EAB

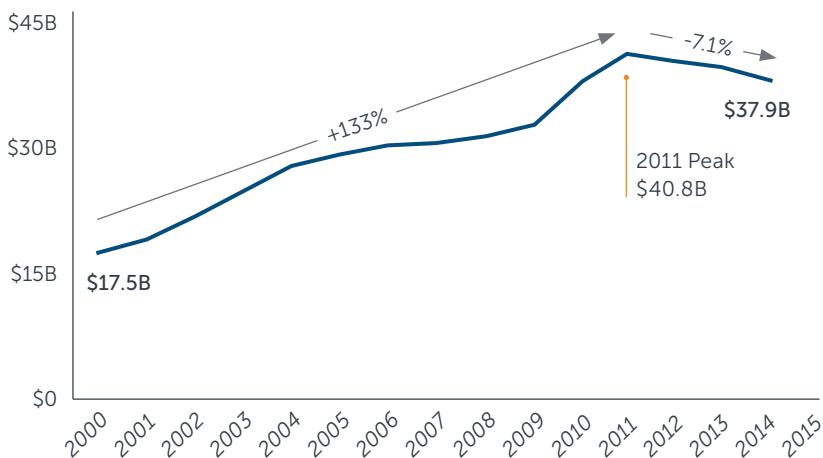# Six Imperatives for Embarking on Grand Challenges

The Research Growth Engine **Has Stalled**

Federally supported, peer-reviewed, individual investigator-driven research has been the foundation of the academic research enterprise for more than 50 years.

But, with the brief exception of the funding from the stimulus legislation of 2009, federal non-defense R&D has not grown since 2004. In fact, federally funded university research expenditures were down by 7% from 2012 to 2015, and few expect federal funding to return to historic growth rates in the foreseeable future.

University research has reached the point in its cycle where changes in resources are forcing a fundamental change in activity.

Total Federal Research Funding for Universities
2000–2015

$45B

$30B

$15B $17.5B

$0

+133%

-7.1%

$37.9B

2011 Peak
$40.8B

2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015

The **Diversification** Imperative

While the individual investigator approach to research remains fundamental to the health of the research ecosystem, it can no longer sustain the growth aspirations of research universities.

Declining federal funding has led to intensifying competition among individual investigators, with declining proposal success rates, falling grant renewal rates, and challenges for young investigators struggling to win their first grant.

In response, universities have been diversifying support for research by pursuing funding from donors, foundations, and corporations. Universities are also investing significant amounts of institutional funds (the second-largest and fastest-growing source for university research expenditures) to sustain research activity and to seed new research that they hope will attract additional external funding.

University Research Expenditures
Percentage Change by Funding Source (Indexed to 100)
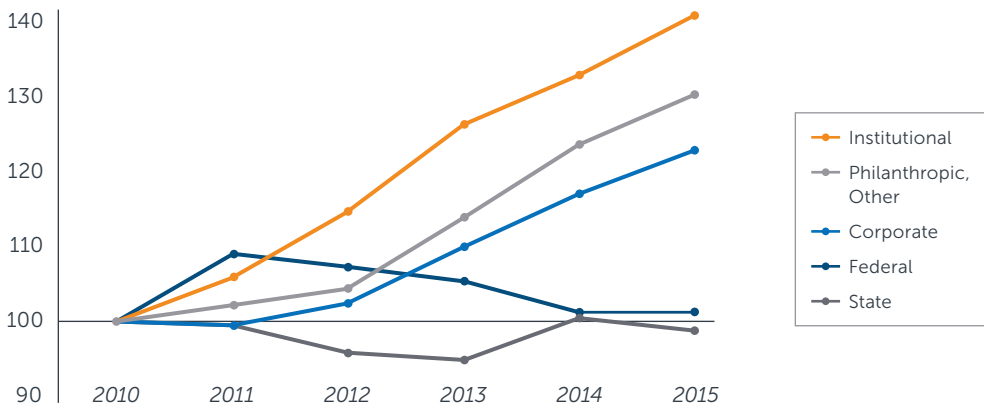
Research Funding Sources

Funding Source	Total *(2015)*	Outlook
Institutional	$16.7B	Increasing fastest, but not sustainable
Philanthropic, other	$6.2B	Increasing, has similarities to corporate funding
Corporate	$4.0B	Growing, greatest amount of elasticity
Federal	$37.8B	Slow deceleration, unlikely to recover
State	$3.8B	No growth, unlikely to recover

The Era of **Big Bets**

Funders (federal, state, philanthropic, and corporate) are increasingly pledging large amounts (grants of $50M up to $500M) for large-scale initiatives focused on solving problems with a clear social benefit.

Rather than award many small grants for early-stage research that might eventually be applied to technologies or treatments, they are hoping to accelerate the translation by offering larger grants to multidisciplinary, multi-institutional, and multi-sector (involving corporations and NGOs) teams.

While these large grants may account for only 10% to 20% of a given institution's overall research expenditures, in many cases they can represent more than half—or even all—of funding growth. As such, winning large grants has become a critical component of research development.

Pursuing Bigger Bets

- Single institution
- Single disciplinary focused
- Primarily basic research
- Offers critical seminal value

- Multiple institutions
- Multi-disciplinary
- Increasing focus on applied research
- Offers significant societal impact

Competing for
Outcomes-Focused Funding

Unlike the traditional model of federal funding where committees of disciplinary peers assess proposals based on their potential contribution to scholarship, non-federal sources tend to evaluate research proposals on potential impact on business and society. These funders want to solve a problem rather simply produce highly cited publications. At the same time, increasing portions of federal research funding are now going to large-scale collaborative research projects selected in part on the basis of institutional and corporate partners, institutional matching funds, and evidence of translational capabilities.

Universities Require New Capabilities to Be Successful

New Types of Problems

- Large in scope
- Complex causes
- Require new technologies, treatments, or policies
- Local community impact
- Global relevance

New Institutional Campaigns

- Large teams
- Specialists from multiple disciplines
- Cross-sectoral collaboration
- Translation of research outcomes
- Community outreach

New Funding Approaches

- Small number of deep-pocketed funders
- Placing a small number of "big bets"
- Assessing proposals on potential impact rather than disciplinary standards

New Competitive Dynamics

- Larger institutional investment
- Bigger partnership networks
- Proactive outreach/marketing
- Evidence of implementation capabilities

Peer review may be the **gold standard**, but it is no longer the **only standard**.

Embarking on **Grand Challenges**

It takes time to build effective large-scale collaborations. In fact, it is essential to begin the process well before any specific funding opportunities have appeared. Only established teams will be qualified to compete for tomorrow's large funding opportunities.

For this reason, many universities have focused part of their research strategy on building out (and self-funding) grand challenges—a focus on a big problem with a clear and compelling goal, on the hope that strong teams will eventually attract the levels of external funding necessary to keep these projects going.

The strategy for winning traditional peer-reviewed individual investigator grants was relatively straightforward—hire the top researchers in a discipline; provide them with lab space, post-docs, and graduate students; and then do your best to stay out of their way.

> But competing successfully for these large grants requires an entirely new set of capabilities to **select**, **equip**, and **launch** the grand challenge.

How can you successfully launch a **grand challenge**?

Here are six imperatives for universities today:

Select

1 Choose a grand challenge that connects departmental research with a large community problem

2 Focus on a problem your institution is uniquely qualified to address

Equip

3 Reinforce an expert team with internal and external collaborators

4 Remove institutional barriers to collaboration

Launch

5 Position the challenge at the heart of strategic leadership and communication efforts

6 Create a road map of incremental goalposts for measuring success

Choose a grand challenge that connects departmental research with a large community problem

For many department chairs and researchers, the success of their home department often supersedes the desire to develop interdisciplinary research. However, a grand challenge serves as an opportunity to unite individual faculty research around a larger-scale issue. In that way, the grand challenge does not hinder individual departmental research but rather augments it.
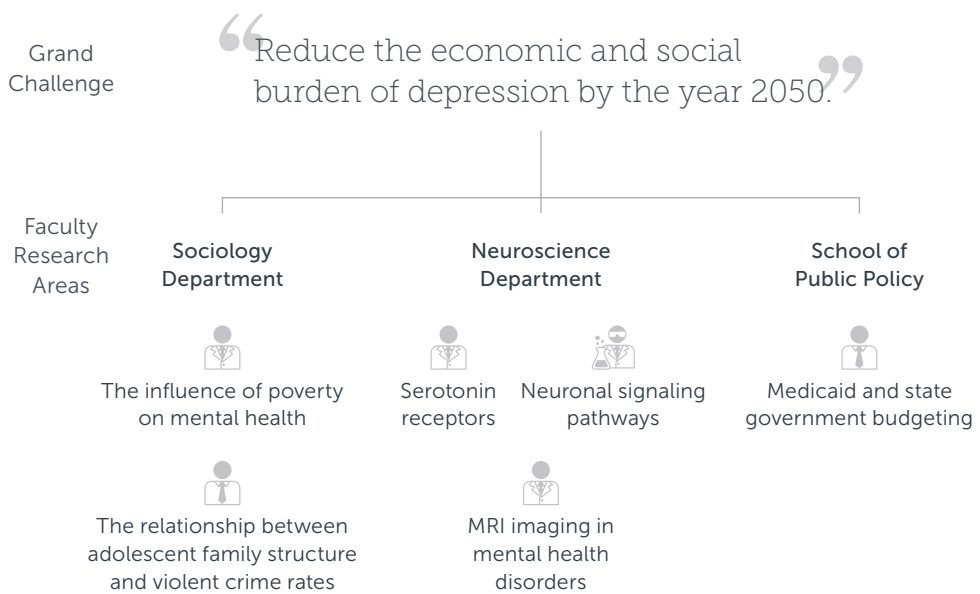
To ensure that the grand challenge achieves this goal, a broad set of internal research stakeholders need to be involved from the beginning. This means getting buy-in from provosts, deans, and faculty on determining the right big idea to go after. But critically, that idea must be meaningful to external stakeholders as well—the community, corporate partners, and key legislators. To scale interdisciplinary research, these internal stakeholders must embrace the idea of working together to generate innovative ideas that can be achieved only through committed team research. Highlighting the possibility for transformational impact through collaborative work can encourage faculty to see the potential of interdisciplinary science.

Uniting Key Stakeholders

Investigators

Deans

Centers and Institutes

University Leadership

Internal

- Compliments existing initiatives
- Will advance research enterprise in transformative way

Grand Challenge

External

- Addresses key local and/or global problem
- Clear economic and societal impact

Corporate

Government

Community

Philanthropy

But the problem that a grand challenge solves cannot replace basic research. As such, work on a grand challenge should not hinder individual departmental faculty research; rather it can serve to pull that collective work up into its aggregate goal. For example, a grand challenge goal of reducing the economic and social burden of depression actually incorporates the work of faculty in sociology, neuroscience, and public policy, incorporating the ongoing work of faculty in these departments.

Departmental Work Rolls Up to the Grand Challenge

Grand Challenge

" Reduce the economic and social burden of depression by the year 2050. "

Faculty Research Areas

Sociology Department

Neuroscience Department

School of Public Policy

The influence of poverty on mental health

Serotonin receptors

Neuronal signaling pathways

Medicaid and state government budgeting

The relationship between adolescent family structure and violent crime rates

MRI imaging in mental health disorders

Sample Grand Challenges

Map the brain to better treat major neurological diseases

Make solar energy economical

Scaling off-grid energy

Provide universal access to clean water

Universal Qualities:

✓ Resonate with community at large

✓ Large-scale and impactful

✓ Multidisciplinary

Focus on a problem your institution is uniquely qualified to address

Grand challenges by design seek new (and large) sources of funding. To win critical dollars, an institution must make an effective case that it is the entity uniquely suited to tackle it. So, the grand challenge that an institution selects should not only rely heavily on the unique expertise of current research faculty, but also make use of local community resources as critical research partners to serve as a test bed for the research to take place.

An institution is more likely to get grand challenge efforts funded based on a **unique combination of expertise or resources**, rather than because it is the best in any one area.

Uniquely Suited to Tackle the Grand Challenge

Autonomous Cars Grand Challenge

- Challenge is to develop autonomous vehicles (AVs) that use technology to partially or entirely replace the human driver in navigating a vehicle from an origin to a destination while avoiding road hazards and responding to traffic conditions.

- University of Michigan is key participant of research funded by Mcity, a public-private partnership research center that funds projects for deploying and testing automated and connected vehicle systems. The Mcity partnership has more than 65 member companies including auto makers, suppliers, and insurance companies.

- Mcity operates a 37-acre test facility located on the university's North Campus Research Center that is utilized by researchers from the university as well as many of the partnership's member companies.

Why University of Michigan and Its Associated Partners Are Best Suited

Largest concentration of automotive engineers in the country

Home to 81 global auto suppliers' North American headquarters or tech centers

Access to testing facilities

Most navigation and smart mobility patents

Over 75% of U.S. automotive R&D spending

Reinforce an expert team with internal and external collaborators

Though a grand challenge should be centered on disciplines where the institution already excels, there are critical additional ingredients that bolster success. First, carefully selected partner institutions (universities, national laboratories, corporations, NGOs) linked by ongoing collaborations can be essential sources for seed funding, facilities, and expertise. As discussed on the previous page, University of Michigan is just one member of a public-private partnership to create autonomous vehicles.

Seed funding can be especially valuable. For example, some federal grants actually require corporate partners.

Federal Grants That Require Corporate Partners

National Science Foundation

- Small Business Innovation Research (SBIR)
  $245K average award across 319 companies
- Small Business Technology Transfer Program (STTR)
  $2.08B in FY2014

National Institutes of Health

- Discovering New Therapeutic Uses for Existing Molecules 2015
  $12.7M for nine groups

Department of Commerce

- i6 Challenge: Proof of Concept Centers 2010–2012
  $24M to 12 universities

Department of Energy

- Building University Innovators and Leaders Development (BUILD) 2015
  $600K across three universities

Even after finding ideal partners, universities may have key deficits that prevent them from executing on a grand challenge effectively. In tackling a challenge that cuts across multiple subject areas, institutions often find they need subspecialized areas of expertise. Successful programs embark on challenges with a complete 360° assessment of critical gaps—openly exploring and then investing in what they lack in expertise, resources, and operational support to successfully execute on the challenge.

Identifying Critical Gaps

Discipline 1	Critical Gaps	Discipline 2

Investing in a Range of Deficits

Expertise	Resources	Operational Support
• Investigators	• Test subjects	• Leadership engagement
• Specialized technicians	• Core facilities	• Faculty engagement
• Students and researchers	• Materials	• Venues for collaboration
	• Data analysis	
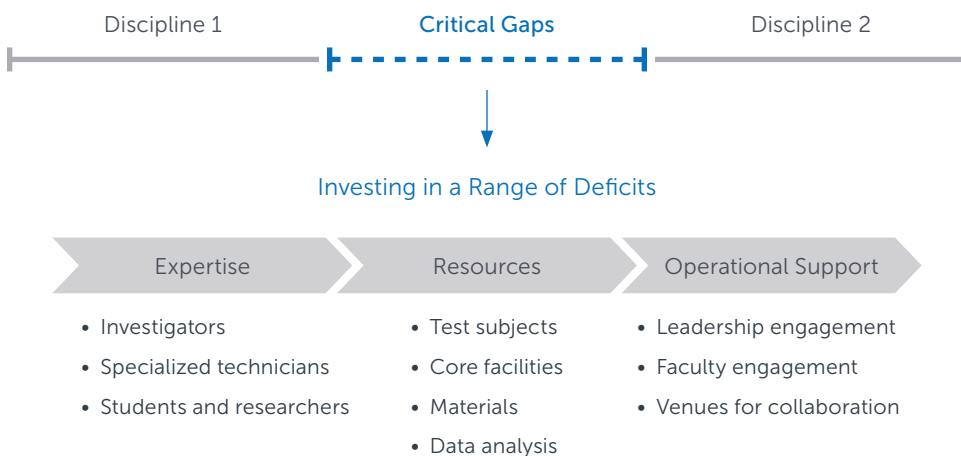
Remove institutional barriers to collaboration

Administrative responsibilities can often hinder deans and department chairs from seeing the benefit of multidisciplinary research. Most academic leaders can think of much more urgent things to do with $5 million than spending it on grand challenge resources. The scarcity of resources within a department might make it difficult to encourage this level of transformational research. Consistent messaging and top-down support from university leaders is essential for helping researchers to adjust their thinking so they can develop collaborative ideas.

There is also often a disconnect with the advancement office. Lack of communication between these two parties can lead to missed opportunities, duplicative efforts, and funds lost due to inefficient contact with funding sources. Proactive advancement teams work with the faculty to identify big ideas that can help to draw more funding into the university. In turn, chief research officers should engage advancement in the research going on across campus that can catalyze long-term partnerships with funders.

Internal Obstacles Can Impede Progress

Current Academic Culture

- Deans focus on day-to-day operational needs and lack time to spend on long-term vision

- Deans and department heads actively incentivized to think within their purview

- Scarcity of resources at odds with need for big-picture thinking

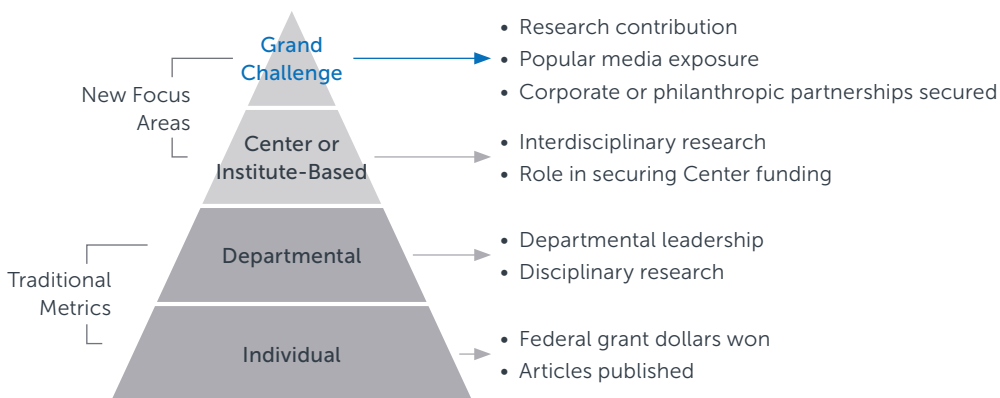### Advancement-Faculty Disconnect

- Advancement and academic leadership often unaware of ongoing faculty projects

- Faculty don't understand or trust advancement

- Deans and faculty often lack training in procuring philanthropic support

Tenure evaluation often relies primarily on department-level achievements, which can hinder faculty involvement in grand challenges.

Institutions also should consider how they evaluate tenure decisions. Often the key metrics used are rooted solely in the past—metrics that mattered more under single-discipline research primarily funded by federal government grants. While those metrics should remain the foundation of tenure decisions, institutions should find a way to incorporate and give credit for faculty contributions to grand challenges.

A New Approach to Tenure Evaluation
Individual, Departmental Work Still the Foundation

New Focus Areas

Grand Challenge
- Research contribution
- Popular media exposure
- Corporate or philanthropic partnerships secured

Center or Institute-Based
- Interdisciplinary research
- Role in securing Center funding

Traditional Metrics

Departmental
- Departmental leadership
- Disciplinary research

Individual
- Federal grant dollars won
- Articles published

Position the challenge at the heart of strategic leadership and communication efforts

Of course, no grand challenge effort will be successful without senior leadership support. However, this support must go far beyond a press release from the provost and vice president for research (VPR). Leadership communication should signal that the grand challenge is an integral part of the university's central strategic priorities. This support must then be bolstered by a comprehensive internal and external communications strategy.

The grand challenge naturally must become a forefront of the research strategic plan, which clearly signals VPR support to the faculty. Further, a "campus roadshow" offering Q&A sessions to various departments can not only garner critical support from deans and faculty, but also give them the chance to weigh in with ideas on execution and voice their concerns. It is critical for these stakeholders to understand how the grand challenge effort will and will not affect their day-to-day departmental duties. Connecting with the advancement team can help research teams strategize about funding sources and perfect their pitch to possible partners.

Externally, a comprehensive media campaign can help attract new funders and grow student and faculty interest. Many academic leaders point out that part of the lure is the marketing and PR value taking on the grand challenge can earn for the university. By focusing on a big problem, the grand challenge can be a central tool in communicating the value of university research. To reap full value, universities should invest in a dedicated website, local press attention, and events that connect with the community and relevant corporate partners.

Comprehensive Internal and External Communications Plan

President, Provost Announcement

Internal	External

Campus Roadshow

- Inclusion in research strategic plan
- One-on-one meetings with deans
- Q&A session with faculty from relevant departments
- Advancement Office strategy session to develop sophisticated funding pitch
- Presentation to students from relevant graduate programs

Media Campaign

- Use of grand challenge to communicate value of university research
- Central placement on university website homepage, links to dedicated website
- Alumni magazine feature
- Local newspaper article
- Presence at local community events

Create a road map of incremental goalposts for measuring success

To make clear that the grand challenge goal is more than just a marketing ploy, institutions should lay out a proposed road map to measure incremental progress. The road map should offer key specific sub-challenges and defined near-term goals. The work plan should also be transparent and regularly updated to keep stakeholders informed and excited about the grand challenge.

When UCLA set out on its "Sustainable LA" grand challenge, to transition Los Angeles County to 100% sustainability by 2050, it unveiled a comprehensive work plan that included specific objectives for three sub-challenge areas: energy, water, and ecosystem health. UCLA created an initial report on the overall environmental baseline from which to measure progress on the grand challenge. They now release "Sustainable LA Environmental Report Cards" twice per year, each focusing on one of the three sub-challenges. Every other year they publish a summary report that highlights major accomplishments and important current environmental topics. UCLA's grand challenge leaders note that developing these reports can be resource-intensive, so they have allocated specific funding and staff to digest the data and put it into a consumable form for the public.

UCLA | Sustainable LA Grand Challenge

- **GOAL:** Create the road map to transition LA County by 2050 to 100% renewable energy, 100% locally sourced water, and enhanced ecosystem health
- Extensive five-year work plan available on public website, with progress measured through environmental report cards along the way

Specific goals and rationale

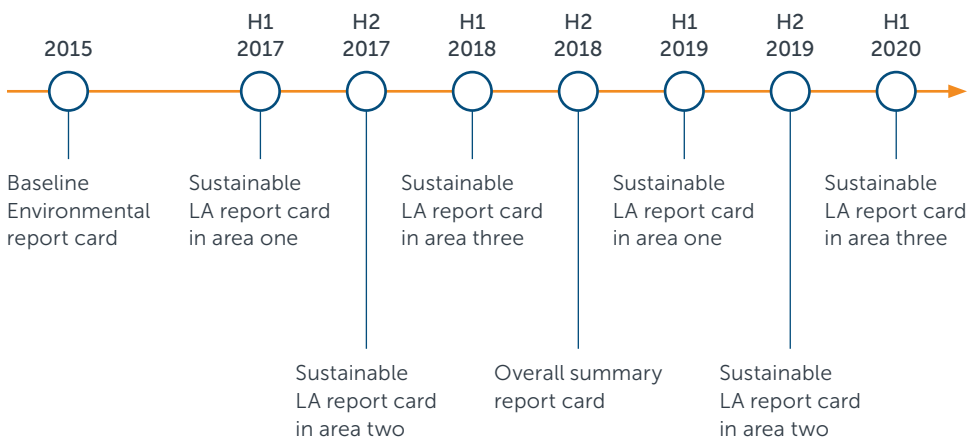Proposed solutions and goalpost objectives for three sub-challenge areas

Next steps for education, communication, and engagement

Five-Year Work Plan

Specific sub-challenge areas	Objective 1	Objective 2	Objective 3	Objective 4
Energy	Expand renewable energy generation	Design an integrated system for distribution and storage of renewable energy	Improve management of energy consumption	Ensure energy system sustainability
Water	Maximize local water supplies	Reduce water consumption	Improve local water resource management	
Ecosystem Health	Assess biodiversity and ecosystem health	Enhance ecosystem health and resiliency	Integrate ecosystem health and human health and well-being	

Timeline for Sustainable LA Environmental Report Cards

2015	H1 2017	H2 2017	H1 2018	H2 2018	H1 2019	H2 2019	H1 2020

Baseline Environmental report card

Sustainable LA report card in area one

Sustainable LA report card in area two

Sustainable LA report card in area three

Overall summary report card

Sustainable LA report card in area one

Sustainable LA report card in area two

Sustainable LA report card in area three

About the University Research Forum Membership

The University Research Forum is the go-to resource for chief research officers. It offers real-time access to the latest strategic insights and implementation support on their biggest priorities, including both strategic initiatives like grand challenge efforts as well as operational initiatives, such as minimizing the administrative burden on faculty and overseeing research communications.

Check out some of the other resources available from the University Research Forum or learn more about our services at: **eab.com/urf**

› For the Greater Good: Boosting the Value of Industry Partnerships

As federal funding levels stagnate, CROs must achieve growth targets through more strategic partner recruitment and management in the corporate world. This study outlines 11 practices that will help you match emerging demand, present one face to the market, and use internal data and service offerings.

› Delivering on the Growth Agenda

This three-part webinar series focuses on: 1) how changes in federal funding have impacted research universities, and how universities are responding to these changes by pursuing larger scale team-based research initiatives, 2) how universities are creating grand challenge research teams and organizing institutional resources and funding around these initiatives, and 3) how universities are launching, growing, and assessing cluster hiring initiatives.

› Playbook for Effective Cluster Hiring

This white paper reviews the required comprehensive steps universities must tackle in a cluster hire—from allocating funding to assessing outcomes.

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Cover image: iStock.

Sources

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Page 9: The idea for this grand challenge ("Reduce the economic and social burden of depression by the year 2050") comes from UCLA. The potential faculty research areas are illustrative. For more information see https://grandchallenges.ucla.edu/depression/.

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Page 18: UCLA Grand Challenges Sustainable LA, www.grandchallenges.ucla.edu/sustainable-la.

All other pages: University Research Forum interviews and analysis.

Special thanks to Michelle Popowitz, Assistant Vice Chancellor for Research and Executive Director, UCLA Grand Challenges at UCLA, for sharing her experience and insights during our research process. Additional detail can be found in Michelle Popowitz and Cristin Dorgelo, "University-Led Grand Challenges" UCLA (February 13, 2018) https://escholarship.org/uc/item/46f121cr.

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