment for new research initiatives, including:

- the breadth provided by having a comprehensive range of disciplines on one contiguous campus;
- well-developed cross-talk between campus schools and colleges based on very low barriers between units;
- a strong history of collaborative research endeavors among researchers from multiple disciplines;
- an established and successful process for vetting and funding campus research;
- a demonstrated ability to support research concepts from idea to development; and
- a productive data-sharing and data-interpretive support network.

Description of the *Fundamental Discovery Initiative* and Potential Areas of Research Interest

The *Fundamental Discovery Initiative* will focus on projects that address unanswered, fundamental questions, building on areas in which the UW-Madison has particular strength, and offering great investment potential for advancing basic science. A sample of the areas we believe are ripe for fundamental discoveries, together with possible questions that could be pursued, is provided below.

1. Biomolecular and material science engineering at the interface of polymer science and stem cells
Can we develop materials that both influence the path of differentiation by stem cells and adapt to their maturation into complex tissues?
2. In vivo visualization of physiological processes
How do cellular signaling complexes assemble in time and space?
3. Adaptive nanotechnology - evolutionary engineering
Can we make self-repairing physical systems?
4. Computational innovation in high energy physics
Can new methodologies, such as quantum computing, uncover novel phenomena?
5. Cellular regulation by microenvironment and tissue interactions
How do cells sense "home"?
6. Gene-environment interactions as determinants of health and disease
Can genetic variants be identified that help explain why individuals most vulnerable to adverse social environments may be the same ones who thrive in nurturing and supportive environments?
7. Human-machine interfaces and virtual visualization
What is the minimal complexity of a virtual world required to support effective learning?
8. The next generation of space science to include complex physiology
What technical and biological processes impede long-term, human space travel?
9. Real-time microbial ecology and community control
How do biofilms alter bacterial responses?
10. Understanding the neural mechanisms underlying perception, cognition, memory, emotion, and language
Are there early differences in brain development that distinguish infants who will go on to have language learning challenges?

One of the keys to the success of our approach will be to break down a project into the short, medium, and long-term phase of its development, recognizing that each phase requires a different form of support. The focus of this initiative on the early, short-term phase will allow us to explore a far broader range of ideas than is currently possible, as funding for the short-term phase is the most difficult to identify. Our goal is to support a large portfolio of early stage, novel ideas, each having the potential to advance science in its field. Some of

these ideas will result in true paradigm shifts that lead ultimately to new fields of research or have an impact on society that we can't begin to predict.

Logistics

The *Fundamental Discovery Initiative* will have a visible presence within the Office of the Vice Chancellor for Research and Graduate Education, where the logistics of the program will be integrated with both campus activity and the university capital campaign.

A panel of judges will be appointed by the Vice Chancellor for Research and Graduate Education to serve as impartial experts in providing expertise, evaluating proposals, and assisting in connecting research projects with potential donors. We will emphasize the core values of the *Fundamental Discovery Initiative* and build an evaluation process that ensures that creative, high risk-high reward proposals receive appropriate review. This process will include an emphasis on the potential of the outcomes rather than prior work, and novelty rather than obvious next steps.

Although the full array of details regarding proposal submission and funding remain to be developed, the highlights of the process will be as follows:

- The *Fundamental Discovery Initiative*, within the Office of the VCRGE, will maintain an open call for white paper “idea” submissions with the goal of evaluating and providing feedback on these abbreviated submissions within one month.
- Applicants with promising “idea” proposals will be invited to submit full applications for support.
- The process used to evaluate the submissions will be based on consideration of several overarching elements that address the viability of the proposal, including: scientific impact of the experimental question if it should prove viable, creativity, timeliness, innovation, and strategic alignment.
- The goal will be to fast-track the process, such that funding for successful proposals could be awarded within a few months of the “idea” submission.

Funding decisions would be made after review of the full project proposals. We envision two levels of funding available for successful proposals:

1. A “starter” or incubator award: one year of support at the level of \$50,000 to \$150,000, designed to provide resources to further develop an initial embryonic idea.
2. A “proof of concept” award: two years of support at the level of \$200,000 to \$400,000 per year to support work testing a more fully developed hypothesis and carry the project to the point of viability for sustained extramural support.

Management of the Research Fund

We have established the UW-Madison Fund for Basic Research to provide support for fundamental research proposals that are judged worthy. The fund is administered by the University of Wisconsin Foundation, which receives and manages gifts granted to the University. The foundation is an entity independent from the University and is a Wisconsin non-profit, non-stock corporation that is exempt under 501(c)(3), 509(a)(1), and 170(b)(1)(A)(iv) of the U.S. code. The Foundation can create different types of accounts. The primary account type is a spendable account for dollars that are available to the University for immediate expenditure. These funds are typically invested for security and liquidity. The Foundation also has an endowment pool that is made up of a number of different individual funds that are invested as a single unit, but accounted for separately. Individuals or entities can use this pool to hold gift funds on a temporary or permanent basis. Funds that are

temporarily invested in the endowment pool are generally referred to as quasi-endowments and some portion of all of the funds so invested may be removed from the endowment pool and spent through normal university spending procedures. Funds that are permanently designated as endowments will only make available funds that are declared by the Foundation as “available for distribution” under the Foundation’s spending plan. Thus, we will have the flexibility of structuring fund management in multiple ways that can be tailored both to fit the needs of the research activities and the varied intentions of foundations and individual donors.

Conclusions

The critical objective of the *Fundamental Discovery Initiative* is to connect the UW-Madison culture of basic science with philanthropic resources that share this agenda. This initiative signals the desire of the University of Wisconsin-Madison to engage in genuinely novel forms of research, and that the university has the scale, talent and community to make the project a success. As the title of our proposal makes explicit, our goal is to foster a new age of fundamental discovery. This opportunity comes at exactly the right moment for our campus, and our researchers and students are excited to make this project a great success.