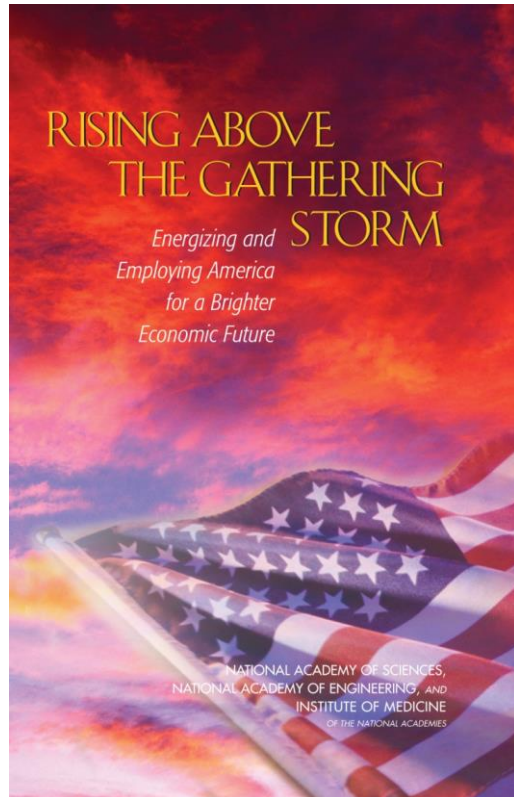


*Research Universities and
the Future of America:*
Implications for UMBC

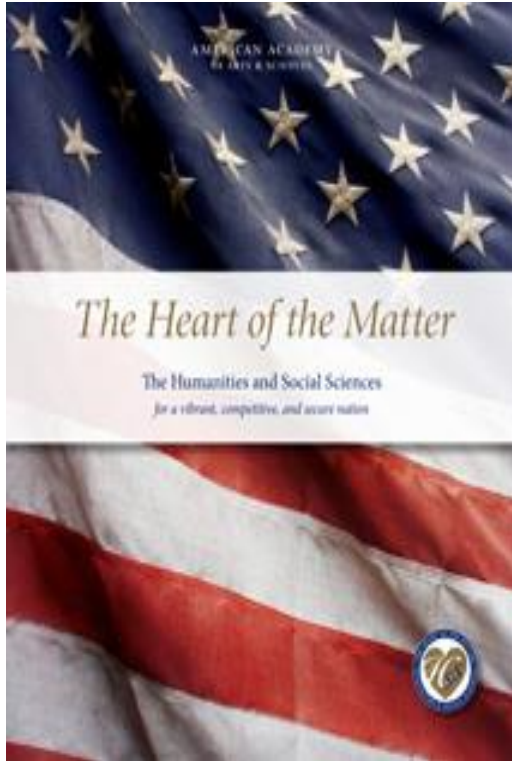
Peter H Henderson

August 20, 2013



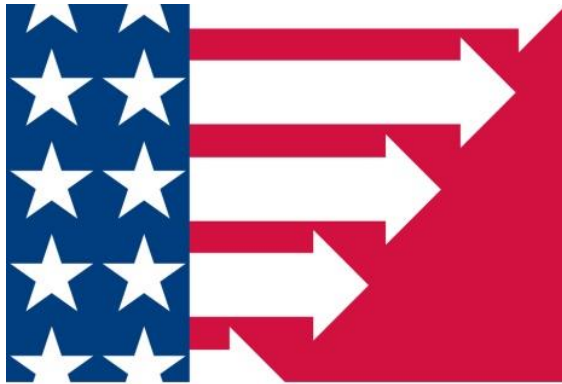
Powerful Narrative:

1. **Innovation is the key to economic growth and national security in the globally competitive 21st century.**
2. **Investments in STEM education and research** that provide talented people and new ideas are the key to innovation.



Critical Narrative:

- 1. Knowledge and insights from the arts, humanities and social sciences** are critical for civic ideals, cultural understanding, public discourse, a creative workforce, and a dynamic society.
- 2. Investments in education and research** focused on literacy, languages, the arts, history, civics, international affairs, and ethics are the keys to this cultural knowledge.



RESEARCH UNIVERSITIES AND THE FUTURE OF AMERICA

Ten Breakthrough Actions Vital to
Our Nation's Prosperity and Security

NATIONAL RESEARCH COUNCIL
OF THE NATIONAL ACADEMIES

Research Universities and the Future of America:

Our strong national ecosystem of research universities – which includes UMBC – is the chief source of the knowledge and talented people with advanced degrees across all of these disciplines that power our progress and provide for a rich and creative society.

Protecting the Earth's Ozone Shield



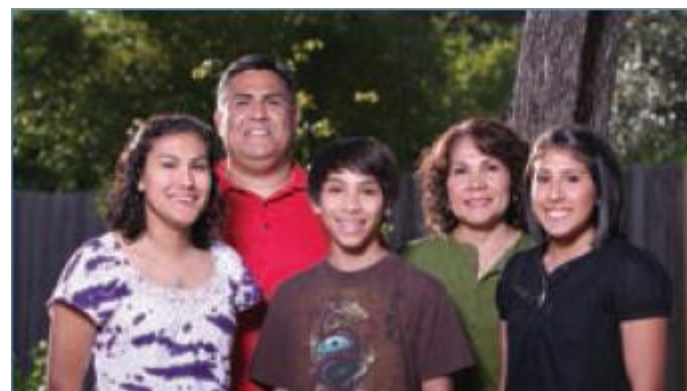
Synthetic Taxol: Sustainable Cancer Treatment



Forensic DNA Analysis



Data on US Households

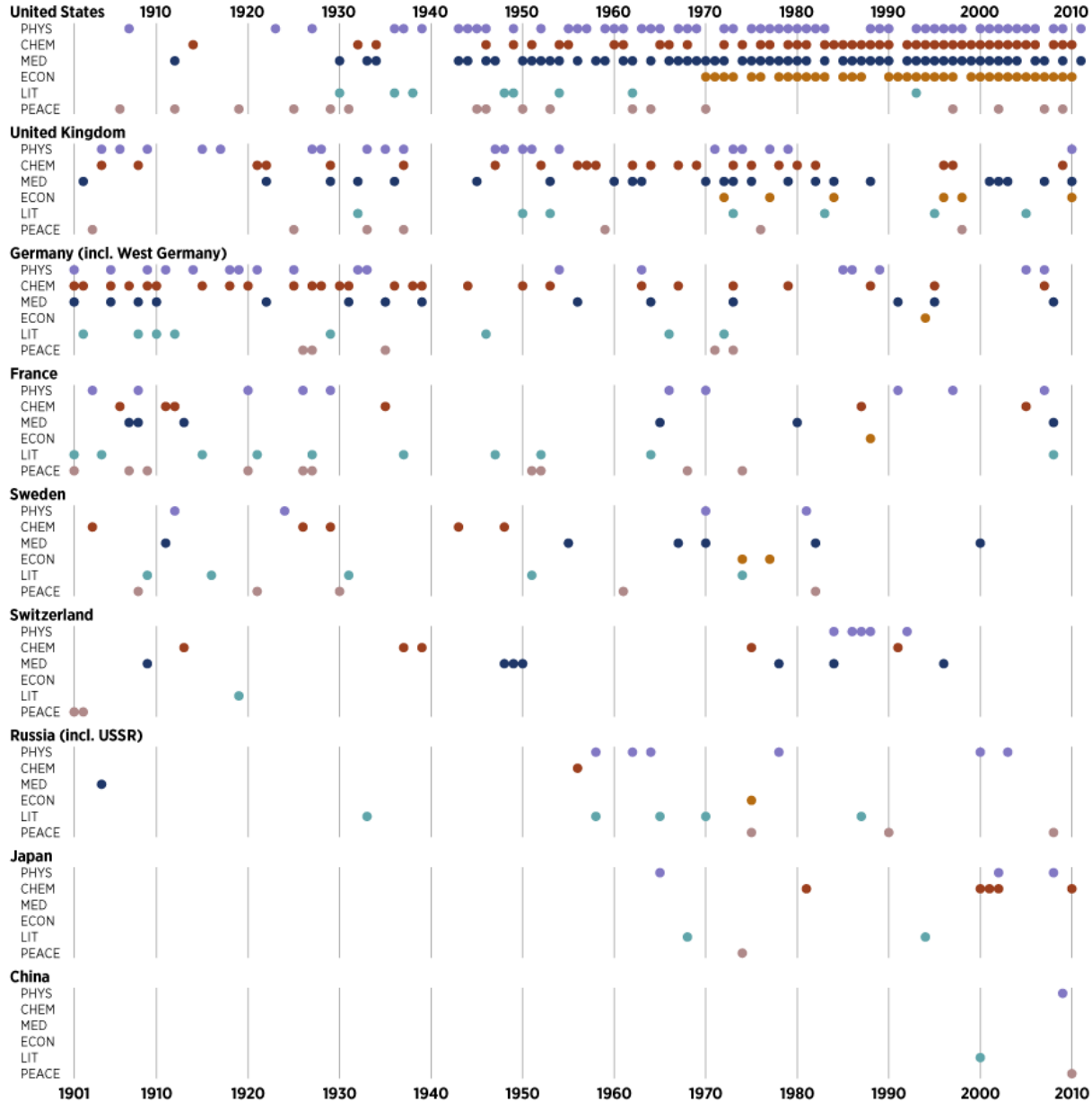


Top 50 Research Universities, Academic Ranking of World Universities 2010

1	Harvard University	19	University of California, San Francisco	35	Duke University
2	University of California, Berkeley	20	The University of Tokyo	36	University of British Columbia
3	Stanford University	21	University College London	37	University of Maryland, College Park
4	Massachusetts Institute of Technology	22	University of Michigan - Ann Arbor	38	The University of Texas at Austin
5	University of Cambridge	23	Swiss Federal Institute of Technology Zurich	39	Pierre and Marie Curie University - Paris 6
6	California Institute of Technology	24	Kyoto University	40	University of Copenhagen
7	Princeton University	25	University of Illinois at Urbana-Champaign	41	University of North Carolina at Chapel Hill
8	Columbia University	26	The Imperial College of Science, Technology and Medicine	42	Karolinska Institute
9	University of Chicago	27	University of Toronto	43	Pennsylvania State University - University Park
10	University of Oxford	28	University of Minnesota, Twin Cities	44	The University of Manchester
11	Yale University	29	Northwestern University	45	University of Paris Sud (Paris 11)
12	Cornell University	30	Washington University in St. Louis	46	University of California, Davis
13	University of California, Los Angeles	31	New York University	47	University of California, Irvine
14	University of California, San Diego	32	University of California, Santa Barbara	48	University of Southern California
15	University of Pennsylvania	33	University of Colorado at Boulder	49	The University of Texas Southwestern Medical Center at Dallas
16	University of Washington	34	Rockefeller University	50	Utrecht University
17	University of Wisconsin - Madison				
18	The Johns Hopkins University				

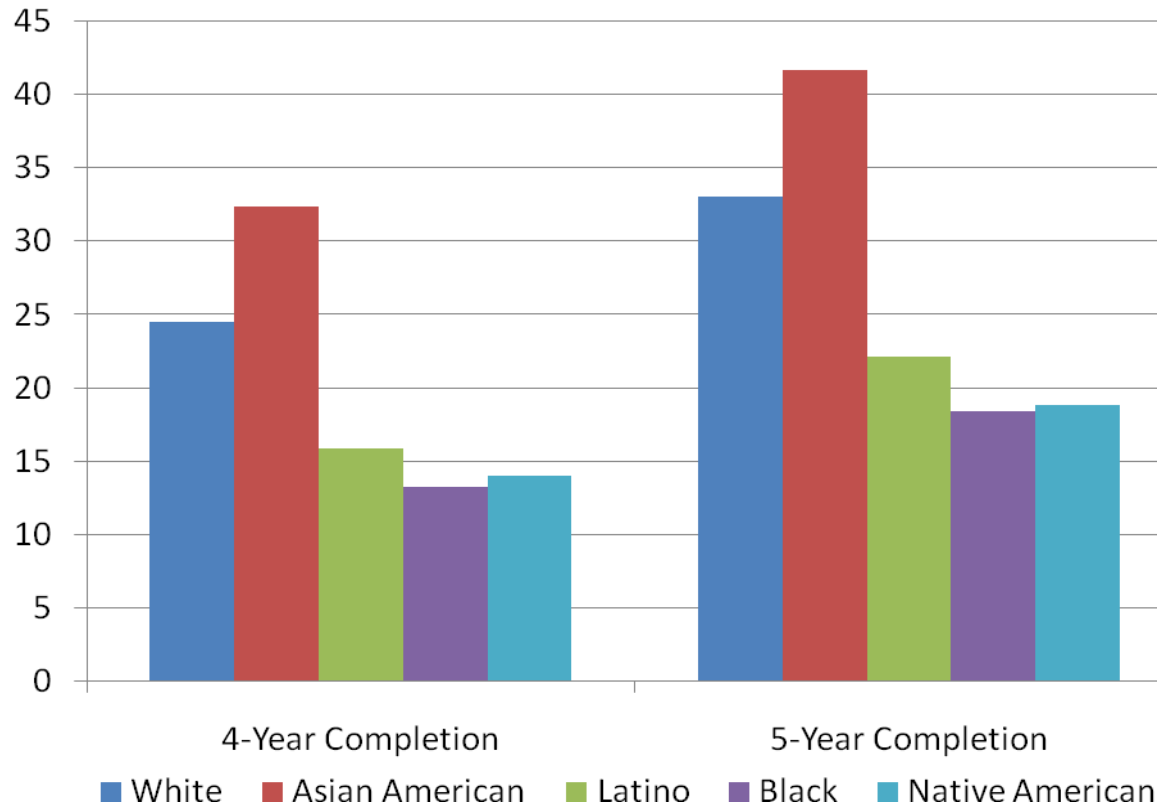
Nobel Laureates

By Country and Prize



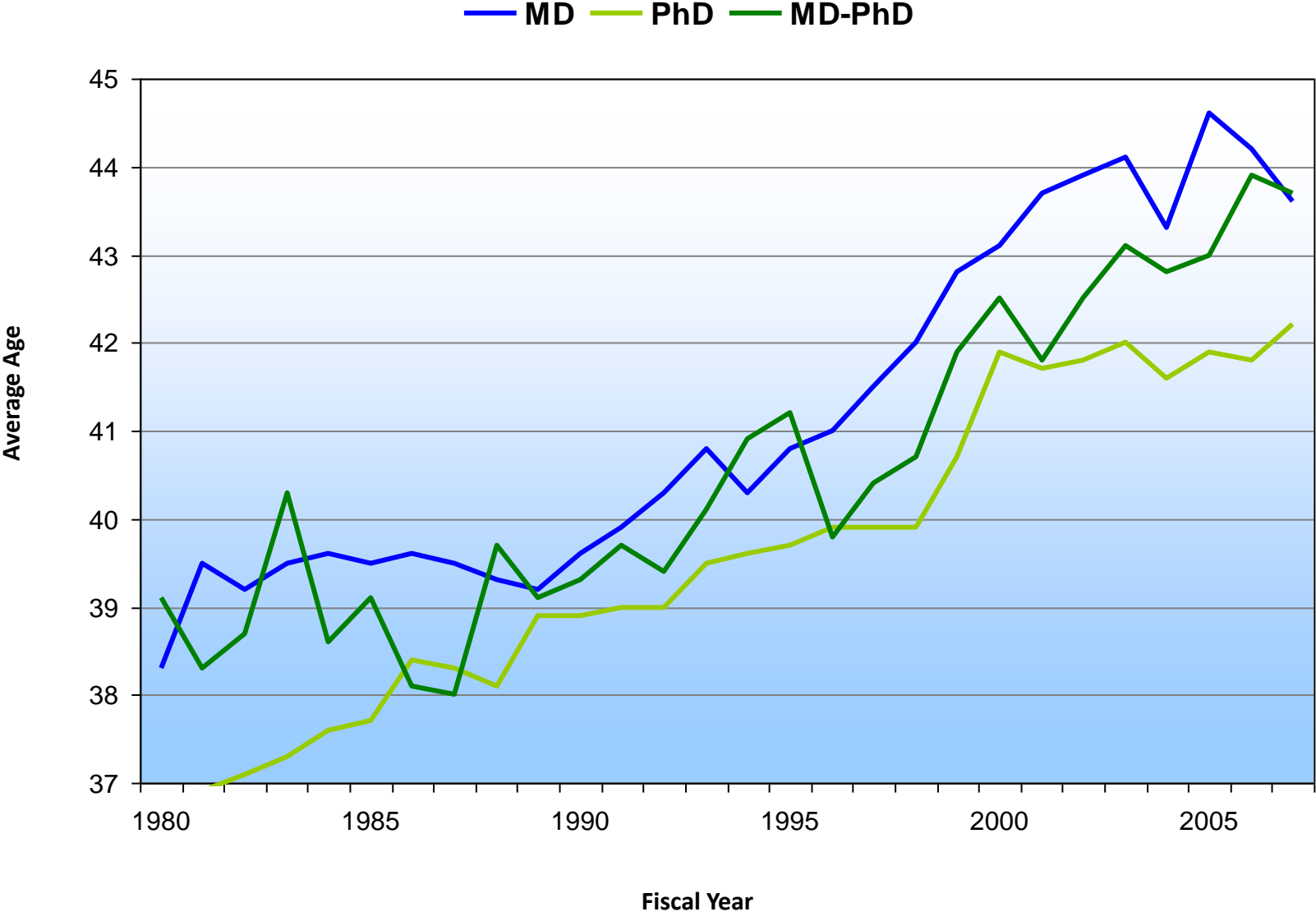
SOURCE: NOBELPRIZE.ORG
 Laureates are shown in the country that hosted their research at the time of award
 Last updated on October 4, 2011

Percentage of 2004 STEM Aspirants Who Completed STEM Degrees in Four and Five Years, by Race/Ethnicity



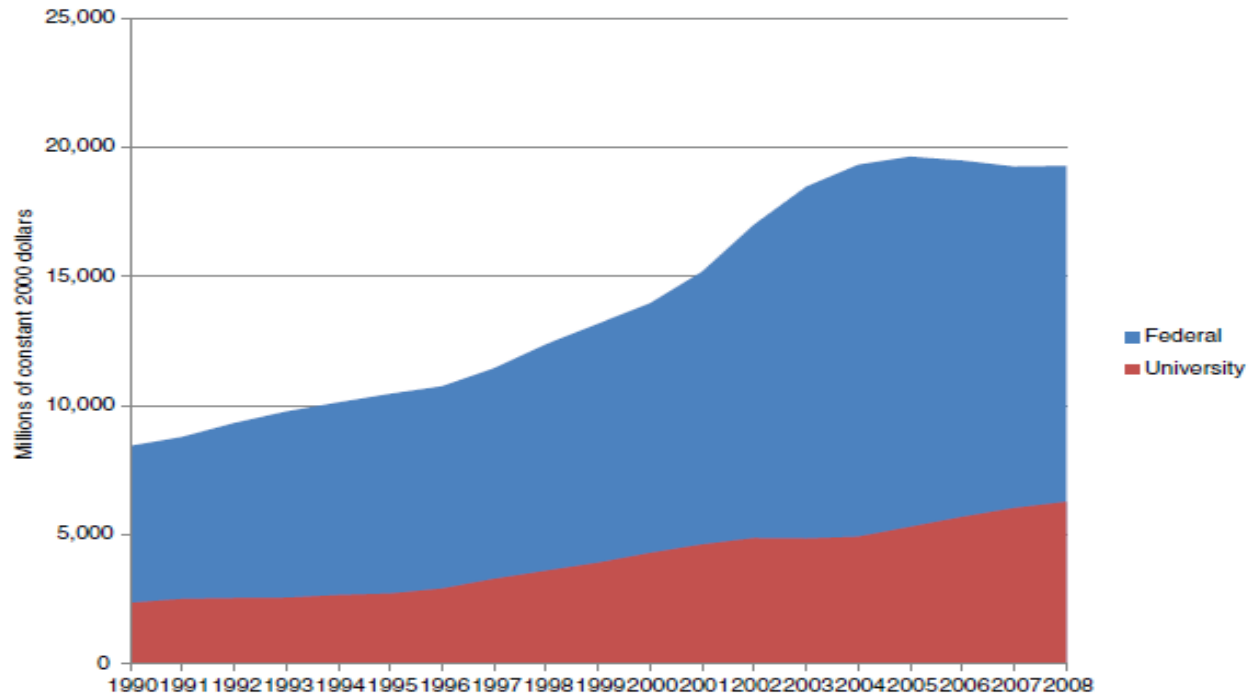
Source: UCLA, Higher Education Research Institute

Average Age Of First-time R01-equivalent Principal Investigators By Degree



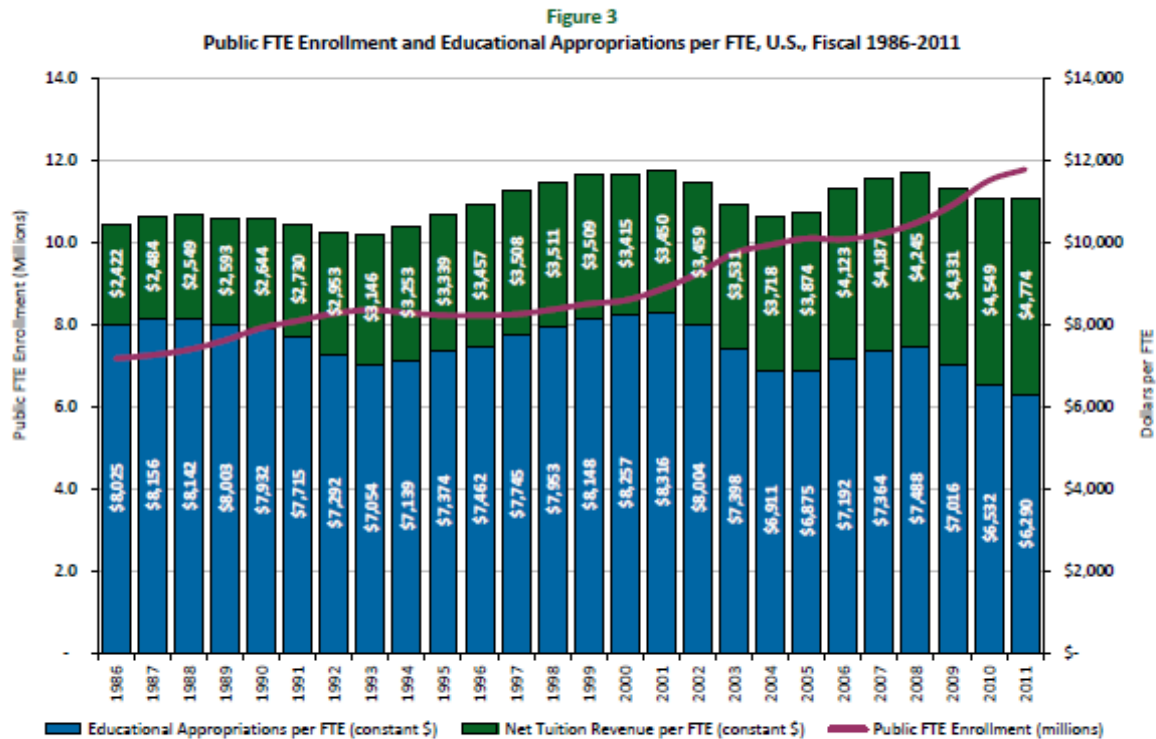
Source: National Institutes of Health

Federal & University Funding for University-Performed Basic Research 1990-2008 (millions of 2000 constant dollars)



Source: NSF, National Center for Science and Engineering Statistics

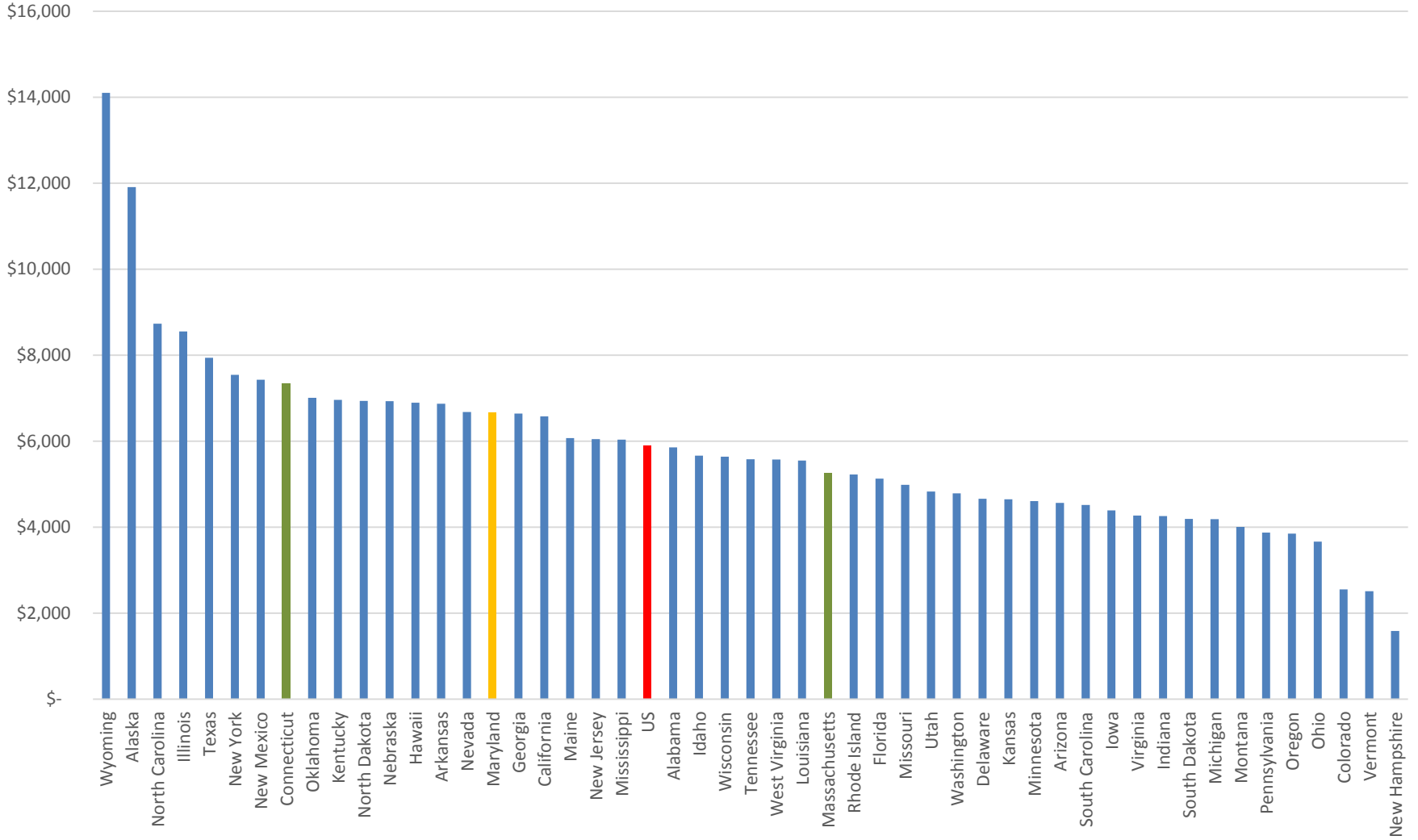
Public Higher Education Appropriations per Full-Time Student, 1986-2011 (millions of constant dollars)



Note: Net tuition revenue used for capital debt service are included in the above figures.
Constant 2011 dollars adjusted by SHEEO Higher Education Cost Adjustment (HECA).

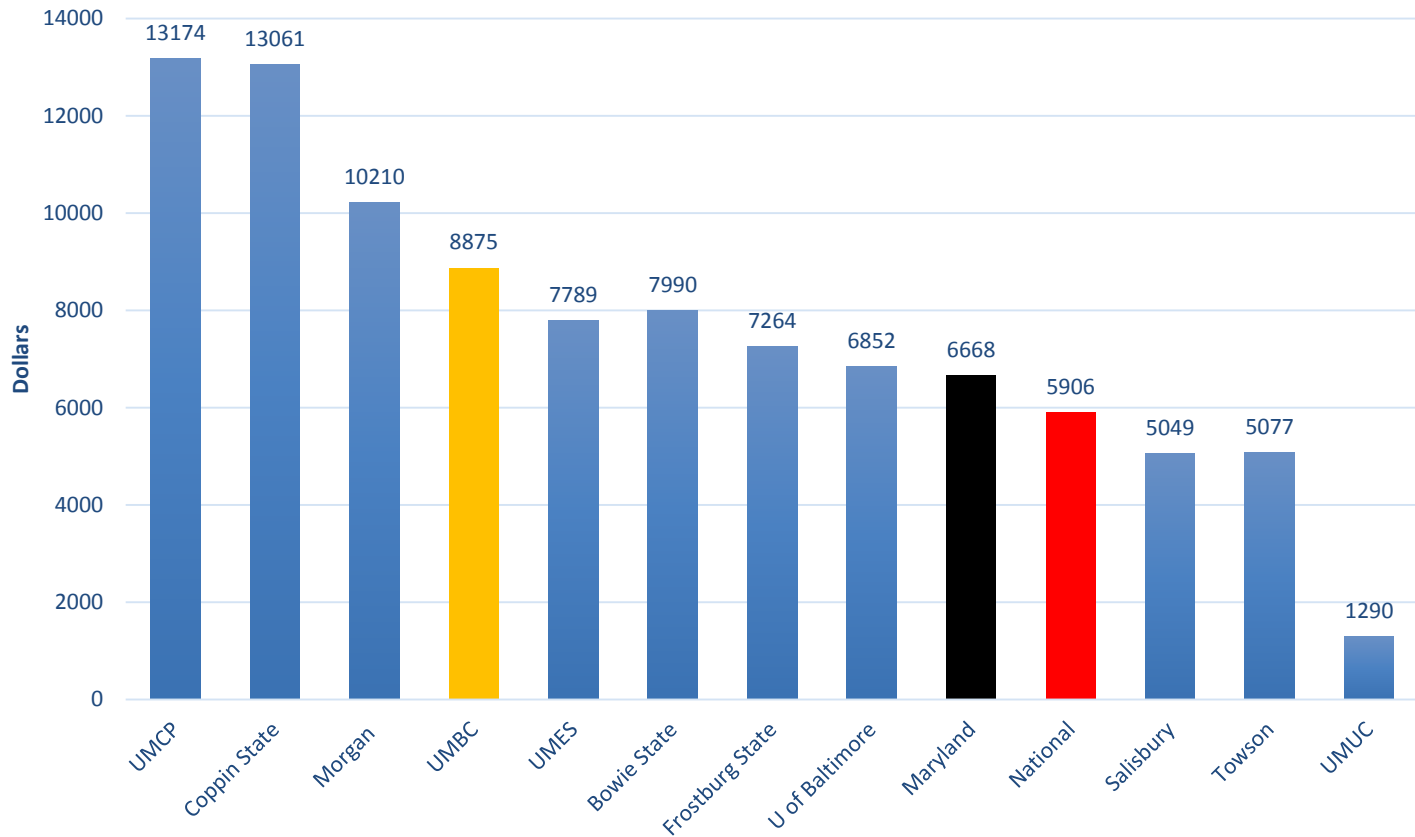
Source: State Higher Education Executive Officers

State Appropriations per FTE Student, By State, FY 2012



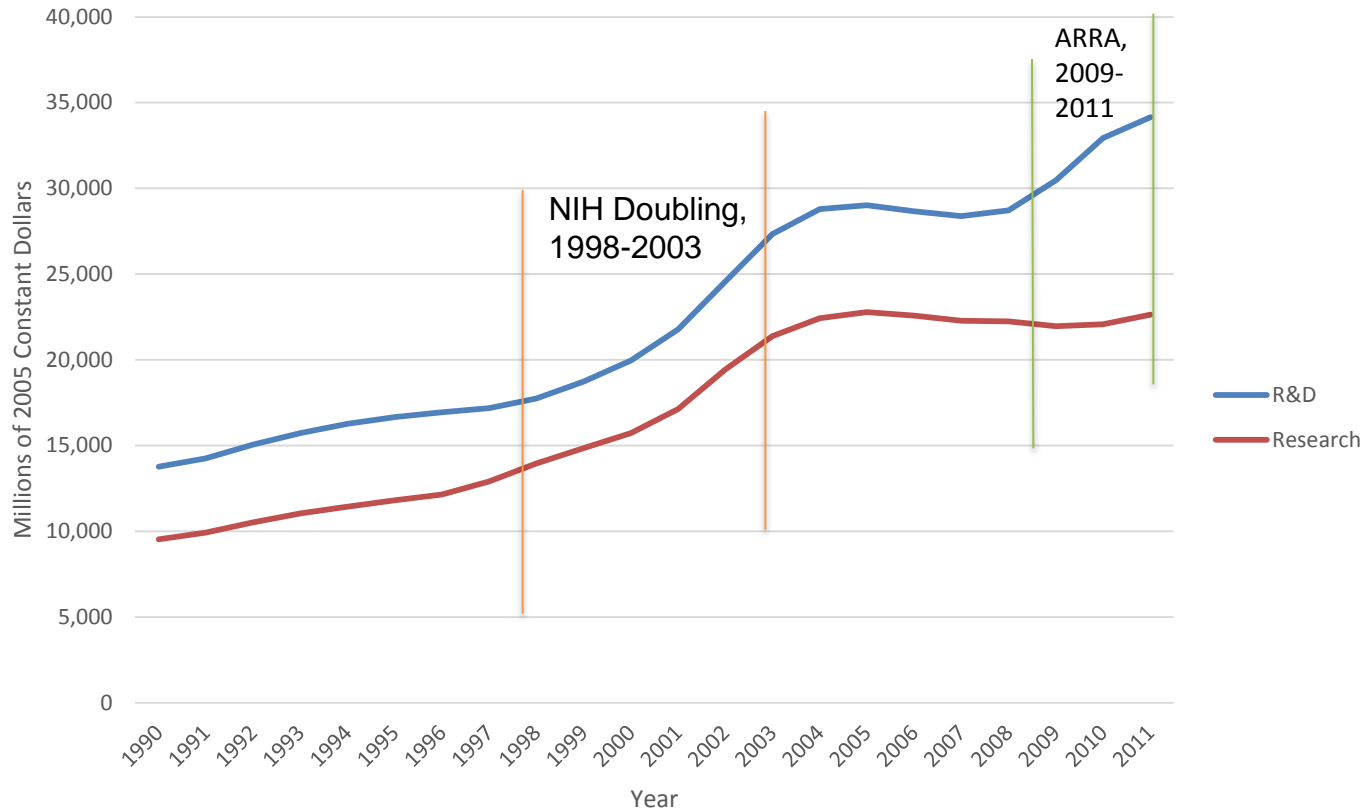
Source: State Higher Education Executive Officers (SHEEO)

State Funding per FTE Student, FY 2011 Maryland Institutions v. National Average



Source: UMBC and State Higher Education Executive Officers (SHEEO)

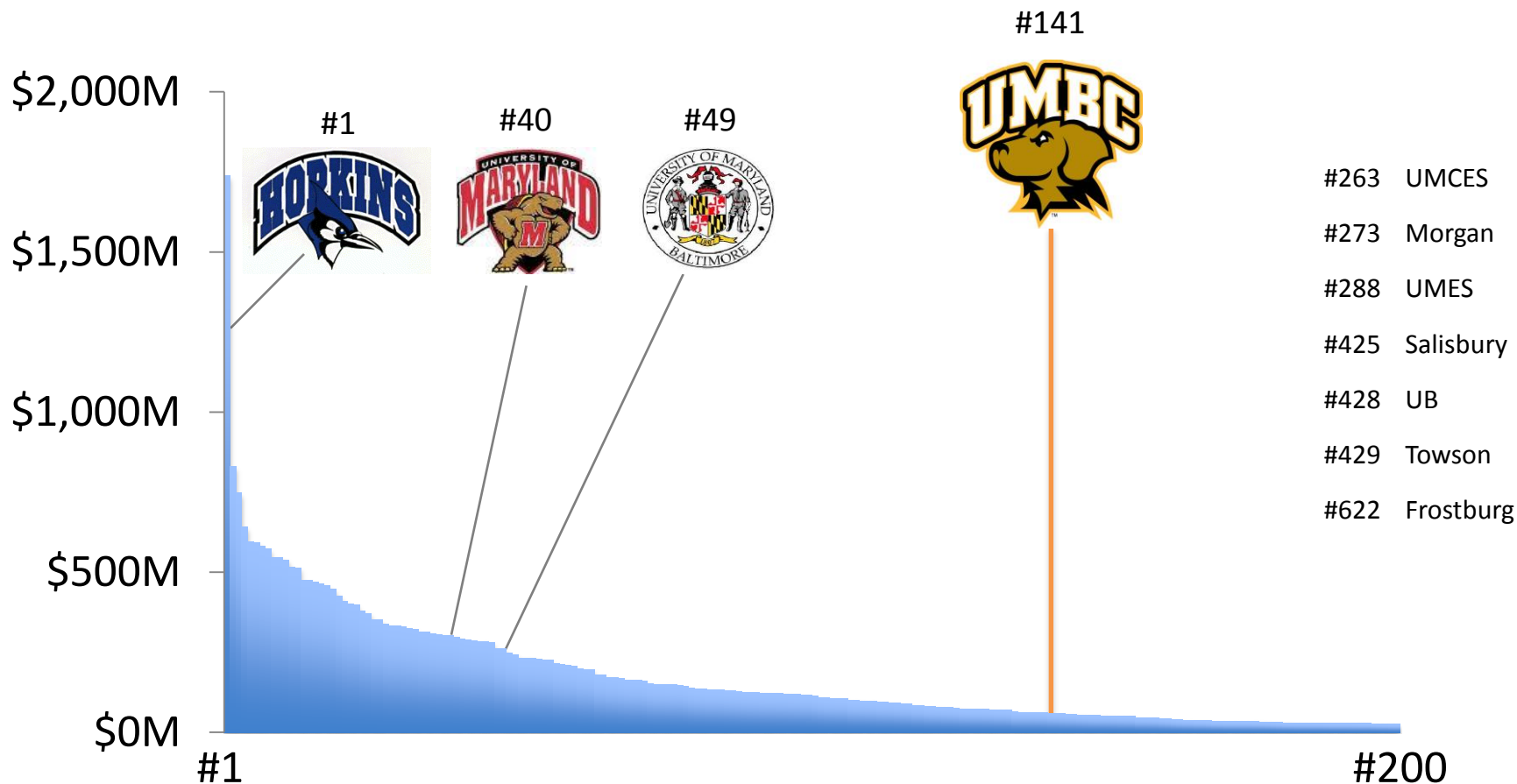
Federally-Funded, University-Performed Basic Research and R&D, 1990-2011 (Millions of Constant Dollars)



Source: NSF/National Center for Science and Engineering Statistics , National Patterns of R&D

UMBC in the Federal Landscape

Top 200 recipients by FY10 expenditures



UMBC's FY10 Rankings

By Research Area, Federal and Non-Federal

All Sources

- #152 All R&D expenditures
- #141 Federal Government
- #190 State and Local Government
- #188 Business (Corporate)
- #164 Nonprofit Organizations
- #147 Institution Funds
- #298 All Other Sources

Agency

- #123 DOD
- #258 DOE
- #169 HHS
- #7 NASA
- #197 NSF
- #157 USDA
- #186 Other Federal

Research Area

- #18 Environmental Sciences
- #232 Life Sciences
- #70 Math/Comp Sci
- #106 Physical Sciences
- #121 Psychology
- #62 Social Sciences
- #149 Sciences (other)
- #141 Engineering
- #191 All non-S&E fields

Chinese University Programs in QS World University Rankings, By Field

Life Science and Medicine	Natural Sciences	Engineering and Technology
21 Peking University	21 Peking University	11 Tsinghua University
37 University of Hong Kong (HKU)	27 Tsinghua University	26 Hong Kong University of S&T
55 Tsinghua University	56 University of Hong Kong (HKU)	33 Peking University
62 Hong Kong University of S&T	77 University of Science and Technology of China	43 Shanghai Jiao Tong University
67 Chinese University of Hong Kong	91 Chinese University of Hong Kong	52 University of Hong Kong (HKU)
69 Fudan University	92 Fudan University	70 Hong Kong Polytechnic University
	94 Hong Kong University of S&T	71 University of Science and Technology of China
		79 Zhejiang University
		85 Chinese University of Hong Kong

Source: Presentation of Bill Berry, National Research Council, Policy and Global Affairs Committee, November 2010.



RESEARCH UNIVERSITIES AND THE FUTURE OF AMERICA

Ten Breakthrough Actions Vital to
Our Nation's Prosperity and Security

NATIONAL RESEARCH COUNCIL
OF THE NATIONAL ACADEMIES

What are the top ten actions that Congress, state governments, research universities, and others could take to assure the ability of the American research university 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?

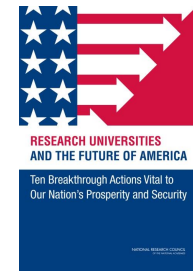
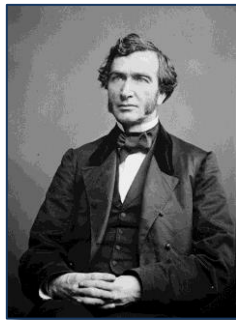
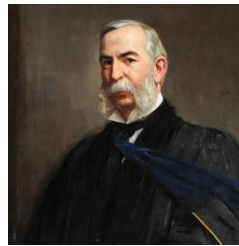
Study Committee

- Chair: Chad Holliday (DuPont; *Gathering Storm*)
- Sectors: Academia, Business, Govt., Labs, Philanthropy
- Balance: Publics and privates; Geography; Size
- Winners of Nobel Prize and National Medals of Science and Technology

Ecosystem of U.S. Research Universities

- U.S. has a diverse ecosystem of 200+ research universities that:
 - Award doctorates and
 - Have > \$35m in annual R&D expenditures
- Characteristics:
 - Large and comprehensive
 - Culture of openness, intellectual freedom, and creativity
 - Competitive drive for excellence in students, faculty, and research
 - Residential undergraduate experience
 - Productively combine research and doctoral education
 - Faculty intensively engaged in research

(Reduced) History of U.S. Research Universities



Third Wave

Ten recommendations in three areas to achieve the “Third Wave”:

1. Revitalize the Partnership
2. Strengthen Institutions
3. Build talent

Building Talent

Recommendation 10: International Students/Scholars

- Rec: Ensure that the U.S. will continue to benefit strongly from the participation of international students and scholars in our research enterprise by ensuring efficient visa processing and streamlining processes for obtaining temporary work visas and permanent residency.
- Status: Immigration Reform legislation recently passed the Senate and has moved to the House.

Building Talent

Recommendation 9: STEM Educational Pathways

- Rec: Secure for the United States the full benefits of education for all Americans, including women and underrepresented minorities, in science, mathematics, engineering, and technology (STEM).
- Status: Ongoing work to implement two reports:
 1. PCAST: *Engage to Excel: Producing One Million Additional College Graduates with Degrees in Science, Technology, Engineering, and Mathematics*.
 2. National Academies: *Expanding Underrepresented Minority Participation: America's Science and Technology Talent at the Crossroads*

Building Talent

Recommendation 8: Reforming Graduate Education

- Rec: Improve the capacity of graduate programs to attract talented students by addressing issues such as attrition rates, time-to-degree, funding, and alignment with both student career opportunities and national interests.
- Status: Key developments:
 1. OSTP Graduate Education Modernization Working Group;
 2. NIH Broadening Experiences in Scientific Training (BEST) Program
 3. CGS Completion Project and Pathways Report

Strengthening Institutions

Recommendation 7: Regulatory Burden

- Rec: Reduce or eliminate regulations that increase administrative costs, impede research productivity, and deflect creative energy without substantially improving the research environment.
- Status: Following a July 2012 House hearing on the report, Rep. Mo Brooks (R – AL) asked GAO to undertake a study examining regulatory burden for university research both in general and with a particular focus on:
 - Ineffective, duplicative, redundant, inappropriately applied or onerous regulations
 - Effort reporting under A-21
 - Sub-recipient monitoring under A-133

Strengthening Institutions

Recommendation 6: Full Funding of Research

- Rec: The federal government and other research sponsors should cover the full cost of research they procure in consistent and transparent manner.
- Status: OMB review/re-write of circular A-21 with progress on:
 - Charging administrative support as a direct cost;
 - Expanding the pool of institutions eligible for utility cost reimbursements; and
 - Standardizing negotiations for cost rates.

Strengthening Institutions

Recommendation 5: A Strategic Investment Program

- Rec: Create a Strategic Investment Program that funds initiatives critical to advancing education and research in areas of national priority... beginning with a focus on:
 1. Investing in campus cyberinfrastructure to improve computing power across academic, research and administrative functions
 2. Increasing opportunities for young faculty through a faculty chairs program similar to one successfully implemented in Canada
- Status:
 1. UC Berkeley: \$113 million grant from Hewlett for 100 endowed chairs
 2. UCSD: Re-interpreted the recommendation for focus on:
 - BRAIN Initiative: Center for Brain Activity Mapping
 - Health informatics

Strengthening Institutions

Recommendation 4: Improving University Productivity

- Rec: Increase university cost-effectiveness and productivity in order to provide a greater return on investment for taxpayers, philanthropists, corporations, and other research sponsors.
- Status: Some have been moving on this:
 - Cornell/UNC: Bain Consulting focus on procurement, administrative organization, IT investments
 - University of Texas System: productivity and transparency
- Status: Politicization and Confusion?
 - Tuition v Net Tuition v Cost
 - Tuition increases as an offset for state cuts
 - Costs at publics v Costs at privates (“buying the best”)
 - Cost-cutting in reaction to cuts v strategically increasing productivity

Revitalizing the Partnership

Recommendation 3: University-Industry Partnerships

- Rec: Strengthen the business role in the research partnership, facilitating the transfer of knowledge, ideas, and technology to society, and accelerate “time to innovation” in order to achieve our nation goals
- Status: All of the regional meetings emphasized building university-business partnerships and creating opportunities for university research start-up spin-offs.
- Status: Additional issue is university-business partnership in education.

Revitalizing the Partnership

Recommendation 2: State Governments

- Rec: Restore state appropriations for higher education to levels that allow public research universities to operate at world-class levels. In the meantime, provide greater autonomy for public research universities so that these institutions may leverage local and regional strengths.
- Status: Divergent trends:
 - In 2012 most (30) states up though overall, spending was down due to larger cuts in the rest (20)
 - But some states are taking a new approach: Governors in Massachusetts and Connecticut have requested substantial increases in spending for higher education investments that can provide a competitive advantage in talent and new ideas for their states.

Revitalizing the Partnership

Recommendation 1: Federal Government

- Rec: The federal government should adopt stable and effective policies, practices, and funding for university-performed R&D and graduate education so that the nation will have a stream of new knowledge and educated people.
- Status: Going forward there's bad news and good news...
 - Funding for FY 2013 has been negatively affected by current fiscal politics, including the *sequester*. And this may continue into 2014...
 - The President's Fiscal Year 2014 budget includes:
 - An increase in non-defense R&D spending of 9.2 percent
 - The budget request specifically proposes a doubling trajectory for NSF, NIST, and DOE Science in alignment with the report recommendations
 - It also requests an increase of 5.6 percent for NEH though an almost imperceptible increase of 0.14 percent for NEA

What does this mean for ?

- We have done very well over 50 years with limited resources and a can-do attitude
- Strategic implementation of key actions will continue to build the university over the coming decade...

Possible actions for ?

- Build on strengths in undergraduate education
- Continue to improve graduate education across disciplines
- Strategic investments in IT, facilities, faculty, and research
- Build partnerships with corporations, public agencies, and UMB
- Increase state-funding per FTE student
- Grow and leverage non-federal resources
- Pursue excellence in research across disciplines -- targeting strengths, interdisciplinary teams, and large projects for federal funding