

Executive summary

Planning for Future Research in Public Universities in Uncertain Times

Sally Frost Mason, President, University of Iowa

- The current climate for university research presents us with some significant challenges. Total federal R&D spending and federal non-defense R&D dollars have declined in the past ten years, and the prognosis for the future is pretty stagnant. Projecting to 2021, federal funding is forecasted to have only very modest growth.
- While the United States' public investment in research over recent years has declined, many of our international colleagues/competitors are enjoying major upswings in federal research dollars. State legislatures and university governing boards are re-examining the role of research in a state-supported institution, and usually these controversies center on a university's emphasis on teaching and a university's role in state economic development.
- Economic issues play into many such controversies across the country. Metaphorically, the public university research enterprise is in the midst of its own "climate change" in three major areas: state priorities, federal funding, and international competition. As with any kind of change, adaptability remains key. I propose three broad areas in which we must think about playing a new game: 1) Research portfolio diversification, 2) new partnerships, and 3) interdisciplinary approaches.
- We must remain vigilant and redouble our institutional advocacy for the nation's research enterprise. We must create physical spaces that are flexible enough to encourage interdisciplinary research, and classrooms that support inquiry-based learning. We must revisit our standards for promotion and tenure - publication should remain important to the promotion and tenure process, but we must also develop real standards for assessing the impact of interdisciplinary work, innovation and excellence in teaching, and public engagement.

Engaging with the Private Sector: Nebraska Innovation Campus

Harvey Perlman, Chancellor, University of Nebraska

- There are at least three trends that must be accounted for as we plan our research future. First, while innovation is a major driver for economic growth, most public companies are withdrawing from investments in basic research. Yet, companies also understand they must position themselves to access research that has commercial value and that research takes place largely within universities. Thus there are market forces that make university-private sector partnerships essential.
- Second, federal research support is uncertain, particularly in this period of political dysfunction in Washington. If Universities are to sustain their core research enterprise, it seems sensible to diversify our sources of funding. Other potential sources are the private sector, international engagements, philanthropy, and internally generated resources.
- Third, the political pressure on government expenditures causes even public funding agencies to demand more evidence of returns from the investments in research. We would be foolish to ignore this. Increasingly, federal research funding programs are insisting on proof of commercialization prospects for research proposals or insisting that private sector companies be a partner in funded research.

- All three of these trends dictate that universities develop stronger ties with the private sector as an alternative source of research funding. I think we are far beyond the question of whether we should engage with the private sector in research partnerships. I believe that is a given and a necessity. However, there remains much to be considered in how these relationships are structured, implemented, and assessed. Getting these items right will have a lot of influence on the future of our research enterprise.

Adaptive Planning in a Chaotic Research Environment:

Aligning Academic and Business Issues

Brian Foster, Provost and Professor Emeritus, University of Missouri

- Uncertainty is everywhere and can pose both challenges and opportunities. Adaptive planning must address both in an on-going, responsive way. The most important guiding principle is to build the plan on institutional strengths, to position the institution favorably in relation to other universities.
- It is critical to work with non-traditional constituents whose interests, political positioning, and other properties can help build on the institution's strengths—constituents such as large corporations, government agencies, beltway bandits, national labs, and economic development agencies.
- The key to engagement is to have real discussions, to bring together people who are positioned very differently and who have different perspectives. Real discussions will get the disagreements, value differences, and special interests on the table so they can be dealt with.
- The environment differs for every institution; the responses differ for every institution. The most that can be made of the specific information is that it provides the first steps for mapping the particular institution's environment, linking it to the broad direction it wishes to take, and creating a viable plan for implementing the goals to get to where the institution wants to go.
- Research is deeply embedded in the broader Higher Education dynamics. Like other elements of Higher Education, it cannot be seen as separated from fiscal, political, regulatory, instructional, facilities and other elements of the university—and of Higher Education broadly.

Enhancing University Research through Corporate Engagement and Collaboration

Jeffrey Vitter, Provost and Executive Vice Chancellor, The University of Kansas

Julie Nagel, Executive Director of Corporate Partnerships,
The University of Kansas

- As part of our strategic plan, we seek to promote active entrepreneurship and vibrant external partners. A key component of this strategy was the creation of the Office of Corporate Partnerships, developed to diversify KU's research portfolio.
- We have created a one-stop shop at KU for external groups looking to collaborate with us. Having these groups working under a single set of metrics provides for cross-collaboration. A portal for both faculty and industry sponsors to work through to create research-based partnerships removes barriers companies often cited as reasons for not working with universities.

- KU has many different products (or domains) that companies may want to access. Interactions between KU and a company can lead to other forms of partnership with the company, which can move the company along a conceptual path of increasing engagement. We facilitate all aspects of industry-sponsored research at our core, and we lead the university-wide strategy on how to coordinate these different areas with a central message.
- It is crucial for us to share information about company visits and interactions and to put forward a coordinated face to companies - so we know exactly how the company has worked with the university in the past, which helps us expand the collaboration in the future. By sharing, each of the different groups that works with companies can leverage the others and create a greater benefit for the university.
- We opted to use the Salesforce.com Customer Relationship Management tool (CRM) and configured it to track all our company engagements. Today, we have data feeds coming in from numerous units across multiple campuses. These data feeds include details on tech transfer, development, research, and numerous other ways in which companies engage with KU.
- Between Fiscal Year 2011 and 2013, our licensing revenue increased by a multiple of 15, or by a multiple of four if you exclude an outlier that generated significant revenue to KU. Licensing agreements increased by 15 percent, patent issues increased by 131 percent, and industry-sponsored research is up 40 percent.

Revolutionizing science through simulation: A junior researcher's perspective on research challenges in uncertain times

Baskar Ganapathysubramanian, Assistant Professor, Mechanical Engineering,
Iowa State University

- Universities must encourage faculty to aspire towards a diversified portfolio of problems as well as funding agencies to target. There has to be a conscious move away from funding from a single federal source (like NSF in engineering, or NIH in medical sciences). This includes a healthy distribution of funding between industry and federal sources.
- Promotion and tenure documents may look different in this context of multi-disciplinary work, with half-dozen or more co-authors on papers, jointly mentored students, and multiple co-PIs on grants becoming the norm. The administration should have clear guidelines for faculty to articulate their contributions for P&T as well as awards/recognition. Departments should not discourage junior faculty from participating in large grants.
- The university and college can initiate research in strategic areas that are of relevance at the university/state/national level, by means of awards which enable the formation of large teams and provide pursuit funding.
- A key factor is trained support staff who are well versed in the budgetary and regulatory intricacies of various funding sources (NSF vs NIH vs DoD). Providing travel grants to visit funding managers across the country is clearly a low-risk, high-reward investment for the university. Additionally, universities can make industrial partners feel welcome by making IP issues straightforward.

- Universities (especially in the Midwest) can leverage existing facilities to create win-win conditions by collaborating to establish large scale centers. This avoids duplication of infrastructure in a narrow geographic area and can promote significant cost-matching. Buy-in from the faculty can be cemented by making other university faculty part of centers, and by awarding courtesy appointments. It appears that this is strategically promising for the group of universities attending the Merrill conference in the areas of engineering sciences, agriculture, and medicine.

Interdisciplinary collaborations at work in brain-machine interfacing

Jonathan Brumberg, Assistant Professor, Speech-Language-Hearing,
University of Kansas

- It is now possible to translate the experimental conclusions of cognitive and computational neuroscience into practice for diagnosing and rehabilitating disorders with a neurological deficit.
- Cochlear implants and deep brain stimulators are great examples of the translational research potential at the intersection of engineering and neuroscience. Computers are interfacing directly with neural tissue in a one-way, input fashion. The reverse design pattern in which neural activity controls a computer is also relevant for rehabilitation purposes, and are more traditionally considered brain-machine interfaces.
- Recent trends in national and local policy have led to some uncertainty for the future of the research missions of public universities. These trends may potentially increase diversity of scientific study and add to our ongoing research activities. Suggestions for how to enhance university involvement in interdisciplinary research:
 - Including recruits with non-traditional backgrounds
 - Focus on the potential for interdisciplinary application of applicant research
 - Continued training for managing broad scope of interdisciplinary research
 - Establishing expectations for promotion and tenure
 - Identifying alternative funding sources
 - Draw from funding typically associated with each collaborating discipline
 - Look to commercial and foundation partners
 - Establish appropriate relationships with collaborating disciplines
 - Enable cross-disciplinary student mentoring, course instruction and research opportunities

Collaborative research between engineering and life sciences:

Influence of surface attachment on the biological properties of proteins

Shannon Bartelt-Hunt, Associate Professor, Civil Engineering,
University of Nebraska

- Collaborative research between the basic sciences and engineering is critically important to the ability of academia to answer future societal challenges. Despite the importance of fostering collaboration between scientists and engineers, there can sometimes be institutional or interpersonal roadblocks that limit successful collaborations.

- I joined the faculty in the Department of Civil Engineering in January 2006 and almost immediately began to collaborate with Dr. Jason Bartz on experiments to investigate the environmental behavior of the prion protein. In the beginning, we kept the research question very simple. By keeping our question simple, we were able to learn the terminology and techniques of each other's discipline, and we also successfully answered our question. A more complex or complicated question might be important to answer, but with initial collaboration, I would encourage keeping it simple.
- Another trait of successful collaborations is that they raise questions that may not have been ever thought of by an individual working in a single discipline. Also, the answers to these questions many times require the knowledge of people from disparate disciplines. Our collaborative work allowed us to develop a conceptual model of prion disease transmission that encompasses both environmental behavior and passage into and within the host animal. This linked environmental and biologic model would not have been possible without our collaborative research relationship.
- What contributes to a positive collaborative relationship? Working collaboratively requires that you take the time to understand each other's language and respect each other's expertise. Meeting in person on a regular basis is very important to establish a collaborative relationship. At the same time, you must read the literature outside your discipline to learn more about the terminology and work being done in your collaborator's discipline.
- A collaborative research relationship requires trust between individuals. Collaboration means that you will share ideas, resources, equipment, and student advising activities, often without knowing ultimately what benefit or products may arise from this work. This requires a leap of faith and a commitment to the long-term collaborative relationship.
- Institutions can provide incentive and support for collaborative research, acknowledging the time investment in developing a collaborative relationship, which may have a longer return period for funding and publications compared with single discipline research. Collaborative research is often published in journals outside your discipline area, and this is significant for faculty going through the promotion and tenure process - there must be an understanding and appreciation of this work and its contribution both to your own discipline as well as other disciplines.

Research, Productivity, and Pressures on Faculty in an Era of Disruptive Change

Danny Anderson, Dean, College of Liberal Arts & Sciences, University of Kansas

- The factors driving change converge in the everyday life of the tenured or tenure-track faculty at public research universities. From the faculty point of view, these tensions create confusing and frustrating situations. The faculty career is one of increasing anxiety and tension as they are asked to juggle additional balls to enable the enterprise to adapt to rapidly changing conditions.
- University presidents and chancellors, provosts, vice chancellors for research, and deans can enable their faculty and strengthen their research universities by adopting and adapting three key strategies to fit our unique institutional cultures:
 1. Communicate laser-sharp focus regarding vision and goals. Clarity of focus includes a clear understanding of individual faculty roles and contributions to the goals. Because

department chairs directly relay central administrative goals to faculty, it is essential to aid them in this communication challenge with clear priorities and consistent talking points; support for effectively using departmental talent is essential.

2. Construct conditions that motivate. As the academic career becomes more complex, the external motivations of carrots-and-sticks are not sufficient for inspiring engagement. Recognizing and supporting faculty autonomy, mastery and purpose is more effective for leveraging employee engagement.
 3. Cultivate faculty engagement over the entire arc of a changing career. By focusing on the full arc of the faculty career and intentionally designing strategies to sustain faculty members for the long game, we can strengthen our institutions and strengthen faculty engagement.
- These three strategies exemplify practices in a research university that create the opportunity to lead. With clarity of vision, conditions that motivate, and cultivation of faculty careers over the life span, these strategies call upon presidents, chancellors, provosts, and deans to lead as genuine collaborators with faculty in the reinvention of the university during an era of disruption.

Stabilizing Research Departments in a 10% World

John F. Leslie, Head, Department of Plant Pathology, Kansas State University

- Most land grant universities have 150+ years of history of conducting research in Science, Technology, Engineering and Mathematics (STEM). Support for the research mission has varied through the years in terms of both amount and source.
- Since a high water mark for external funding in the 1960s, funds for STEM research have been slowly whittled down with most federal programs supporting STEM research now having a success rate near or below 10%. The scarcity of funds has led to questions regarding criteria for faculty to obtain tenure and promotion, and the measures used to evaluate department and institutional excellence.
- The survival of institutions and their constituent departments remain a primary, if uninspiring, goal. Faced with declining budgets and loss of faculty and other staff, successful departments have become more collaborative in their research efforts, more cautious in their hiring patterns, and more deeply involved in interdepartmental and inter-institutional research efforts.
- Institutions with a clearly enunciated vision for their future and the ability to form multi-dimensional collaborations – administration and faculty, across discipline boundaries, and between basic and applied researchers – are the best positioned to not only survive, but to prosper in a 10% world.

Strategic Investments in Research in Microbiology and Immunology – Importance of Technology Infrastructure

Mark McIntosh, Professor and Chair, Molecular Microbiology and Immunology,
Director of Research Core Facilities, University of Missouri

- Managing a microbiology and immunology basic science research department has long focused on developing a balanced faculty that provides breadth in expertise and that works

within the institution to fulfill the three fundamental missions of education, scholarly research and discovery, and community service, whether local, regional, national or international.

- Infused into those missions in all basic and applied sciences over time has been an increasing emphasis on economic development as the fourth mission. The historical management perspective however has changed over the past several years with the growing emphasis on building comprehensive research teams that tackle complex research problems with a “translational” goal.
- This emphasis requires more targeted recruitment strategies, replacing the “cast a broad net and pick the best scientist no matter what the subject matter” approach. In parallel, high throughput, high resolution and highly analytical technical instrumentation and data analyses have become essential for the development of any comprehensive research strategy.
- This report will summarize the significant institutional challenges to investigator-driven research in the current federal funding climate and propose strategies for integration of highly focused basic science investigators into an interdisciplinary research network that depends on technology infrastructure to ensure and enhance research productivity.
- It is written from the perspective of a basic science chair at a public research institution who has experienced the transition from a siloed departmental set of academic objectives to an environment of networked and interdisciplinary research. It also touches on the growing concerns within such institutions in generating sufficient institutional resources to build an appropriate infrastructure capable of sustaining cutting edge research.

Interdisciplinarity in Uncertain Times: Research Centers

Karen Burg, Vice President for Research, Kansas State University

- The barriers to interdisciplinarity in a university setting are many. The typical university units naturally promote territorialism. The perceived incentives for faculty members to participate in interdisciplinary research is low. Interdisciplinary units are inherently more difficult to manage, and a high university investment is required. Importantly, the return on investment is ill-defined and, although potentially extremely high, very difficult to quantify.
- Interdisciplinary is a great buzzword, but is an exceedingly difficult activity to manage. The National Academies (2014) has released many position papers promoting the concept and has provided compelling rationale for striving to achieve interdisciplinarity. Interdisciplinarity is the convergence of multiple disciplines that results in longer term effects. That is, each participating discipline is richer for the experience and gains in some tangible manner.
- An interdisciplinary center generally spans university units and provides a collaborative and infrastructure for team-based work. The ideal center relies on a core of permanent research faculty, rather than building on the talents of tenured or tenure track faculty, who have multiple responsibilities beyond the bounds of the center. Research faculty provide an environment which is industry friendly – particularly with respect to goals, deliverables, and metrics - they also provide a student friendly environment – i.e. training of students in a real world, collaborative environment.

- The center is, in effect, a flexible clearinghouse. The institute or center must be independent from but complementary to departments and should serve as a hiring draw for departments (due to the ready-made collaborators and infrastructure). Longer-term stability is provided by the appointment of permanent research faculty members as the core. In contrast, tenured and tenure-track faculty are involved as dictated by the scientific needs of projects and investigator availability.
- There are several important reward concerns. In particular, effort toward and participation in a center must be recognized by tenure/promotion committees. Rewards are based on output; common output includes congressional testimonies, public policy initiatives, popular media, or product development. Center research tends to lend to multiple author publications, which incorporate different perspectives from different disciplines. Letters of support from collaborators, defining the critical role of a center researcher, can be vital to the tenure and promotion process.
- The described interdisciplinary center model is industry friendly, major government initiative friendly, and student friendly. Center research faculty complement departmental unit foci and provide stability. When based on existing collaboratives, a center provides a rich training environment. Most importantly, the center provides a microenvironment where the disciplines gain independently and collectively.

The New Role of Land Grant Universities in the 21st Century: An Essay

Henry Foley, Senior Vice Chancellor for Research and Graduate Studies,
University of Missouri

- Historically, land grant universities provided broad access to needed higher education for people of all backgrounds, especially from the industrial classes. The land grant universities played a significant role in advancing the state of agriculture and industry in the United States. By the end of the 20th century, the mission of the land grant institutions rested firmly on the three strong pillars of teaching, research and outreach.
- Today, many land grant universities have added economic development as a fourth pillar under their missions. The federal government made clear that research universities, including the land grant universities, were to take on the challenge of driving economic growth. They were to do fundamental research and convert its outcomes into new products, processes, and innovation and in a transparent, demonstrable way. Land grant universities began to pay much more attention to technology transfer as it relates to economic development. The land grants are well suited for this because of their historical role as socially responsible institutions that seek to improve the well-being of citizens in their states and the nation.
- At the University of Missouri, our research strategy is to become an even larger and more powerful engine of innovation and economic impact in the Midwest. With total research expenditures well over \$270 million per year, our research engine's displacement is significant, but we expect and need this displacement to grow. Our goal is to become the very best among Midwestern land grant institutions at the conversion of the products of research and scholarship into innovations that will make life better. By growing new businesses, by supporting and improving existing businesses and by growing jobs, we can play a significant role in raising prosperity.

- At this point in our history and that of our nation, we are asked to do even more than before; we are expected to drive innovation to help the country achieve renewed prosperity through sustainable economic growth. To do this, is to be an “engine of innovation.” To succeed at this, we need to bring our institutions closer to the real economy and to the business community. We need to do so locally, regionally, nationally and internationally. We need to test new approaches that will set the course for the land grant university for the rest of the 21st century, a course that will integrate the strengths of our past with entrepreneurship to bring forth more innovation from our research and scholarship than ever before.

Top Secrets to Growing University Research in Uncertain Times

Prem Paul, Vice Chancellor for Research and Economic Development,
University of Nebraska

Monica Norby, Assistant Vice Chancellor for Research, University of Nebraska

Nathan Meier, Director of Research Strategy, University of Nebraska

- Flat federal funding for academic science and engineering research, increased competition and lower success rates for grants, heightened rivalry for top faculty talent and a larger burden of costs for research compliance make these uncertain times for university research.
- Like the federal agencies, we have to balance our investments in single investigator and inter-disciplinary centers and large teams. Our Programs of Excellence funding and other funds enabled us to hire new faculty, both senior and junior, in targeted areas. Multi-disciplinary cluster hires enabled us to build strong teams in a short time. Areas in which we have invested central resources include materials and nanoscience, atomic and molecular physics, virology, early childhood education, water and food security, computational sciences and digital humanities.
- We support junior faculty leadership development through our Research Development Fellows Program, a focused year-long experience of formal and informal learning sessions designed to help early stage investigators conceptualize project plans, interact effectively with program officers, identify funding opportunities, plan and draft effective grant proposals and develop an understanding of the proposal review process.
- We created an office that provides grant support to faculty from idea generation to facilitating team building and external review of proposals prior to submission to funding agencies. Our faculty have benefited from these services, which have increased their funding success. This focus on enhanced grantsmanship also includes developmental assistance with graphics and generation of grant proposal budgets.
- An effort to build connections among faculty through interdisciplinary faculty retreats in targeted thematic areas has been fruitful. The most recent retreat involved more than 275 faculty, featured nationally recognized speakers and talks and “quick pitches” by UNL faculty, panel discussions, networking activities and breakout sessions focused on thematic areas. At the conclusion of the retreat, a new seed grant program was announced. These retreats have proven essential to build faculty connections and stimulate the level of cross-disciplinary collaboration and innovative thinking needed for long-term funding success.

- Data-driven decision making, emphasis on individual investigator and team-based projects (including multi-institutional and interdisciplinary efforts), targeted hiring and infrastructure investments, and focused research and faculty development resources represent some of the strategies necessary to maintain market share and facilitate academic R&D in the face of stagnant or diminishing extramural funding.

A Newcomer's View of Research Administration in Uncertain Times

Sarah Nusser, Vice President for Research, Iowa State University

- State investment and federal funding are at best volatile and more likely to be shrinking; we are experiencing increased scrutiny of our administrative, educational and research practices; and the role of research is also being reframed as part of the broader creative and translational process of innovation.
- We are working with a few basic tenets to help us move forward. First and foremost is the importance of a diversified portfolio in managing volatility in funding opportunities. The second focus area is preparing our faculty to respond to opportunity as it arises. A third and trickier consideration is managing risk in the research and development process as funding sources, regulatory guidelines, and commercial opportunities expand. Finally, serious strategic planning and effective resource management are required to meet our goals.
- We tend to invest heavily in the star researchers and research-intensive colleges, departments, and programs where the return on investment is most significant. However, there are pockets throughout the rest of the university that have the capacity to engage in sponsored research. These researchers may lack the knowledge required to identify funding sources and develop successful proposals, as is often the case with new assistant professors in research active domains. This problem is readily addressed by existing faculty development programs.
- ISU has a distributed and heterogeneous network of pre- and post-award support. To assist academic units with limited grant support, we are creating a shared pre- and post-award service that will be available to individuals, research groups, and academic units. Anticipated benefits of this initiative include more efficient administrative processes in submitting grants and higher quality proposals. We also hope this reduces the barriers for capable faculty to submit proposals for sponsored funding.
- We are discussing how we evolve our culture and support activities that foster commercialization of research outcomes. In partnership with ISU's Economic Development and Industry Relations unit, our main activities have focused on two areas: (1) initiating pilot programs to better understand what training is needed in order for our faculty to be successful in translating their research to commercial applications, and (2) determining what to prepare for as an institution in order to manage risk in the translation process.
- In recent years, the burden, complexity, and risk associated with research conduct and compliance have steadily increased. The dynamic, conflicting, and arcane regulatory environment makes it difficult for researchers to understand and engage with this responsibility, particularly given their intense workload. As we migrate to new software systems for compliance committees, we have an opportunity to evaluate our processes and see if we can reasonably address these forces.

Anticipating New Directions in Human Subjects Research

Michele Kennett, Assistant Vice Chancellor for Research, University of Missouri

- Human subjects research, highly regulated and overseen through the Institutional Review Board, is still viewed by many as a barrier to research. The question is, how we can as institutions, move from being the barrier to research to aiding in creating a culture of compliance?
- The changing funding environment is at the top of most lists of challenges. With decreased federal funding there is increased competition for research dollars and increased look to industry to remain competitive. In addition, institutions face challenges in dealing with the increasing number and complexity of regulations. Increased complexity of contracts creates challenges, extending timelines for study implementation in an already competitive environment. Difficulty recruiting subjects poses another challenge. Inadequate research training, poor mentoring of new researchers, research coordinators without appropriate skills to carry out a research protocols and lack of professional compliance staff, all cause inefficiency in the research enterprise and leads to dissatisfaction and frustration.
- Times have changed, we need to rethink and reanalyze our interpretations. Many in human subjects protections are currently rethinking the reliance on a single IRB in multicenter trials. Another area being explored is the option for equivalent protections in human subjects protections. Federal regulation dictates the regulations applied to federally funded research but flexibility is possible in non-federally funded research, provided it provides equivalent protections. This may lead to a lessening of the burden for some types of research i.e. research in schools.
- Metrics can show the value of what we do in human research protections. Today's systems allow us to track and quantify the many activities that go into human subject protections. Metrics allow us to calculate time from submission to approval and identify where delays occur.
- Investigators often do not have the toolbox that would allow access to pertinent information directly related to their research needs. A toolbox would allow investigators to access information needed for IRB submission, forms and templates, FDA regulations, and guidelines on how to navigate the human subjects research experience. With the technology available to us, the ability to create a more centralized place for investigators and compliance staff to interact is possible.

Building Research Capacity and Infrastructure

Chitra Rajan, Associate Vice President for Research, Iowa State University

- The last seven to ten years have been very challenging for universities: we have seen a growing scarcity of resources for research due to decreases in federal funding and reductions in state support. At the same time, research administrative costs have been increasing, as greater resources (including staff time) are required to handle the growth in compliance, accountability and reporting requirements.
- Despite severe cuts in state funding over a 3 year period, ISU was able to make critical investments, develop new programs, and improve processes and overall efficiencies. Some of these efforts included institutional strategic investments, new faculty hires (cluster hires), and a strong commitment to provide the research support services and facilities needed to enable research excellence and knowledge transfer.

- Most notably, the VPR Office has stepped up the resources available to help faculty submit grant proposals and manage awards by offering a comprehensive menu of research development and support services chain (identify funding opportunities; proposal preparation and submission; project management and compliance; reporting and closeout), making it easy for faculty to develop, prepare, and submit grant proposals by reducing administrative/clerical work. The VPR Office and the Office for Sponsored Programs Administration also provided several training and workshops for support staff in departments and centers to upgrade their skills in grant preparation and post-award and project management.
- There is a strong commitment that all support service units under the VPR Office will be well managed, service-oriented, and responsive to faculty needs. Staffing for many of the critical research support offices such as sponsored programs administration and responsible research has increased, making it easier for these units to keep up with the growth in the volume and complexity of sponsored funding contracts. There are resources now for staff professional development and a cultural shift that emphasizes consultative decision making, and continuous self-assessment and improvement.
- By building on existing strengths, and working across and between disciplines, ISU was able to see growth in external funding from a range of sources across the breadth of the university's research activity. It is critical that research universities develop a plan to diversify their funding portfolio to hedge against the vagaries of external funding and make selective, strategic investments even in difficult times. It is crucial for research universities to develop long-term sustainable plans for programs and units; and, although it may be politically unpopular to do so, discontinue support for unproductive and under-used programs and units. It is important that research universities are willing to take some calculated risks.

Clinical Research: New Frontiers

Richard Barohn, MD - Vice Chancellor for Research, University of Kansas Medical Center; Director, Frontiers: Heartland Institute for Clinical and Translational Research, University of Kansas Medical Center

Laura Herbelin, BSc - Research Instructor, Department of Neurology, University of Kansas Medical Center

Lauren S. Aaronson, PhD, RN, -Professor, School of Nursing and Dept. of Health Policy & Management, School of Medicine; Deputy Director, Frontiers: Heartland Institute for Clinical and Translational Research, University of Kansas Medical Center

- Both NIH and PCORI recently have created and funded large programs aimed at doing clinical research better and more efficiently so that discoveries are brought to patient care and improve the health of the public more rapidly.
- The CTSA program is managed by the new National Center for Advancing Translational Science (NCATS). Today, five academic institutions and 10 health care institutions comprise the Frontiers program, and investigators from all of these sites are eligible to apply for and use Frontiers resources.

- Among the successful programs under the Frontiers umbrella is a pilot study funding program. Pilot study funding for a project has varied from \$20-30K for each project. The Trailblazer program provides a smaller amount of funding on a more flexible basis. These applications may be submitted at any time and undergo an administrative review.
- NeuroNEXT is a consortium supported by the National Institute of Neurological Disorders and Stroke (NINDS) (<http://www.neuronext.org>). It was created to expand the capability to conduct clinical studies in neuroscience. Through the NeuroNEXT program, KUMC is currently involved with four studies, focusing on four diseases.
- The Patient-Centered Outcomes Research Institute (PCORI) was established as part of the federal Affordable Care Act. The overall goal of PCORnet is “to improve the nation’s capacity to conduct clinical research by creating a large, highly representative national patient-centered network that supports more efficient clinical trials and observational studies”
- Central to this new frontier is collaboration. The shared hope is that through collaboration we can more rapidly and more rigorously find answers to the questions that matter most for achieving a healthier public.

Can Research Inform us about the Efficacy of University STEM Education?

Joseph Heppert, Associate Vice Chancellor for Research, University of Kansas

- The increased climate of accountability around the use of taxpayer funding has come to rest on the U.S. public higher education system. Key accountability metrics include both student retention in college and time to degree. These metrics present challenges for traditional models of university STEM instruction, which are perceived to contribute to higher than institutional average attrition from the ranks of STEM majors. Degree obtention rates of 60 percent represent a national average for U.S. Engineering programs, for instance. These challenges could, if left unaddressed, become a threat to the structure and mission of public research universities.
- There are many instructional models that accommodate a broader range of learning student learning styles, improve success in learning and increase student engagement with subject matter. We need to consider whether public research universities should systematically turn the tools of rigorous quantitative and qualitative research inward to study the instructional changes being driven, in part, by a culture of increasing accountability.
- The key questions we must ask: Can rigorous quantitative educational research answer fundamental questions about the efficacy of university curriculum reform, what are anticipated institutional commitments and costs for these studies, and what are reasonable boundaries for the implementation of such programs?
- It is to our advantage to demonstrate that resources aimed at STEM curriculum enhancement are providing the anticipated benefits for our students. We have the tools of research at our disposal, faculty who could benefit professionally from partnering in such studies, and the need to move away from an anecdotal narrative for evaluating the efficacy of educational change.
- This process can contribute to protecting the diverse, interrelated missions of public research universities and provide a narrative for engaging a sometimes-skeptical public in the discussion that the research and educational missions of the university are indivisibly linked.

Department of Defense Research Funding: Opportunities, Idiosyncrasies, and Risk Analysis

Kurt Preston, Associate Vice Chancellor for Research, University of Nebraska

- Notwithstanding the relative modest proportion that DoD basic research funding takes in the federal budget, there are some disciplines, such as engineering, where the DoD basic research funding effort comprises a significant portion of its resourcing. Mechanical engineering, electrical engineering, and aeronautical engineering respectively receive 80%, 61%, and 35% of their federal basic research funding through the DoD.
- The take away message from examining the DoD RDT&E budget is that there are two highly differentiated funding modalities. The first modality is the basic research mode in which one finds grants awarded, largely to research universities, through the vehicle of a broad agency announcement (BAA.) The second modality funds applied research and advanced technology development. In general terms, there is an inverse relationship between involvement by universities and maturity of the technology. The further one departs from basic research, the smaller the proportion of funding is likely to be found going to a college or university.
- There are two modes of DoD science and technology (S&T) funding. The first, basic research, is designed to engage the university research faculty member. The second mode, the rest of the (S&T) funding, rarely benefits university research faculty members unless they lead or find themselves in a team focused on applied DoD problems. It is critical to understand that applications, demonstrations, and systems are all outside the realm of basic research in the DoD context.
- DoD research funding has a place in planning for future research in public universities in uncertain times. However, the DoD is not the principal source of research dollars to colleges and universities. It is a distant fourth behind NIH, NSF, and DOE. It is unlikely that DoD research funding would form the basis for funding the University research enterprise. Nonetheless, the DoD basic research program provides a vehicle for university principal investigators to be involved in the defense of the nation through their research activities.

Building upon Existing Research Strengths in Uncertain Times: Analytical Chemistry and ISU

Emily Smith, Associate Professor, Department of Chemistry,
Iowa State University

- Competitive start-up funds and space requirements for a research group are the most significant challenges to maintaining research strengths in the chemical sciences. The average start-up package for an assistant professor of chemistry for 19 selected universities across the Midwest is roughly \$810,000 for an assistant professor, excluding associated costs for renovating space. The average start-up package for a senior faculty member is approximately \$1.7 million excluding renovation costs.
- Industrial connections are increasingly seen as an important source of funding and partnership in times when obtaining federal funding for basic research is a growing challenge. These connections make particular sense for applied research projects that may offer a shorter-term payoff in the form of developed products or new measurement techniques. There is existing evidence for the successful partnership between industry and academic

departments with analytical chemistry divisions. Named endowments, donated equipment for departmental use, and the use of equipment at remote sites may be beneficial approaches for fields in which analytical measurements are taken.

- The careful planning of shared university (center) equipment purchases may alleviate need for a portion of start-up funds for new faculty members, and the entire university community might benefit from the addition of on-site equipment experts.
- It is necessary to invest time and money in advertising the unique strengths within and outside one's own organization. Seminars and local conferences have been the traditional route for achieving this. Existing research strengths at public universities in uncertain times may not remain strengths unless the university invests both time and money to maintain them. This may be accomplished with traditional as well as innovative strategies. Leadership from all levels will be key to successful implementation of these strategies.

Enhancing the Success of Early-Career Faculty in STEM Fields During Uncertain Times

Joy Ward, Associate Professor, Ecology and Evolutionary Biology,
University of Kansas

- Early-career faculty face numerous challenges when working to establish an upward professional trajectory, particularly those in STEM fields. Federal resources for basic and applied science have diminished since ARRA funding ended. This presents challenges within universities, since investment in tenure-track faculty is often substantial (particularly in STEM fields), and the loss of faculty members through tenure denials is far from ideal.
- Teaching release: There are times when early-career faculty members would greatly benefit from teaching release for short periods of time (1-2 semesters) in order to enhance their research programs, and this may be essential to their success. Teaching release for early-career faculty to attain the momentum needed to sustain a long-term research career may be best applied in mid- to late stages of the pre-tenure period.
- Networking: Early-career faculty are eager to develop close networks with other colleagues that may be in different, yet complimentary fields. This may facilitate the formation of large multi-disciplinary teams that will eventually be highly competitive for large grants. Development of these networks can be particularly strong within new cohorts, since all are adjusting to new positions at a new university.
- Service: Within departments, there tends to be a movement towards minimizing hours spent conducting service for early-career faculty, mainly because this allows for greater time for teaching and development of research programs. I strongly agree with this practice, as the demands on early-career faculty can be overwhelming, and teaching and research productivity will be more heavily scrutinized when tenure decisions are being made.
- Mentoring and feedback: Early-career faculty require excellent senior faculty mentors, and these mentors need to be clear and outspoken if deficiencies exist that may block the candidate from gaining tenure. The mentor should then work with the early-career faculty member to overcome these deficiencies as soon as possible. On the other hand, when early-career faculty are thriving, and are clearly on a trajectory to gain tenure, it is imperative that faculty mentors convey this information to the candidate as well.

37 Years an Academic Scientist

Christopher Sorensen, Courteyou-Rust University Distinguished Professor,
Kansas State University

- Despite a universal decline in science funding, we all owe our prosperity and our health prospects to advances in the sciences. NIH Director Francis Collins stated in recent testimony to Congress, “Our nation has never witnessed a time of greater promise for advances in medicine.” Yet NIH’s budget for fiscal year 2014 (FY14) is 11.7% below the FY04 peak. How can our universities help us win the grants to keep our researches going?
- Solid infrastructure is the foundation – access to diagnostic equipment that is too expensive and require too much expertise to run and money to maintain by a single investigator. Things like electron microscopes, XPS and X-ray diffraction. It is the university’s role to provide these devices, man them with expert operators and provide for their continued maintenance.
- Other ways the universities can help researchers: develop outreach connections across a wide range of venues such as K-12 schools, community colleges, minority institutions, civic groups, museums, etc. In addition, it would be very useful to have readers to read drafts of our grants and give advice - readers who know the current trends and buzzwords, the ins and outs of the funding agencies.
- In a recent editorial in *Science*, John Edward Porter argued that “we must convince the public and our representatives that cutting research is not a pathway to deficit reduction; it is a pathway to increased health threats, lost lives, and economic insecurity”. And yet, Porter points out “there has been little outreach by scientists to the public to help them understand how science contributes to better health, job creation, and global competitiveness.” Furthermore he writes “Scientists remain largely invisible to the public”
- You would think professional teachers would be terrific at communicating these important messages to the public. Let’s try to communicate by writing op-eds and letters to the editor of local newspapers about the latest scientific breakthroughs and their implications for society, by volunteering to speak at local organizations, chambers of commerce, junior high and high schools about our work or the latest discoveries. We could offer to be a scientific advisor for candidates or create and serve on science advisory committees.
- In addition, I believe that we have the opportunity to profoundly influence the future every class day by teaching the value of science to our students - by letting our students know that we not only teach but do research as well. By being good and reasonable people to win their respect and thus ensure our arguments gain efficacy. What we do in the classroom might not have an effect overnight, but it will certainly change the future.