

RESEARCH UNIVERSITIES AND THE FUTURE OF AMERICA

Statement of

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before the

Subcommittee on Research and Science Education
Committee on Science, Space, and Technology
U.S. House of Representatives

June 27, 2012

Introduction

Good morning, Mr. Chairman and members of the Subcommittee on Research and Science Education. My name is Chad Holliday. I am the retired Chair and CEO of DuPont and currently serve as non-executive Chairman of the Board of Bank of America. I am testifying to you today in my capacity as Chair of the Committee on Research Universities of the National Research Council (NRC). The Research Council is the operating arm of the National Academy of Sciences, National Academy of Engineering, and the Institute of Medicine of the National Academies, chartered by Congress in 1863 to advise the government on matters of science and technology. The Council's Committee on Research Universities released its report, *Research Universities and the Future of America: Ten Breakthrough Actions Vial to Our Nation's Prosperity and Security*, on June 14, 2012, and you have asked me to appear before you today to provide you an overview of its findings and recommendations. This testimony is accompanied by a copy of the summary of the report.

Context

Mr. Chairman, America in the 21st century is driven by innovation – that is, advances in ideas, products, and processes that create new industries and jobs, contribute to our nation's health and security, and allow us to achieve our national goals. Innovation in the United States, in turn, has been increasingly driven by educated people and the knowledge they produce. And our nation's primary source of both new knowledge and graduates with advanced skills is our nation's research universities. As such, this set of institutions represent a key asset—perhaps even our most potent national asset—for the 21st century.

Today, 35 to 40 of the top 50 research universities in the world are in the United States. And the strength of these institutions, public and private, is the direct result of forward-looking federal and state policies, largely enacted by Congress and often in periods of national crisis. Indeed, we can begin this story almost exactly 150 years ago during the Civil War with the enactment of the Morrill Land-Grant College Act of 1862 that established a partnership between the federal government and the states to build universities that would address the challenges of creating a modern agricultural and industrial economy. The story continues with the strengthening of this partnership during and following World War II: over the last 60 years, federal policies and programs have concentrated basic research in our universities and funded it through federal programs that have supported a unique and extremely productive combination of research and graduate education.

In 2009, Representatives Bart Gordon and Ralph Hall, then Chair and Ranking Member of the House Science Committee, and Senators Lamar Alexander and Barbara Mikulski requested that the National Academies prepare, as a follow-up to the landmark *Rising Above the Gathering Storm*, a report examining more deeply the health and competitiveness of the nation's research universities. In their letter of request, they noted that America's research universities "have been the critical assets that have laid the groundwork—through research and doctoral education—for the development of many of the competitive advantages that make possible the high American standard of living." But they were also alarmed that while our research universities consistently rank among the best in the world they are nevertheless "under stress, even as other countries are measurably improving the quality of their research institutions."

Indeed, our research universities today confront challenges and opportunities that require systematic response. Consequently, the Congressional request asked that the NRC assess the competitive position of our research universities and respond to the following question:

What are the top ten actions that Congress, state governments, research universities, and others can take to maintain the excellence in research and doctoral education needed to help the United States compete, prosper, and achieve national goals for health, energy, the environment, and security in the global community of the 21st century?

In response, the NRC convened a committee of leaders in academia, industry, government, and national laboratories.¹ That committee has now delivered its report, *Research Universities and the Future of America: Ten Breakthrough Actions Vital to Our Nation's Prosperity and Security*.

Key findings

Research Universities and the Future of America argues that the nation must reaffirm and revitalize the unique partnership that has long existed among research universities, federal and state governments, and philanthropy, and strengthen its links with business. It is this partnership that is central to the global strength of our institutions and what makes them a potent asset for our nation. University research has addressed environmental concerns, such as damage to the earth's ozone shield; produced new drugs and technology that improve health, including synthetic insulin, blood thinners, and magnetic resonance imaging (MRI); led to innovations that make our nation safer, such as imaging technology that scans containers as they enter our ports; and contributed countless products that have revolutionized our way of life, including lasers, rocket fuel, computers, and key components of the World Wide Web. And talented graduates of

¹ See committee roster at end of testimony.

these institutions have created and populated many new businesses that have employed millions of Americans.

Despite their success, our nation's research universities are now confronting challenges and opportunities that a reasoned set of policies must address in order to produce the greatest return to our society, our security, and our economy. *Research Universities* identified the following as especially important:

- Federal funding for university research has been unstable and, in real terms, declining at a time when other countries have increased funding for research and development (R&D).
- State funding for higher education, already eroding in real terms for more than two decades, has been cut further during the recent recession.
- Business and industry have largely dismantled the large corporate research laboratories that drove American industrial leadership in the 20th century (for example, Bell Labs), but have not yet fully partnered with research universities to fill the gap.
- Research universities must improve management, productivity, and cost efficiency in both administration and academics.
- Young faculty have insufficient opportunities to launch academic careers and research programs.
- There has been an underinvestment in campus infrastructure, particularly in cyberinfrastructure, that could lead to long-term increases in productivity, cost-effectiveness, and innovation in research, education, and administration.
- Research sponsors often do not pay the full cost of research they procure, which means that universities have to cross-subsidize sponsored research from other sources, such as tuition or clinical revenues.

- A burdensome accumulation of federal and state regulatory and reporting requirements increases costs and sometimes challenges academic freedom and integrity.
- Doctoral and postdoctoral preparation could be enhanced by shortening time-to-degree, raising completion rates, and enhancing programs' effectiveness in providing training for highly-productive careers.
- Demographic change in the U.S. population necessitates strategies for increasing the educational success of female and underrepresented minority students.
- Institutions abroad are increasingly competing for international students, researchers, and scholars, as other nations increase their investment in their own institutions.

Research Universities argues that we must address these issues in order to assure that our institutions continue to contribute the new knowledge and talented people our society requires.

Recommendations

The report provides ten strategic recommendations requiring strong actions from the federal government, state governments, universities, and business that are designed to accomplish three broad goals: (i) strengthen the partnership among universities, federal and state governments, philanthropy, and business in order to revitalize university research and speed its translation into innovative products and services; (ii) improve the productivity of administrative operations, research, and education within universities; and (iii) ensure that America's pipeline of future talent in science, engineering, and other research areas remains creative and vital, leveraging the abilities of all of its citizens and attracting the best students and scholars from around the world.

The report provides actions to be taken by recommendation. Here I wish to review, instead, the actions to be taken by actor.

Universities

We call on universities in our report to play a strong role in shaping the future for themselves, for those they serve, and for the nation.

First and foremost, the nation's research universities should set and achieve bold goals in cost-containment, efficiency, and productivity in business operations and academic programs, striving to limit the cost escalation of all ongoing activities -- academic and auxiliary -- to the inflation rate or less. In addition to implementing efficient business practices, universities should (1) review existing academic programs from the perspectives of centrality, quality, and cost-effectiveness, (2) encourage greater collaboration among research investigators and among research institutions, particularly in acquiring and using expensive research equipment and facilities, (3) adopt modern instructional methods such as cyberlearning, and (4) improve management of intellectual property to improve technology transfer.

By increasing cost-effectiveness and productivity, institutions will realize significant cost-savings in operations that may be used to improve their performance, allowing them to shift resources strategically and/or reduce growth in their need for resources such as tuition. Many institutions have already demonstrated that significant cost efficiencies are attainable. University associations should develop and make available more powerful and strategic tools for financial management and cost accounting that enable universities to determine the most effective ways to contain costs and increase productivity and efficiency. As part of this effort, they should develop

metrics that allow universities to communicate their level of cost-effectiveness to the general public.

In fulfilling their educational mission, research universities should engage in efforts to improve education for all students at all levels in the United States by reaching out to K-12 school districts and by taking steps to improve access and completion in their own institutions. Similarly, research universities should assist efforts to improve the education and preparation of those who teach STEM subjects in grades K-12. Universities should also strive to improve undergraduate education, including persistence and completion rates in STEM, and take urgent, sustained, and intensive action to increase the participation and success of women and underrepresented minorities. Research universities should also restructure doctoral education to enhance pathways for talented undergraduates, improve completion rates, shorten time-to-degree, and strengthen the preparation of graduates for careers both in and beyond the academy.

State Governments

For states to compete for the prosperity and welfare of their citizens in a knowledge-driven global economy, the advanced education, research, and innovation programs provided by their research universities are absolutely essential. And the importance of these universities extends far beyond state borders; these institutions play a critical role in the prosperity, public health, and security of their regions and the entire nation. However, an alarming erosion in state support for higher education over the past decade has put the quality and capacity of public research universities at great risk. State cuts in appropriations to public research universities over the years 2002 to 2010 are estimated to average 25 percent -- and range as high as 50

percent for some universities -- resulting in the need for institutions to increase tuition or to reduce either activities or quality.

Going forward, state governments should move rapidly to provide their public research universities with sufficient autonomy and agility to navigate an extended period with limited state support. As budgets recover from the current recession, though, states should strive to restore and maintain per-student funding for higher education, including public research universities, to the mean level for the 15-year period 1987-2002, as adjusted for inflation. Federal programs designed to stimulate innovation and workforce development at the state level, including those recommended in this report, should be accompanied by strong incentives to stimulate and sustain state support for their public universities, which are both state and national assets.

Federal Action

The study committee was acutely aware of – and robustly discussed—the current federal fiscal environment and, consequently, recommends both actions with little or no cost that could be taken in the short term and increased investments that should be made over time as the economy improves.

Federal Policies on Costs and Regulation

There are important actions that could be taken – in fact should be taken – in a constrained budget environment. First, the federal government and other research sponsors should support the full cost, direct and indirect, of research and other activities they procure from universities so that it is no longer necessary to subsidize these sponsored grants by drawing on resources intended to support other important university missions, such as undergraduate

education and clinical care. Both sponsored research policies and cost-recovery negotiations should be developed and applied in a consistent fashion across all federal agencies and academic institutions, public and private.

Second, federal policymakers and regulators (OMB, Congress, Agencies) and their state counterparts should review the costs and benefits of federal and state regulations, eliminating those that are redundant, ineffective, inappropriately applied to the higher education sector, or impose costs that outweigh the benefits to society. The federal government should also make regulations and reporting requirements more consistent across federal agencies so that universities can maintain one system for all federal requirements rather than several, thereby reducing costs. Reducing or eliminating regulations can reduce administrative costs, enhance productivity, and increase the agility of institutions. With greater resources and freedom, universities will be better positioned to respond to the needs of their constituents in an increasingly competitive environment.

Federal Investments

Over the next decade, as the economy improves, the federal government should invest in basic research, graduate education, infrastructure and technology transfer in order to produce the new knowledge and educated citizens the nation needs and to ensure that these are fully and productively deployed in our economy and society.

Congress and the administration should provide full funding of the amount authorized by the America COMPETES Act, doubling the level of basic research conducted by the National Science Foundation, National Institute of Standards and Technology, and the Department of Energy's Office of Science. By completing funding increases that Congress has already authorized, the nation would ensure robust support for critical basic research programs,

achieving a balanced research portfolio capable of driving the innovation necessary for economic prosperity. Together with cost-efficient regulation, this stable funding will enable universities to make comparable investments in research facilities and graduate programs. And because research and education are intertwined in universities, this funding will also ensure that we continue to produce the scientists, engineers, and other knowledge professionals the nation needs.

The federal government should, within the context of also making the R&D tax credit permanent, implement new tax policies that incentivize business to develop partnerships with universities (and others as warranted) for research that results in new economic activities located in the United States.

The federal government should significantly increase its support for graduate education through balanced programs of fellowships, traineeships, and research assistantships provided by all science agencies that depend upon individuals with advanced training. This rebalancing of support is designed to facilitate better alignment of doctoral education with national needs and with the careers of graduates. Furthermore, all stakeholders – the federal government, states, local school districts, industry, philanthropy, and universities -- should take urgent, sustained, and intensive action to increase the participation and success of women and underrepresented minorities across all academic and professional disciplines, especially in science, mathematics, and engineering.

The federal government should create a new Strategic Investment Program to support two 10-year initiatives: (1) an endowed faculty chairs program to facilitate the careers of young investigators during a time of serious financial stress and limited faculty retirements, and (2) a research infrastructure program initially focused on rapidly evolving cyberinfrastructure that will

increase productivity and collaboration in research and may also do so in administration and education. Federal investments in these initiatives would be intended for both public and private research universities, and they would require institutions to obtain matching funds from states, philanthropy, business, or other sources. Also of critical importance is the endowment of chairs, particularly for promising young faculty.

Federal agencies should ensure that visa processing for international students and scholars who wish to study or conduct research in the United States is as efficient and effective as possible consistent with homeland security considerations. In order to ensure that a high proportion of non-U.S. doctoral researchers remain in the country, the federal government should also streamline the processes for these researchers to obtain permanent residency or U.S. citizenship. The United States should consider taking the strong step of granting residency (a green card) to each non-U.S. citizen who earns a doctorate in an area of national need from an accredited research university.

Business Action

The role of business in the university-government-industry partnership is critically important and must be enhanced. As noted above, industry has largely dismantled the large corporate research laboratories that drove American industrial leadership in the 20th century (e.g., Bell Labs), but have not yet fully partnered with research universities to fill the gap. Nor have they adequately partnered with university programs to help produce the advanced graduates that industry needs.

Tax incentives and research support mechanisms can promote collaboration between business and universities that will lead to the creation and efficient use of knowledge to achieve

national goals—particularly the development of new products and US-located economic activity and jobs. In order for this to be successful, the relationship between business and higher education should become more peer-to-peer in nature, stressing collaboration in areas of joint interest rather than remaining in a traditional customer-supplier relationship, in which business procures graduates and intellectual property from universities.

Businesses and universities should work closely together to develop new graduate degree programs that address strategic workforce gaps for science-based employers. Employers -- businesses, government agencies, and non-profits -- that hire master's and doctorate level graduates should more deeply engage programs in research universities by providing internships, student projects, advice on curriculum design, and real-time information on employment opportunities.

Committee Process

The committee agreed to the above findings and recommendations following a rigorous process of information gathering and deliberation. As outlined in an appendix to the report, the committee solicited input for its study from a broad range of stakeholders during the course of several meetings. In parallel with our information gathering process, the committee deliberated its findings and conclusions by first considering the current strengths and weaknesses of our research universities and the opportunities and threats they face today and are likely to face over the next decade. This deliberation allowed the committee to brainstorm and discuss key issues over a period of time, including several committee meetings, and ultimately formulate the set of ten issues they agreed to address in the report.

The study committee reached consensus on the top ten report recommendations through thorough discussion that addressed strengths and opportunities, weaknesses and threats, but also difficult contextual issues that would affect actions and potential outcomes. These contextual issues included the current federal fiscal environment; pressures on state budgets over time; the intricacies of university finances, including cross-subsidies; increases in tuition, typically driven by pressures on other revenue streams; the kinds of productivity gains that universities can achieve, and under what scenarios; the appropriate roles of universities, government, and business in the development of technology and its transfer into the marketplace, and the importance of differences by industry; and the need for more effective communication of these complicated issues to the public. We were strongly motivated to present a mix of actions that were low-cost or no-cost as well as actions that required investments and we have done so. We believe we have presented a fair and balanced – as well as critically important – set of recommendations that require strong action from all key stakeholders in the university-government-industry partnership.

Your written questions asked if there were issues that were particularly challenging for consensus building. There was a concern at the outset that one such issue might be differences between public and private research institutions over steps to be taken to develop a way forward from the current economic and fiscal climate. No such difference materialized and, indeed, I can report that the entire committee was strongly unanimous in their recommendations regarding the importance of ensuring the strength of our nation’s public institutions that are critical not only to their states and regions, but also to the nation. Another, related issue that might have also raised differences of opinion was the rhetorical question about the “right number” of research universities in the United States. The committee did not believe any group of people could

determine *a priori* what the “right number” of such institutions might be and that it would be damaging to try to do so. Instead, it is important to articulate a set of principles that would naturally lead to an appropriate, but fluid number: these include the importance of merit review, competition, and striving for excellence in faculty and students; they also include taking the opportunity to build capacity or incentivize regional partnerships when it makes sense for the benefit of the nation. The committee also believes that the ecosystem of research universities should be diverse. It will include large and comprehensive institutions that can aspire to excellence across the range of fields and others that, because of limited resources or a particular comparative advantage, should pick specific areas in which they should compete.

Lastly, I would like to note four additional items of national importance that came before us that we did not act on because other committees properly assembled for the task had been empanelled to do so. First, some members of the committee were interested in exploring the business model for research, particularly in the biomedical sciences. We did not take up this subject because the Advisory Committee to the Director of the National Institutes of Health had appointed a task force to examine the structure of the biomedical workforce and appeared to be ready to explore the issues raised before us.² Second, a related issue focuses on the status, conditions, and future careers of the nation’s postdoctoral trainees. We addressed this in an oblique way through our recommendations on reform of doctoral education and the creation of an endowed chairs program, but the postdoctoral experience requires more in-depth examination. During the course of our work, the National Academies appointed a study committee, under the aegis of the Committee on Science, Engineering, and Public Policy (COSEPUP) to undertake just that and we await their final report. Third, the Experimental Program to Stimulate Competitive Research (EPSCoR) and similar programs play a fundamental role in the research

² This task force, by coincidence, also released its report on June 14, 2012.

university landscape. We might have looked more in-depth at that program. However, during the course of our study Congress mandated that the Academies undertake an assessment of the EPSCoR program and the Academies have appointed a study committee to do that, also under the aegis of COSEPUP. Lastly, committee members were very concerned that the full range of fields in the research university—across the physical sciences, life sciences, engineering, social sciences, and humanities—be preserved as critical to the core mission of education and research. We were pleased to note in our report that, in response to a Congressional request similar to ours, that the American Academy of Arts and Sciences has appointed a blue-ribbon committee that will soon release a report on strengthening the humanities and social sciences in higher education and society. As you can imagine, the committee received in its meetings a large range of issues and recommendations from well-informed and engaged individuals, universities, and associations. While we could not include all of them, the committee's records in its Public Access File will preserve them for possible use by similar committees in the future.

Conclusion

Mr. Chairman, I would like to note again, in conclusion, that during past eras of challenge and change, our national leaders have acted decisively to create innovative partnerships to enable our universities to enhance American security and prosperity. Today our nation faces new challenges, a time of rapid economic, social, and political transformation driven by an exponential growth in knowledge and innovation. A decade into the 21st century, a resurgent America must stimulate its economy, address new threats, and position itself in a competitive world transformed by technology, global competitiveness, and geopolitical change. In this environment, educated people, the knowledge they produce, and the innovation and

entrepreneurial skills they possess, particularly in the fields of science and engineering, are keys to our nation's future. So, it is essential that we reaffirm and revitalize the unique partnership that has long existed among the nation's research universities, federal government, states, philanthropy, and business. The actions recommended in our report will require significant policy changes, productivity enhancement, and investments on the part of each member of the research partnership. Yet they also comprise a fair and balanced program that will generate significant returns for a stronger America.

Mr. Chairman, thank you for this opportunity to address the Subcommittee on this set of issues so critical to our nation.

**Committee on Research Universities
Roster**

Chad Holliday, *Committee Chair*, Chairman of the Board, Bank of America, and Chairman and CEO, E.I. du Pont de Nemours and Company (DuPont) (retired) [NAE]

Peter Agre, University Professor and Director, Johns Hopkins Malaria Research Institute, Department of Molecular Microbiology and Immunology, Bloomberg School of Public Health, Johns Hopkins University [NAS/IOM]

Enriqueta Bond, President, Burroughs Wellcome Fund (retired) [IOM]

C.W. Paul Chu, T. L. L. Temple Chair of Science and Professor of Physics, University of Houston, and Former President, Hong Kong University of Science and Technology [NAS]

Francisco Cigarroa, Chancellor, The University of Texas System [IOM]

James Duderstadt, President Emeritus and University Professor of Science and Engineering, University of Michigan [NAE]

Ronald Ehrenberg, Irving M. Ives Professor of Industrial and Labor Relations and Economics, and Director, Cornell Higher Education Research Institute, Cornell University

William Frist, Distinguished University Professor, Owen Graduate School of Management, Vanderbilt University, and US Senator (retired)

William Green, Chairman and CEO, Accenture

John Hennessy, President and Bing Presidential Professor, Stanford University [NAS/NAE]

Walter Massey, President, School of the Art Institute of Chicago, and President Emeritus, Morehouse College

Burton McMurtry, Founding Partner, TVI

Ernest Moniz, Cecil and Ida Green Professor of Physics and Engineering Systems, Director of the Energy Initiative, and Director of the Laboratory for Energy and the Environment at the MIT Department of Physics, Massachusetts Institute of Technology

Heather Munroe-Blum, Principal, Vice-Chancellor, and Senior Officer of the University, and Professor in the Department of Epidemiology, Biostatistics and Occupational Health, McGill University

Cherry Murray, Dean, Harvard School of Engineering and Applied Sciences, John A. and Elizabeth S. Armstrong Professor of Engineering and Applied Sciences, and Professor of Physics, Harvard University [NAS/NAE]

Hunter Rawlings, President Emeritus and Professor of Classical History, Cornell University*

John Reed, Chairman and CEO, Citigroup (retired), Chairman, New York Stock Exchange (retired), and Chairman of the MIT Corporation

Teresa Sullivan, President, University of Virginia

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Lee T. Todd, Jr., President, University of Kentucky

Laura D'Andrea Tyson, S. K. and Angela Chan Chair in Global Management, Haas School of Business, University of California Berkeley

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* Resigned in April 2011 upon his selection as the next president of the Association of American Universities.

Charles O. Holliday, Jr.

Chairman of the Board, Bank of America Corporation. Former Chairman of the Board and Chief Executive Officer of DuPont, 1998-2008. Under his direction, DuPont established its mission to achieve sustainable growth: increasing shareholder and societal value while decreasing the company's environmental footprint. Member of the National Academy of Engineering and the American Academy of Arts and Sciences. Serves on the Board of Directors of Deere & Co, Royal Dutch Shell, CH2MHill, the Climate Works Foundation, the Nicholas Institute for Environmental Policy Solutions at Duke University, and the National Geographic Education Foundation. Chairman of the World Business Council for Sustainable Development. Co-chair of the United Nations Secretary-General's High-Level Group on Sustainable Energy for All. Past Chair of the Board of The Business Council, Catalyst, and the Council on Competitiveness.