Building a 21st Century Research Enterprise: Roles of the Research University

Where we are
Where we could be
What it will take to get there
Why it matters

Keith R. Yamamoto
keith.yamamoto@ucsf.edu
National Academies Committee on Research Regulations
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• Stable, effective Federal policies, practices, funding
• Greater autonomy for public research universities
• Strengthened partnerships with business
• Increased university cost-effectiveness, productivity
• Strategic federal investment in university education and research
• Full federal funding of research
• Reduced regulatory burden
• Reformed graduate education
• Improved STEM pathways and diversity
• Support for international students and scholars
Research Universities: excellence across three missions

• Educating next gen researchers and "enablers"

• Creation of new knowledge and concepts

• Exchange and export of knowledge and tools
Federal support for fundamental discovery

Basic scientific research... provides scientific capital.

Vannevar Bush
1945

An investigation... might not pay off for a year, or a decade, or at all. And when it does, the rewards are... enjoyed by those who bore its costs, but also by those who did not. That’s why the private sector under-invests in basic science – and why the public sector must invest in this kind of research.

President Barack Obama
2009
Research at an inflection point

How move through the inflection point?

- **Build a research continuum: transdisciplinary science**
- **Integrate across stakeholder sectors: .edu, .com, .gov, .org**
- **Adjust policies in academia, government, private sector**
- **Change education: specialization w/ literacy, quantitation, discovery**
Integrating research to advance research

Create transdisciplinary research

Provide incentives and remove barriers so that concepts and tools developed within disciplines cooperate to produce novel concepts and tools across disciplines.

Build synergies amongst .edu, .gov, .com, .org

Develop policies that motivate academic, government, and private sectors to establish a common research/development/deployment environment.

http://www.amacad.org/arise2/pdf
Integrate practices and policies across two planes

Stakeholder synergy: Cooperate across academia, industry, government sectors

Trans-disciplinary science: Merge physical and life sciences theory, concepts, applications
Complications and Barriers

- Siloed disciplines
- Insufficient funding for discovery
- Conflicting cultures, goals
- Unbalanced workforce, trainee excess
- Outmoded, uninspired education

Address with thoughtful policies and regulations, but don’t build restrictive policies/regulation in place of direct approach to issue/problem.
The Perilous, Slow Transition to Independence

- Median age, first independent position: 38
- Median age, first R01: 42
- Percent NIH awards to new investigators: 4

Einstein | Nirenberg | Cech
---------|----------|------
First Position: 32 | 33 | 31
Nobel Prize: 42 | 41 | 42

>> Need to train more efficiently: 4-8 years?
Challenges/Expectations for Research Education

Mission/Goals for the PhD
- Specialized expertise
- Mentored, original, bold research
- Broad literacy and perspective
- Team-based research
- Math/statistics/computation skills
- Three “tools of the trade”
- Working familiarity with career options

Mission/Goals for the Postdoc
- Progression to independent team-based research
- Management skills for the practice of science

Identify important problem
Design experiments
Select results for follow-up
GOAL: PhD “hub” with career option “spokes”

Outcomes:
- Informed/empowered students
- Postdoc education imperative
- Postdocs market appropriate
- Other options market driven
- Lab demographics change

- PhD
  - BSc
    - Education
      - Teaching
        - Education
        - Admin
    - Communication
      - Journalism
        - Information media
      - Business
        - Biotech startup
        - Venture capital
  - Law
  - Science policy, advocate
    - Intellectual property
    - Patent
  - Independent investigator
    - (Assistant Professor, Biotech/Pharma)
Day science calls into play arguments that mesh like gears, results that have the force of certainty... Conscious of its progress, proud of its past, sure of its future, day science advances in light and glory.

By contrast, night science wanders blind, it hesitates, stumbles, recoils, sweats, wakes with a start. Doubting everything, it is forever trying to find itself, question itself, pull itself back together.

Night science is a sort of workshop of the possible, where what will become the building material of science is worked out.

- Francois Jacob

If at first the idea is not absurd, then there is no hope for it.

- Albert Einstein
For graduate students:

- Broad literacy with specialized expertise
- Math/statistics/computation skills
- "Tools of the trade": [a] identify important problems; [b] design experiments; [c] choose which results to pursue
- Working familiarity with career options

For postdocs:

- Management skills for the practice of science
- Progression to independent research: "bold and owned project" development; independent "fellows programs"

Potential outcomes:

- Greatly reduced training period: 4-8 years total
- Appropriate training for next gen leaders
- Right-sizing the workforce
Scientific discovery takes ... the occasional flash of brilliance; ... it takes time and hard work and patience; it takes training; it requires the support of a nation. But it holds promise like no other area of human endeavor.

President Barack Obama
2009
Promise and Impact

• Richer, more vibrant culture
• Societal crises and needs addressed