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HEARING ON THE ROLE OF RESEARCH UNIVERSITIES IN SECURING AMERICA'S FUTURE PROSPERITY: CHALLENGES AND EXPECTATIONS

BEFORE THE
SUBCOMMITTEE ON RESEARCH AND SCIENCE EDUCATION
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
JUNE 27, 2012

Chairman Brooks, Ranking Member Lipinski, and other distinguished Members of the subcommittee, thank you for your leadership in calling this hearing on the important role of our nation's research universities and thank you for the opportunity to provide comments on that role from the perspective of one of the nation's large public land-grant research universities.

My name is Leslie Tolbert. I serve as the Senior Vice-President for Research at the University of Arizona, in Tucson, Arizona.

Background on Research in Universities: A Changing Landscape

For many decades, the U.S. has led the world in research and education. Early impetus came from the Morrill Acts of the 1860's, which established the nation's land-grant universities and laid the groundwork for our public university system. Land-grant universities were to provide "liberal and practical" education and research that would generate new knowledge to undergird the nation's growing agriculture and industries. The public universities more broadly would provide students of all backgrounds and means the opportunity for higher education and involvement in the research enterprise. The impact of these universities on society would be profound. More of the citizenry than ever before achieved college degrees, and university campuses became hubs of

discovery, innovation, and invention. As the federal government funded the research it saw as vital, federal funding agencies adopted a novel competitive system for distributing research funds, with much of the funding distributed on the basis of evaluations of proposals by peer experts. Our university system, and our competitive-evaluation system for distributing federal research funds to the most meritorious projects, became the envy of the world.

Private-sector companies were partners in this innovation ecosystem. Many of the largest companies, including pharmaceutical and information technology giants, formed laboratories that conducted wide-ranging fundamental exploratory research as well as more applied research and technical development of new products.

After World War II, the federal government took the lead in supporting the nation's innovation, providing huge resources to universities to conduct research and graduate education that would fuel innovation and invention. Both university and private-sector research flourished. Fundamental exploratory research, which is not targeted to particular outcomes or uses, thrived and was the wellspring for many life-changing technological advances.

In recent years, federal financial support for research has not kept pace with what is needed in order to take full advantage of the opportunities and is falling behind rates of support in other industrialized, and some developing, countries. Simultaneously, private-sector companies that do research and development (R&D) increasingly have tightened their focus to more applied research and development, leaving to the universities and national labs most of the fundamental (or "basic") research – and unexpected discoveries – that provide the foundation for all future applied R&D. In recognition of the strategic importance of basic research, the federal government continues to be the major source of funding for it, and in FY2009 universities performed 53% of that research (NSF Science and Engineering Indicators 2012 report at http://www.nsf.gov/statistics/seind12/c4/c4s1.htm).

Limitations in federal funding for university-based research today threaten our nation's prospects for continued leadership in the high-technology economy of tomorrow. In 2011, the U.S. Congress asked the National Academies to make recommendations about what the federal and state governments, the universities, and the private sector can do to ensure the long-term health of university-based research and doctoral education as the foundation for economic prosperity. The recently released NRC report, "Research Universities and the Future of America: Ten Breakthrough Actions Vital to Our Nation's Prosperity and Security," makes excellent suggestions.

Case Study of a Public Research University: The University of Arizona

As federal support of university research, while still substantial, fails to fully meet research needs, state universities face special challenges. The economic recession of the last four years has caused the state support that can be used for research-related expenses in most public universities to decline precipitously; in fact, even with the beginnings of economic recovery the levels of state investment in the universities continue to fall (National Association of College and University Business Officers, http://www.nacubo.org//Research/Research_News/State_and_Local_Government_Support_for_Higher_Education_Continues_to_Decline.html). The result is that state universities have a diminishing capability to provide the foundation for our researchers to be competitive for federal funding for research projects. For instance, while in the past the federal government provided major support for the provision of research facilities and equipment, today federal dollars are largely restricted to supporting research operations, with little targeted directly to the costs of providing the research infrastructure those operations depend upon. To fill this gap in federal funding, public universities have relied heavily upon *state* support, as well as their other institutional resources, to support their research infrastructure needs. Reductions in state support, in turn, are now making it increasingly difficult for us to remain competitive.

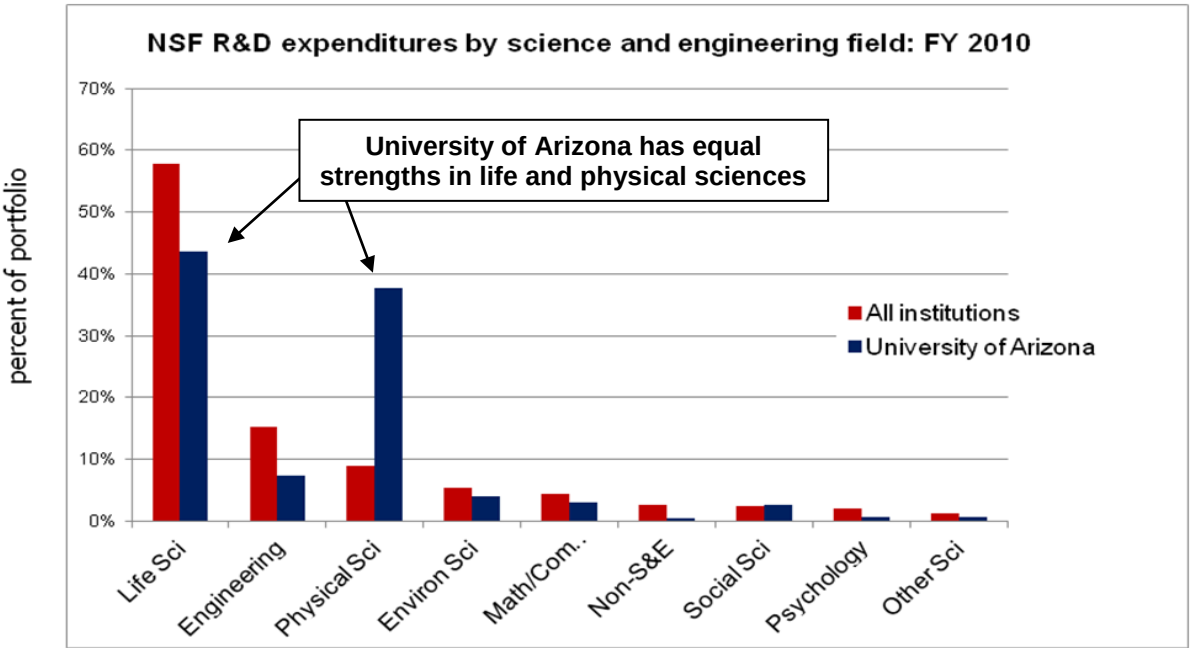
Below I will provide some examples of how the University of Arizona is addressing challenges posed to many public universities by the current economic climate.

Description of the University of Arizona

The University of Arizona is a large, comprehensive land-grant university of 39,000 students. With 10,700 direct employees and an additional 7,000 employees at our UA Science and Technology Park, we are one of southern Arizona's largest employers. Our annual research spending of over $610 million ranks us among the top 20 public research universities in the nation in research size. We consistently rank first or second in the physical sciences overall, and are among the top four universities in Space Sciences. Our research enterprise provides jobs at all skill levels, generally at higher wages than in the state economy overall.

Among other accomplishments, we design and build the largest telescope mirrors in the world and are the only public university to have served as Mission Control for a NASA mission, the Phoenix mission to explore the Martian surface. We provide, for the state

Figure 1. Distribution of University of Arizona's research portfolio by field compared to average of all U.S. universities



and the nation, leadership in smart agricultural water use and genetically based pest control and in advanced mining technologies, as a direct reflection of our land-grant mission. We also are home to one of the nation's top environmental science and policy institutes; taking advantage of our location, ours has a special focus on semi-arid climates and international border concerns. The Tucson region is known as Optics Valley, due to the large number of companies that spin out of our College of Optical Sciences.

Our strengths are rooted in fundamental science. As shown in **Figure 1**, compared to other universities we are unusually strong in physical sciences, with a portfolio that is almost equally balanced between physical and life sciences. Less of our portfolio is attributable to applied areas such as engineering and environmental sciences, although we have distinct strengths and are growing in these areas.

Our total annual budget is approximately $1.8 billion, comprising funds from multiple sources, as shown in **Figure 2**. State of Arizona support for its three public universities has fallen steeply in recent years: for the University of Arizona, state support has fallen

	FY2001-02 Actual		FY2011-12 Budget	
State Support	**329,320**	**32%**	**263,701**	**15%**
Net Tuition	**140,096**	**14%**	**408,900**	**23%**
Tuition Funded Aid	**49,300**	**5%**	**175,200**	**10%**
Grant & Contracts	**330,083**	**32%**	**574,400**	**32%**
Ancillary Units	**95,655**	**9%**	**188,100**	**11%**
TRIF *	**15,799**	**2%**	**19,400**	**1%**
Gifts & Endowments	**35,407**	**3%**	**78,500**	**4%**
Invest. Inc. & Other	**31,781**	**3%**	**67,200**	**4%**
TOTAL	**1,027,441**	**100%**	**1,775,401**	**100%**

Figure 2. Sources of funding for University of Arizona operations (in $thousands)

* TRIF (Technology Research Infrastructure Fund) supports university R&D and technology transfer related to the knowledge-based global economy through a six-tenths-cent increase in state sales tax.

from 32% of our total budget ten years ago to 15% in FY2012, with a reduction of almost $180 million in just the last five years.

We currently enroll 7,170 graduate students, about half of whom are enrolled in our 92 research-intensive doctoral programs and about half in our Master's degree programs. We administer 15 novel Graduate Interdisciplinary Programs, most of which offer the Ph.D. in STEM (science, technology, engineering, and math) areas. They have arisen in part to provide opportunities for students to learn how to engage in large-scale, collaborative research, which will be increasingly important in the 21st Century. Often the students themselves build bridges between faculty across traditional disciplines that eventually yield successful new federal funding for the kinds of large, high-impact projects that require collaborative efforts.

In addition to *graduate* programs focused on research, we have a long tradition of involving *undergraduate* students in hands-on research and other scholarly activity with faculty members, especially in STEM (science, technology, engineering, and math) areas. Our Undergraduate Biology Research Program, for example, was started in 1988 and through successful competition has received continuous funding from the NSF and from the Howard Hughes Medical Institute. Thousands of students have graduated from this and similar programs, armed with direct experience in framing and addressing important questions to advance our understanding of the world. They are well equipped for graduate/professional school and the workforce, with strong critical thinking skills and the will to take risks when needed to address difficult problems. The University of Arizona now is moving toward 100% participation of our undergraduate students in one-on-one research or creative scholarship activity with a faculty member before they graduate. We know that retention and graduation rates increase as students become engaged in active learning like this.

Addressing Challenges to Our Research Enterprise

What are some of the most important challenges currently faced by the University of Arizona in achieving our goals for increased levels of societally relevant research and research-intensive education?

- The *sharp decline in support from the state* affects our ability to compete for federal funding for research in numerous ways. For instance, we struggle to meet matching requirements on certain types of grants and to generate support for graduate students to work in labs, even in our top programs. Also, our physical infrastructure is aging and, as state funds for maintenance and renovation fall far behind the formulaic support that we are designated to receive – and less federal funding is available for infrastructure than in the past – our ability to provide enough modern laboratory facilities is threatened.
- *Fundamental research, in particular, tends to be marginalized* in discussions of the important roles that research plays in U.S. economic prosperity and international competitiveness. The University of Arizona believes strongly that we must continue to provide the inventive new ideas that may ignite whole new fields of application, because if universities do not do this, there will be few new ideas in the pipeline for the future. But this is often not recognized as being an *essential* university function.
- The *growing burden of compliance* with the increasing numbers and complexity of federal regulations consumes increasing amounts of time and money, leaving less for more direct support for research.
- The *full costs of research are not covered by our reimbursements* from the federal or state agencies that procure our research. "Indirect" costs are the common costs of doing research, the costs that cannot be ascribed to individual projects but that collectively are necessary for research to be conducted. Federal laboratories and industry are provided full reimbursement of indirect costs, but universities are not and so must subsidize them from other sources.

In facing these challenges, the University of Arizona embraces the basic premise that public universities provide special opportunities for personal advancement through education, for research that is conducted and analyzed through a broad societal lens, and for connection with the community at large. We work every day to maximize what we can offer to our stakeholders, especially in light of shrinking government support.

How budget cuts have changed the character of the University of Arizona

Budget cuts from the State of Arizona have had a serious impact on the University of Arizona. For example:

- We have had to raise the tuition we charge to students from the truly bargain levels of past years to $10,000 for resident undergraduates, a level at the middle of our peers, in order to more fully cover the costs of education.
- We have lost many faculty members, including some of our leading researchers, to other universities or to early retirement. The overall number of faculty is down by 60 in the past year.
- Demographically, our faculty is aging. Over recent years, we have not had the resources to hire new faculty to keep pace with retirements, so as the generation of faculty that made us a Research I institution leaves us, we do not have a strong generation of successors in place. Indirect cost dollars are a major source of start-up funds for new faculty, and as those are under-recovered we are unable to support new initiatives in response to new opportunities. To be aggressively entrepreneurial and innovative, we must be able to hire selected faculty in targeted areas, and we clearly are falling behind in our ability to do so.
- We have had to turn away from specific research-funding opportunities when the requirements for matching dollars were beyond our means. The funding entity would have doubled or tripled our investment, but we did not have the ability to make the initial investment.
- We struggle to meet the challenge of expanding our medical schools in Tucson and Phoenix. We cannot expand the College of Medicine to meet the state's needs without new faculty.

- Several of our historic laboratory research buildings are in such bad repair that we can no longer use them for research. When we renovate them, they will be office and classroom, not lab, buildings.
- "Temporary," trailer-like buildings constructed many decades ago to accommodate College of Medicine faculty continue to be used for biomedical research laboratories and offices and cannot be replaced with modern research facilities yet.
- We must teach more very large classes than ever before. To accommodate several classes of over 600 students, we have temporarily converted our major performance hall into a classroom for daytime use and are building other large classrooms into older buildings when we do renovate those buildings.

Cost savings and additional new funds are needed in order to buck these disturbing trends.

The need to find institutional efficiencies and make strategic investments

In light of the need to find funds to address issues such as those just described, the University of Arizona constantly seeks to find ways in which we can be more efficient in containing costs, right-sizing administration and oversight, and increasing productivity. Meeting this challenge requires self-study and change, and targeting our investments in selected strategic areas.

Although the University has a comprehensive research profile across the arts and sciences, we increasingly are focusing our research investments in five or six strategically selected areas. Four of these areas are:

1. Space Sciences – We are among the premier universities in the nation for land-based and space-based observation and exploration. In 2011, we won a major $800 million NASA project, called OSIRIS-REx, to study a near-earth asteroid. A member of our faculty will serve as the project leader, and the full team involves multiple other universities as well as the NASA Goddard Space Flight Center and Lockheed Martin.

This project will reveal new information about the origin of the universe and will give many dozens of students the opportunity to work on an exciting project that incorporates broad areas of science and engineering. The project also will incorporate a large program of outreach to K-12 students, who are so easily captivated by space exploration. The University will work hard to maintain its preeminence in the space sciences, which raises the profile of the entire university.

2. Bioscience/Biotechnology – The establishment of our interdisciplinary BIO5 Institute a decade ago generated a very successful collaborative environment in which biologists, agricultural scientists, biomedical scientists, computer scientists, and engineers collaborate easily and readily transmit their results out to practical application through technology transfer. In 2008, a BIO5 group was awarded the University's largest NSF grant ever, for a project called iPlant that has created a national cyberinfrastructure for molecular plant biologists, ecosystems biologists, information scientists, earth-imaging specialists, and others to tackle Grand Challenge problems in plant biology for the future. Our major focus now is to develop strength in translational and applied biomedical science, initially through the hiring of physician-scientists who will build bridges into medicine. The University of Arizona currently garners less funding from the NIH than do most universities with medical schools, but with our well-established interdisciplinary environment for research, we see a ripe opportunity to become stronger in this area. This expansion will take full advantage of new relationships we are building around the state through our College of Medicine in Tucson and its new arm in Phoenix, and will have a direct impact on medical education and healthcare for Arizonans.

3. Environment, Water, and Energy Sustainability – Our Institute of the Environment brings together major expertise in the science, engineering, and public policy of environmental sustainability from 300 faculty across the university, for collaboration locally and around the world. Their focus is to perform research and to transform research outcomes into useful knowledge for decision makers, consumers, and other stakeholders. Institute faculty and students have a special focus on understanding environmental impacts in a desert environment. They focus on such projects as arid lands

agriculture, solar energy and algal biofuels, and social policy related to environmental issues that cross borders or have disproportionate impacts on particular subpopulations. We are international leaders in some of these areas, and want to capitalize on our strength here to have a positive impact on the future.

4. Optics and Information Science and Technology – We have one of only three optical sciences colleges in the U.S. The faculty in that college are highly collaborative, with our space sciences faculty, with our biomedical scientists interested developing and testing non-invasive imaging technologies, and with computer science and engineering. A major NSF-funded Engineering Research Center in "Integrated Access Networks" has its home here. That ERC unites University of Arizona faculty with those from eight other universities in an effort to create optoelectronic telecommunications technologies that will enable seamless, cost-efficient aggregation of IT networks, and it encompasses a comprehensive plan for maximizing diversity among the faculty and students. Our optical sciences faculty lead the university in taking their research all the way to application in society, through the licensing of the knowledge they create and through the creation of dozens of spin-out companies, many of which have stayed in the Tucson area, giving it the nickname "Optics Valley." In our business college, the Management Information Systems program is one of the strongest in the nation. MIS faculty are among the users of our newly opened Research Data Center, which consolidates in a shared facility the high-end computing power needed by researchers who generate and analyze huge volumes of data (so called "big" data). With each passing year, more and more projects have major IT infrastructure needs that we meet with a combination of local and shared IT resources.

Research projects in all of these areas have direct impacts on our state, through stimulating school children's curiosity about space and science, to generating new ideas and new knowledge, to creating new companies, to educating a workforce ready to lead in a highly connected and highly technological world. In each of these areas of focus, our faculty and students collaborate with researchers in other universities both near and far, increasingly engaging in very large projects that involve large consortia of universities,

industry, and national laboratories. There are some instances, however, where additional faculty are needed in our own university to extend or fill gaps in expertise so that we can reach our full potential. As we find the funds to hire faculty to replace retirees or into newly created positions, we pay particular attention to how they fit into research interest-clusters, and we focus our resources on the faculty that complement the strategic areas. This is the way we can most efficiently build the research teams to tackle the Grand Challenge-type problems that face our society. However, it also takes money to provide and maintain the modern research space and infrastructure these faculty will need to make the promise of major research advances a reality.

Encouraging innovation and entrepreneurship

Entrepreneurship is encouraged and nurtured across the University of Arizona campus. Much of this activity has its formal home in the business college, which has a top-ranked entrepreneurship program that has been selected as a National Model Program by the U.S. Association for Small Business and Entrepreneurship. Students in the program are a resource for faculty developing business plans for their start-up companies, and a new venture for the program is the Innovation Law Lab that provides legal strategies and advice to innovation-based start-up companies in our region. Just this year, a new minor in Entrepreneurship is being offered to students across the university, so that scientists and engineers, for instance, can acquire a background that will help them to bring a business perspective to their work.

An entrepreneurial spirit is encouraged through another creative set of programs funded by the Technology and Research Initiative Fund (TRIF). TRIF is a special investment in higher education made possible by the passage of Proposition 301 by Arizona voters in 2000. The TRIF portion of the proceeds from a six-tenths of a cent increase in state sales tax is administered by the Arizona Board of Regents and distributed to the state's public universities. At the University of Arizona, TRIF funds support research in three of the strategic areas of research focus described in the section above, as well as translation of research results to clinical or commercial application and education of a workforce

prepared to lead in a knowledge-based economy. Funds also support specialized research facilities, our new technology commercialization program (described below as Tech Launch Arizona), and distance-learning activities.

A third entity, Science Foundation Arizona (SFAz; http://www.sfaz.org), also plays a key role in spurring innovation and connection to the business community. Created in 2006, SFAz is a nonprofit public-private partnership that was formed to invigorate Arizona's economy by making strategic R&D investments in the state's universities. With total funding of approximately $40-50 million each year, SFAz facilitates strategic collaborations between Arizona universities and industry, supports top-notch graduate students and postdoctoral researchers to come to Arizona's universities, and, as will be described in more detail below, administers a creative program to enhance STEM education in grade schools. One exciting research program funded by SFAz is developing advanced environmentally responsible technologies for mining, through a partnership between the University's Department of Mining and Geological Engineering and a number of leading mining companies. SFAz requires the companies to match SFAz's financial support for the program, and the resulting partnership is strong.

Technology commercialization and partnership with private industry

University of Arizona researchers share our new ideas and innovations in many ways: with other scholars through traditional academic channels, through formal technology transfer into the business sector, and directly with the community through many programs such as AZ Cooperative Extension – and our biggest pipeline of knowledge transfer is to and through our students. Students acquire new knowledge and the ability to think critically, test ideas, and work constructively in teams before they enter the workforce.

New knowledge, or intellectual property, developed at the University of Arizona has had a major impact on the economy in our region. For instance:

- Over twenty years ago, a professor of pathology developed an automated system for processing the histological slides that researchers and hospitals use to inspect tissue samples. He refined the system, with a focus on its use for cancer diagnostics, and in 2008, his company, Ventana Medical Systems, was acquired by the Roche group, one of the world's giant pharmaceutical companies, for $3.4B billion dollars. The company has expanded to over 1000 employees in the Tucson valley, hiring many graduates from the University of Arizona.
- In a similar vein, a University spin-out company, Selectide, which used an innovative technology that allowed scientists to attach individual compounds to tiny beads for specific testing, was acquired by another pharmaceutical giant, Sanofi, in 2004. That company is growing and developing as a neighbor of Ventana Medical Systems.

We currently are revamping our formal technology transfer and commercialization functions, in an effort to spawn more successes like those above, which have the potential to transform our quality of life and also to bring a significant licensing and royalty revenue stream to the University to add to our coffers. Tech Launch Arizona will bring together our offices of technology transfer and corporate/business relations and our business incubator and science park, to provide a more cohesive and entrepreneurial approach to taking ideas and inventions from the University of Arizona to market.

Our Science and Technology Park is already a powerhouse. With more than 7,000 employees, the UA Tech Park is another one of the region's largest employers. It is home to 50 high-tech companies and business organizations, including several emerging technology companies, as well as branches of five Fortune 500 companies. It includes a business incubator, which currently hosts 7 emerging companies, several of which are spin-offs from the University of Arizona. We currently are developing a second UA Tech Park, focused on biotechnology, and received $4.7 million in Federal Stimulus funds from the U.S. Department of Commerce to build the utility and roadway infrastructure that is allowing us to develop that property. Together, these tech parks will

provide a nurturing home for young companies emerging out of the university and also serve as a magnet for technology companies to relocate and stay in Tucson.

Enhancing STEM education and broadening participation in STEM fields

Several initiatives highlight our commitment to strengthening STEM competency in our students and enhancing diversity in STEM areas.

Our Graduate College administers several programs that provide students from underrepresented groups the opportunity to develop their STEM backgrounds and then to succeed as graduate students at the University of Arizona. In Fall 2011, almost 2000 graduate students at the University of Arizona were underrepresented minority, i.e., Hispanic, Native American and African American, a 53% increase in 10 years. Our students from underrepresented backgrounds represent 18% of the graduate student body, a significantly higher representation than any other AAU-member university. One of our most successful feeder programs is the Ronald E. McNair Achievement Program, a graduate school preparation program for University of Arizona undergraduates. Funded by the U.S. Department of Education, this program provides low-income, first-generation college, and underrepresented students with opportunities and activities to excel in their undergraduate studies and assistance in admission into doctoral programs. Many track into science and engineering programs.

Another program targets faculty diversity. This is our five-year NSF-funded ADVANCE program, which is aimed at eliminating the unconscious bias that can limit the success of women, and especially women of color, in the faculty ranks in STEM areas. The $3.3 million grant has enabled the university to create bias-awareness training for the committees that perform searches for new faculty and that evaluate faculty for promotion and tenure, as well as multiple career-development activities for women faculty. As important as any other aspect of the program is the attention that it brings to the University of Arizona, alerting women that ours is a welcoming academic community.

This year Science Foundation Arizona, mentioned above, launched the AZ STEM Network as a proactive approach to STEM teaching in Arizona's middle and high schools. The public-private consortium that developed the Network seeks to develop and disseminate effective education practices and teaching advances including state-adopted, internationally benchmarked Common Core Standards. The Network will provide educators, the business community, and private donors the framework and tools needed to integrate effective STEM learning into Arizona schools. The University of Arizona's College of Education has obtained a three-year grant from AZ STEM Network for $750K, plus matching funds from local business partners, to create the Southern Arizona Science and Math Internship Center. The Center will provide a three-year master's degree program that aims to improve the retention of math and science teachers who are teaching in middle and high schools, through stimulating coursework and paid internships in businesses that use math and science.

National Academies' 2012 Report on Research Universities

Maintaining America's universities' competitiveness in research, especially in the fundamental research that will provide the basis for major leaps in enhancing our prosperity and security in the future, has become a serious challenge. The new National Research Council report, "Research Universities and the Future of America: Ten Breakthrough Actions Vital to Our Nation's Prosperity and Security," makes multiple welcome recommendations to strengthen research and advanced education.

A major theme of the report is that federal and state governments, research universities, and industry must work in partnership to advance the capabilities and impact of our research universities to meet the nation's innovation and education needs.

While all of the recommendations deserve good attention, here we especially endorse three subthemes that relate to the items I have mentioned in this testimony and that the House Subcommittee on Research and Science Education may help to address.

1. Fundamental, or basic, research lays the foundation for the applied research that enhances our economy

Reference is made throughout the "Universities and Prosperity" report, but especially under Recommendation 1, that research and development are founded in the fundamental, or basic, research that is conducted in research universities. As the report is publicized, it will be most useful to universities if fundamental research is mentioned as often as the more applied research that is easier for the public to grasp. We must help the public and law-makers to understand that without fundamental research, there is no basis for applied research applications.

2. Funding agencies should more fully reimburse the real costs of the research they procure. (Recommendation 6)

The full costs of research include not only the funds given for specific projects but also the less visible costs that cannot be ascribed to individual projects but that are necessary for research to be conducted. Among other things, these costs cover administrative support and oversight and research facilities. Although federal laboratories and industry are provided full reimbursement of such "indirect" costs for research procured, universities receive only partial coverage. It is important to note that the partial coverage provided by federal funding agencies is provided as reimbursements for actual expenditures that have been meticulously audited for legitimacy. Fuller reimbursement of actual expenditures would decrease the subsidy that universities currently must provide if they are to accept federal funds to perform research in the national interest.

3. The regulatory burden of administering federal research funds should be re-examined and reduced where possible. (Recommendation 7)

As a federal grantee, the University of Arizona is a conscientious steward of public research investments. We understand the importance of compliance and regulatory oversight and strongly support the objectives of accountability and transparency. We

seek changes in federal policy that will simplify the complex and sometimes contradictory regulatory policies that cost us so much in assuring compliance with federal research policies. Simplification and streamlining of those policies would allow our limited resources to be used more effectively across the board on research, education, and public service. At the same time, federal oversight would cost less, freeing up funds for more direct support of research.

In addition to these three items, the University of Arizona believes it especially important to attend to Recommendations 5 and 8, which would create specific programs designed to fund graduate students and early-career investigators, helping to maintain a robust workforce pipeline, and to Recommendations 9 and 10, which will help us to diversify and strengthen the pool of scientists that we educate and then maintain in the nation's workforce.

While the federal and state governments work on the aspects of the recommendations that apply to government, the University of Arizona will do its part to be ever more efficient and effective.

Thank you for the opportunity to present this testimony.