Value of University Research

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UNCW Research and Innovation

Guest Lecture, EDL 635
November 19, 2025

Who am I?

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Connect on LinkedIn

A few facts …

- **Systems Ecologist**
- **Professor** @ UNCW since 2007
- **Taught ecology** at BS, MS, and PhD levels
- Editorial Board of **International Journal of Ecological Modelling**
- **Parent** of 2 awesome kids, **married** for 27 yrs
- Began serving as **Senior Research Officer in** 2018
- NSF **Program Officer** 8/2024-8/2025
- Worked in **research leadership/administration** for longer than I was in graduate school

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Road Map

1. National Research Enterprise (NRE)
2. State and Value of NRE
3. Value of University Research

Road Map

1. **National Research Enterprise (NRE)**
2. **State and Value of NRE**
3. **Value of University Research**

Definition of R&D

Research and experimental development (R&D) comprise **creative and systematic work** undertaken in order to **increase the stock of knowledge** – including knowledge of humankind, culture and society – and to **devise new applications** of available knowledge.

p.44

Organization for **E**conomic
Cooperation and **D**evelopment

U.S. National Research Enterprise

Institutions and Organizations

- Facilities
- Equipment
- Resources

Investigators, Trainees, Teams

- Disciplinary knowledge, networks, expertise
- Discovery, technology & innovation pipeline

Government
Industry/Corporate
National Labs
Non-profits
Institutions of Higher-Ed

Research Support and Service Infrastructure

- Staff and administration
- Human capacity and capability
- Policies, practices, and processes
- Partnerships

Road Map

1. National Research Enterprise (NRE)
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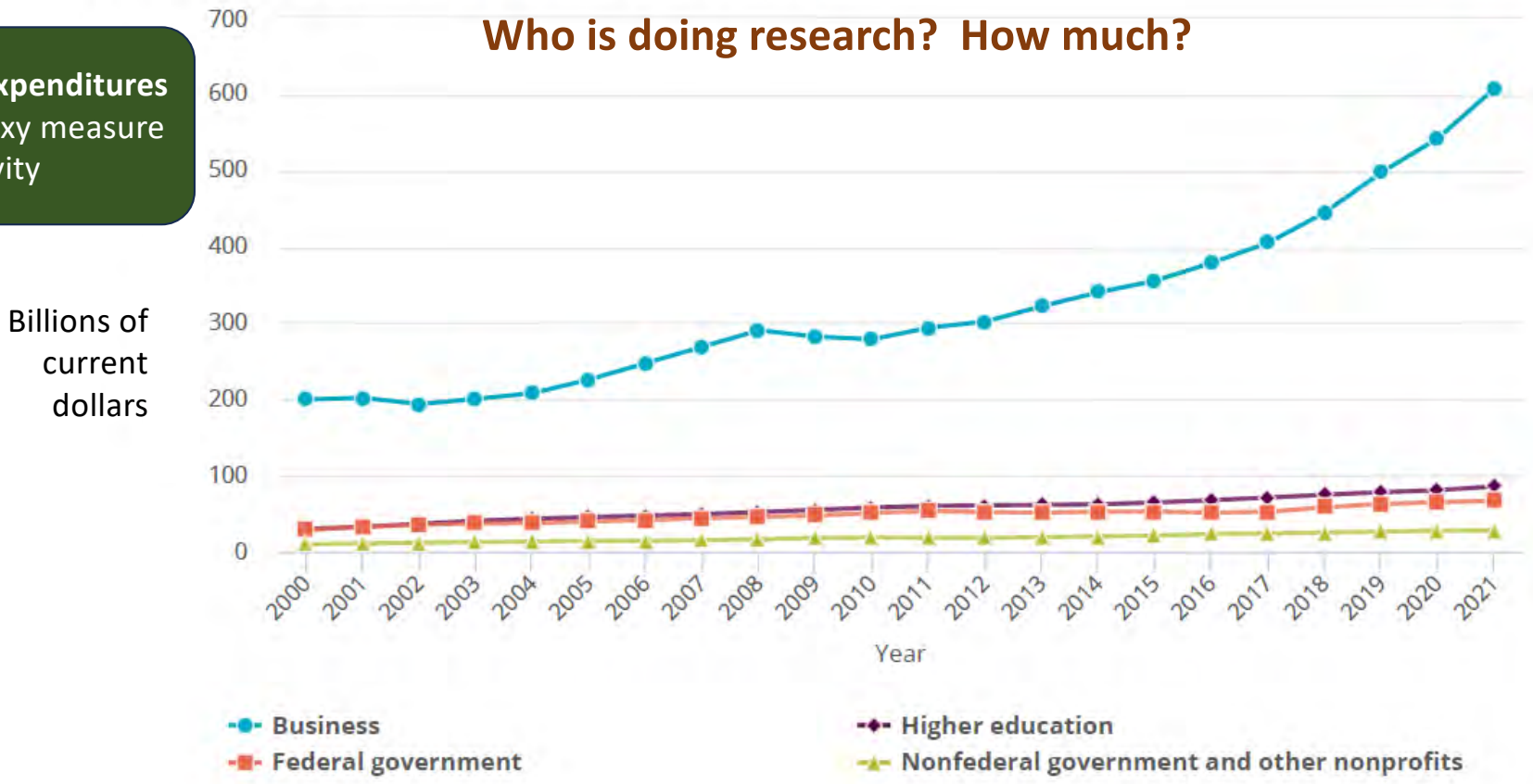
U.S. R&D Expenditures, by performance sector

Using **expenditures** as a proxy measure for activity



Business performs much more R&D than the other sectors, and accelerating

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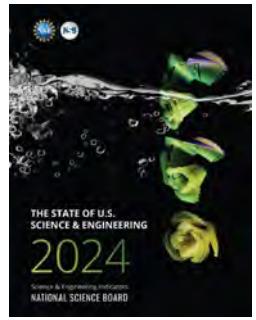
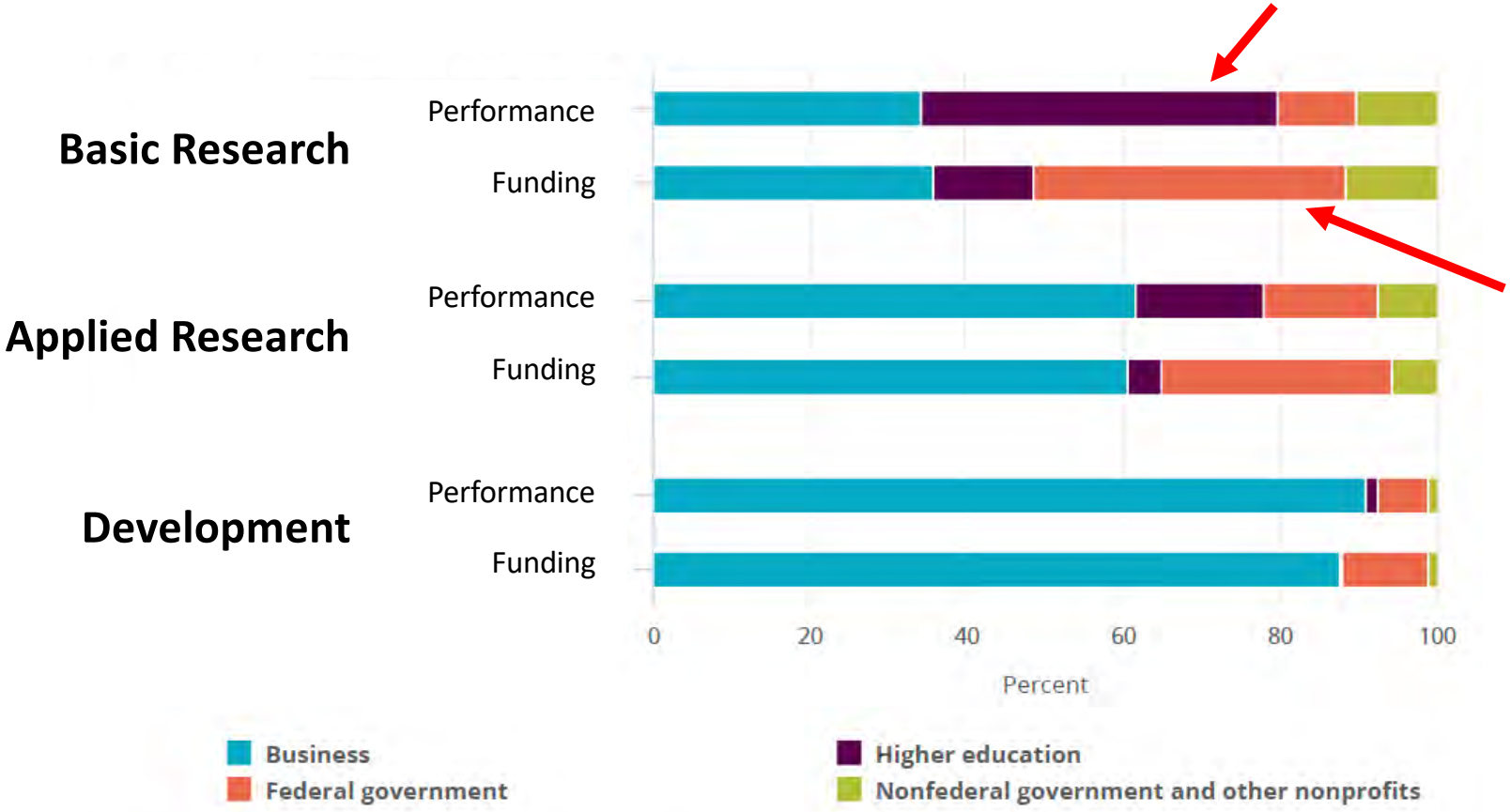
R&D Performance and Funding by Type and Sector: 2021





Universities are do most of the basic research, supported largely by federal funding

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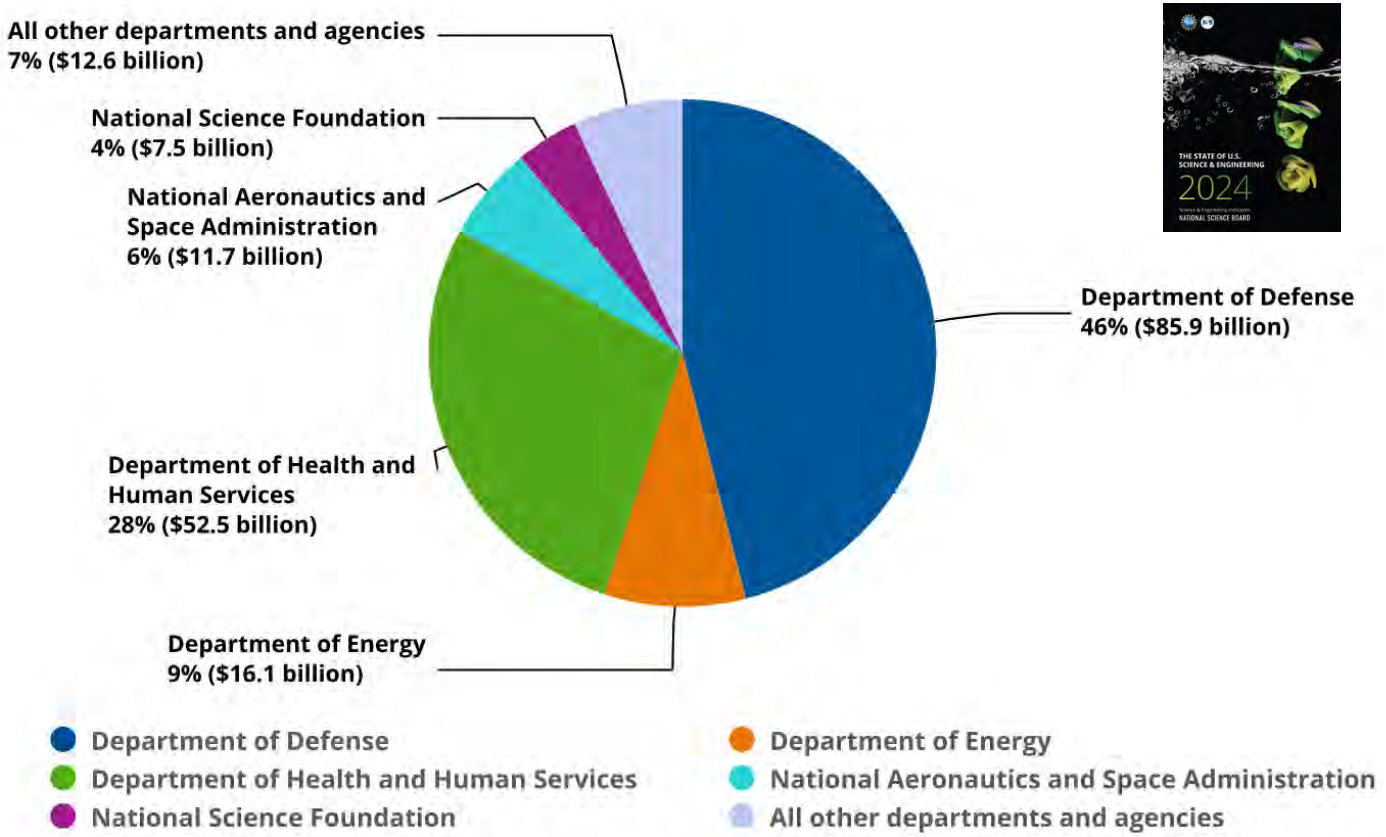
Federal obligations for R&D by agency, FY2023



NATIONAL ENDOWMENT FOR THE HUMANITIES

$207 million

NATIONAL ENDOWMENT for the ARTS
arts.gov

$207 million

$186 B

Note(s):
Because of rounding, detail may not add to total.

Source(s):
National Center for Science and Engineering Statistics, Survey of Federal Funds for Research and Development, FYs 2023–24.

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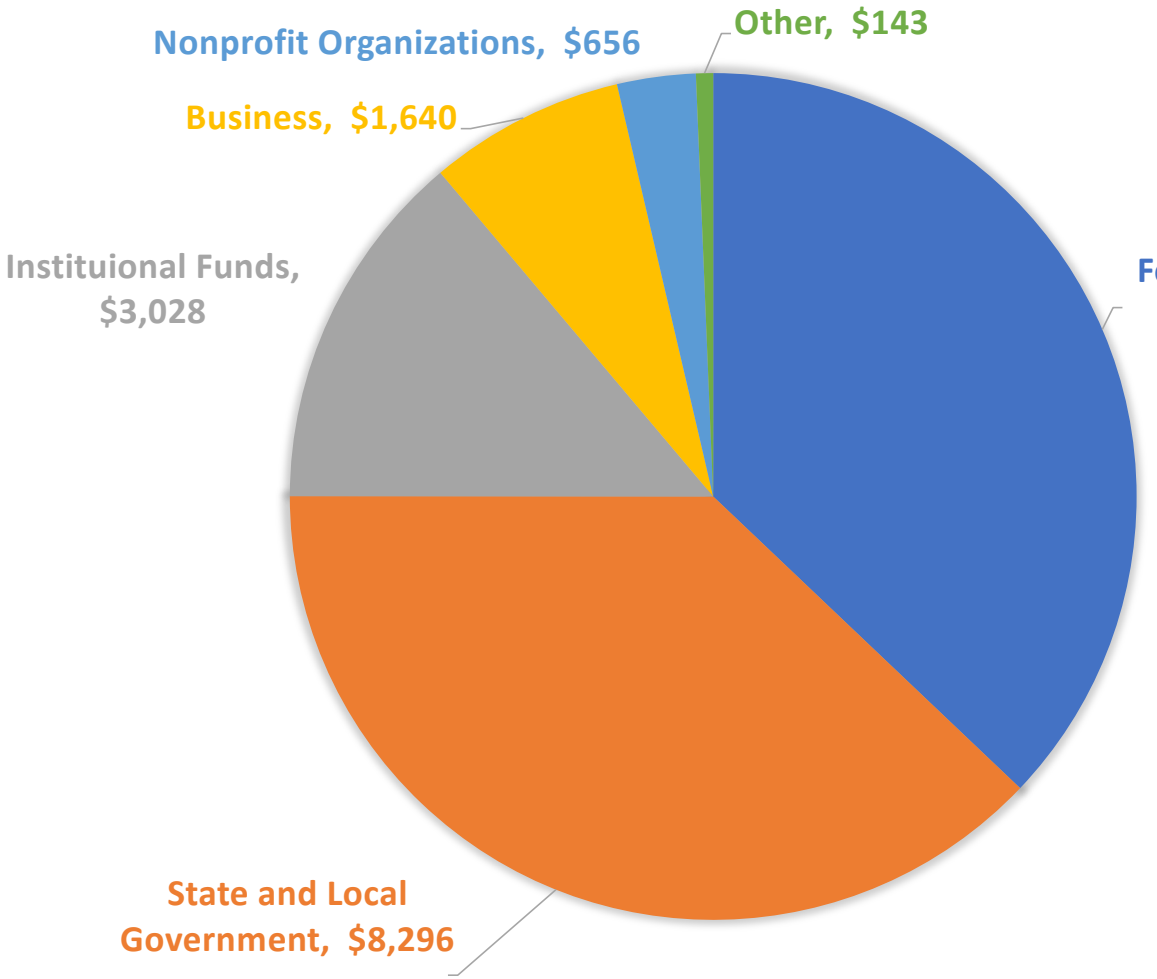
FY23 Research Expenditures, by source (in $1000s)



Total = $21.9 million

What does this include/exclude?

Key metric for R2 classification

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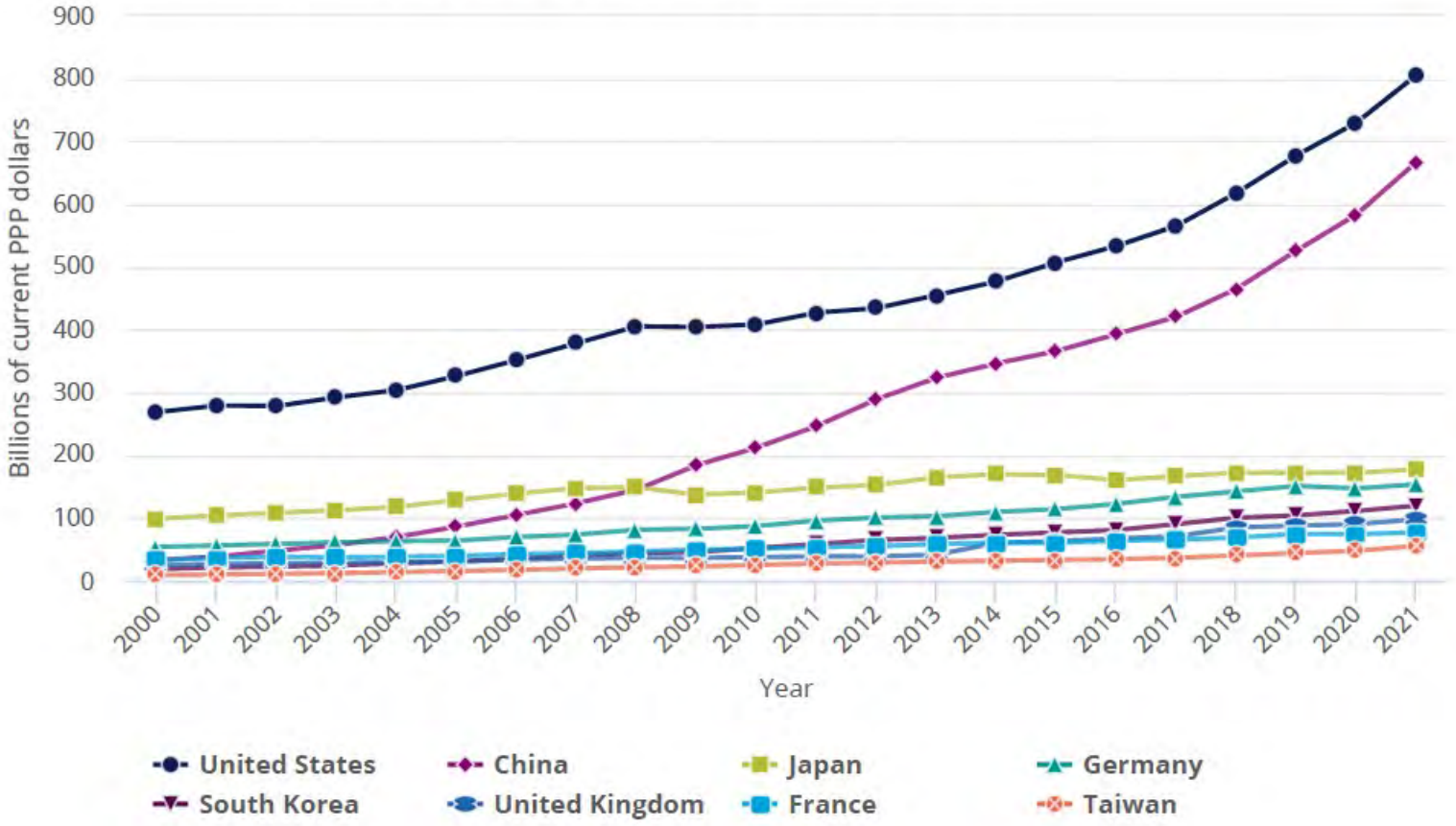
International Context: R&D Expenditures 2000-21



Note(s): PPP is pu

Source(s): OECD,

USA has led R&D investment, but China has grown very rapidly

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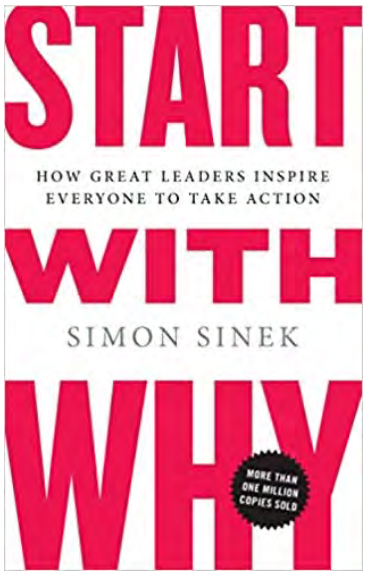
Consider



<u>Why</u> are US taxpayers investing in R&D?

<u>Why</u> does the federal government partner with universities for R&D?

<u>Why</u> does a specific agency support R&D?

<u>Why</u> do universities engage in R&D?

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Example Agency Missions

U.S. National Science Foundation

Independent federal agency that supports science and engineering

Established in 1950 by Congress to:

- **Promote** the progress of science
- **Advance** the national health, prosperity, and welfare
- **Secure** the national defense

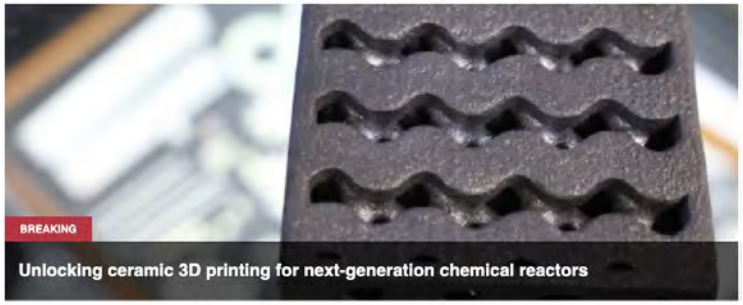
Fulfill mission primarily by **making grants,** guided by merit review

National Institutes of Health

Turning Discovery Into Health

to seek **fundamental knowledge** about the nature and behavior of living systems and the **application** of that knowledge to **enhance health, lengthen life, and reduce illness and disability**.

R&D Outcomes: Recent Headlines



New research explores improving coastal high tide flooding outlooks

Increasing lead times will help communities mobilize flood responses.

Treating opioid addiction in jails improves treatment engagement, reduces overdose deaths and reincarceration

September 10, 2025 — NIH-funded study demonstrates life-saving potential of providing medications for opioid use disorder in carceral settings.

PPPL PRINCETON PLASMA PHYSICS LABORATORY

16-Sep-2025 8:30 EDT

A New Way to Produce Ammonia More Efficiently

Princeton Plasma Physics Laboratory

A new approach for making the chemical ammonia using plasma — the fourth state of matter — could revolutionize how hydrogen is stored and transported and drive down the price of various manufacturing processes.

Repeated head impacts cause early neuron loss and inflammation in young athletes

September 17, 2025 — NIH-funded study reveals brain changes long before chronic traumatic encephalopathy (CTE) develops.

NEH in the News

WSU professor's app will help visually impaired read 'rich visual content'

February 25, 2025

Latest News

ARS researchers and their partners discovered a tomato line that is resistant to tomato brown rugose fruit virus. **More ...**

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New AI model could revolutionize U.S manufacturing

Artificial intelligence has transformed fields like medicine and finance, but it hasn't gained much traction in manufacturing. Factories present a different challenge for AI: They are structured, fast...

July 17, 2025

USDA and DOI Announce Bold Federal Reforms to Improve Nation's Wildfire Response System

September 15, 2025

(Washington, D.C., September 15, 2025) – U.S. Secretary of Agriculture Brooke L. Rollins today issued a new memorandum to modernize and strengthen America's wildfire prevention and response system. This policy direction enacts common-sense reforms that modernize and streamline federal wildfire...

New axolotl study gives researchers a leg up in work towards limb regeneration

Researchers supported by the U.S. National Science Foundation have discovered that it is not how much of a key molecule that allows axolotls to regenerate limbs properly, it is how little. This new...

July 18, 2025

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R&D Outcomes: IT

"Tire Track Plot"

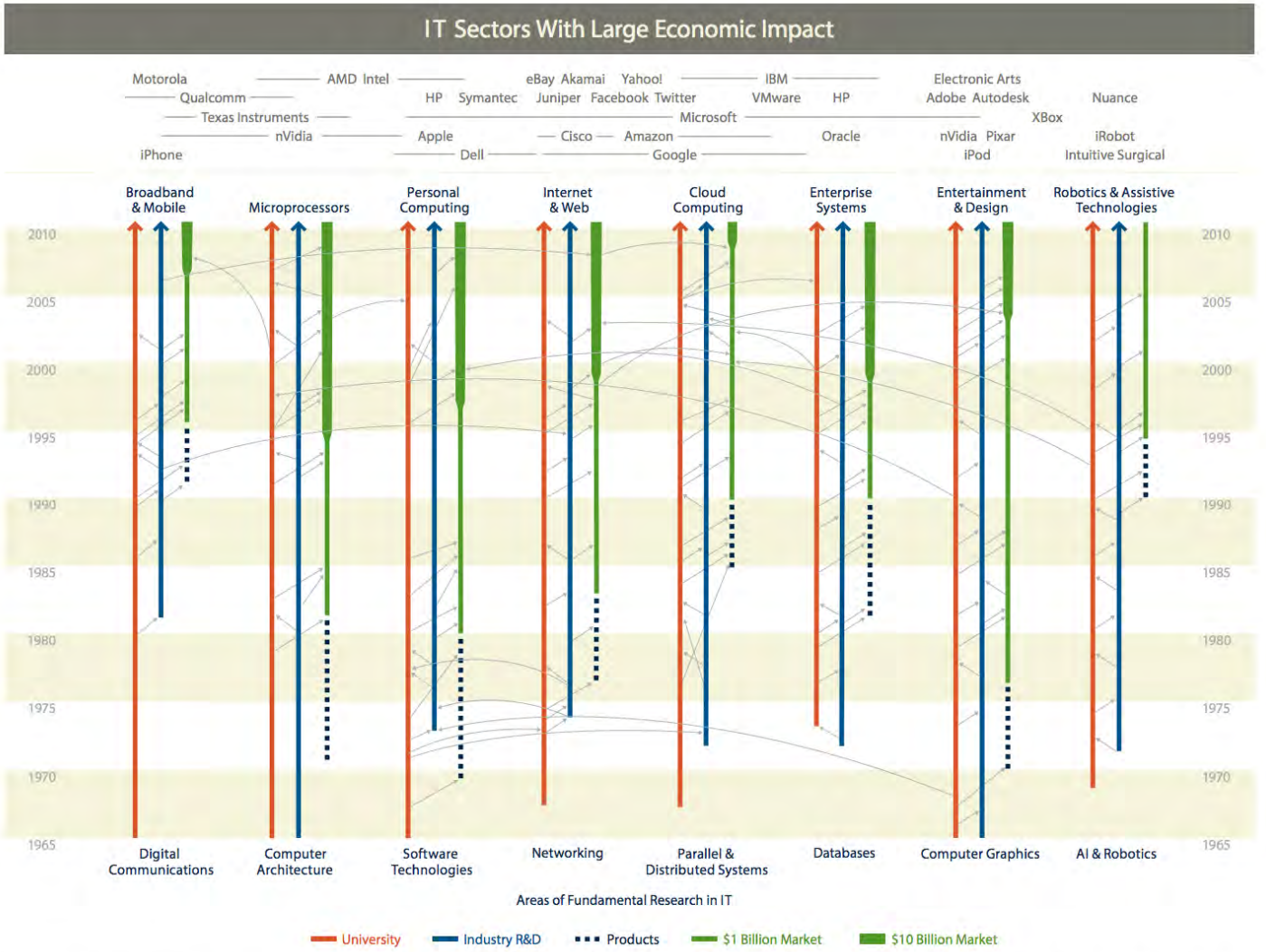

FIGURE I.1 Examples of the contributions of federally supported fundamental research to the creation of IT sectors, firms, and products with large economic impact. SOURCE: Reprinted from National Research Council, 2012, *Continuing Innovation in Information Technology*, The National Academies Press, Washington, D.C.

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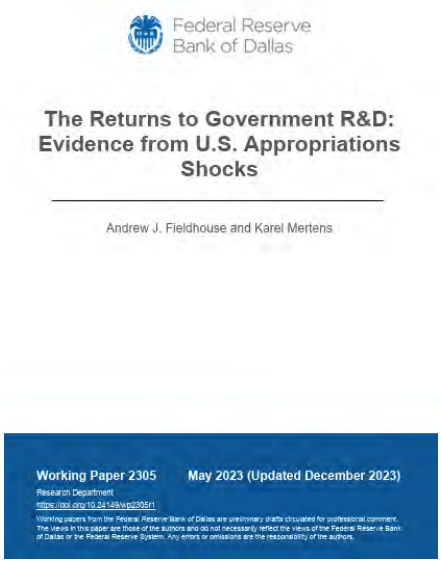
R&D Outcomes: Economic Prosperity


Federal Reserve Bank of Dallas

The Returns to Government R&D: Evidence from U.S. Appropriations Shocks

Andrew J. Fieldhouse and Karel Mertens

Working Paper 2305 May 2023 (Updated December 2023)

Research Department

https://doi.org/10.24149/wp2305r1

Working papers from the Federal Reserve Bank of Dallas are preliminary drafts circulated for professional comment. The views in this paper are those of the authors and do not necessarily reflect the views of the Federal Reserve Bank of Dallas or the Federal Reserve System. Any errors or omissions are the responsibility of the authors.

25%

of business sector economic growth (TFP)

since WWII

is due government funded non-defense R&D

…workforce development too!

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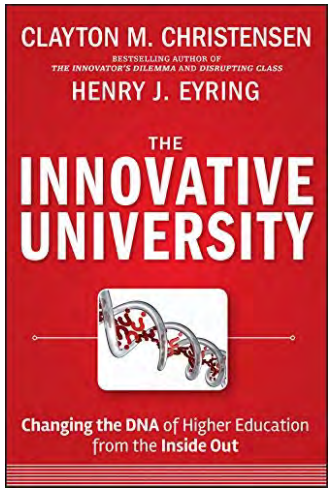
2. State and Value of NRE
3. **Value of University Research**

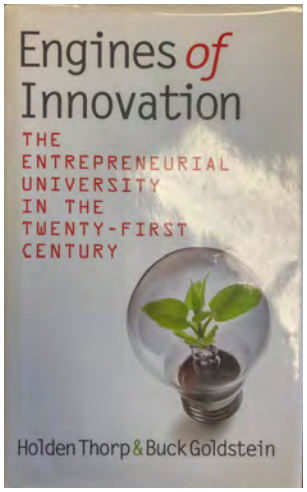
Continuous Construction

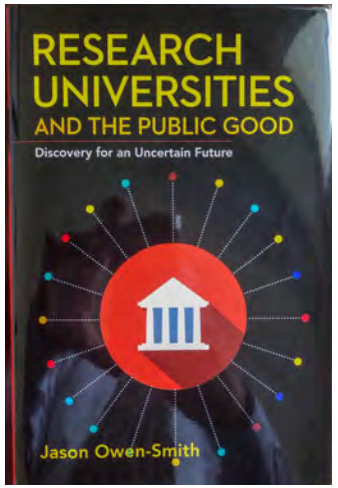
Universities are *diverse* and *works in progress*

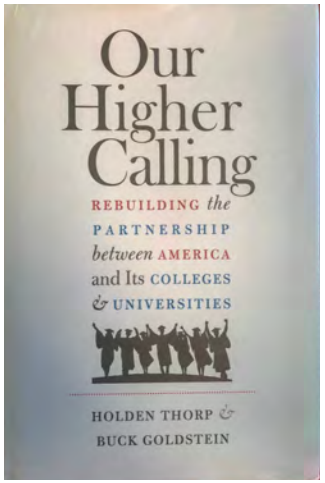
~4000 colleges and universities in USA

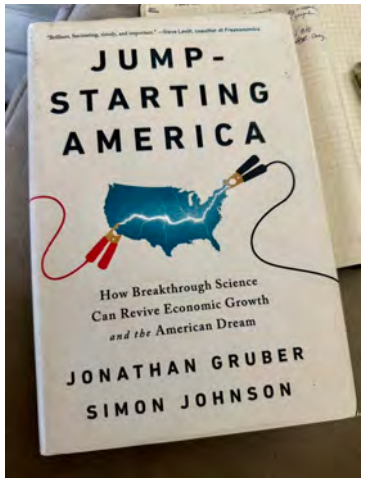
- Morrill Act of 1862 (created Land-Grant universities)
- Truman Commission, 1946 (universities to support democracy)
- Architecture of the National Science Foundation, 1950 (Vannevar Bush)
- Wisconsin Idea, 1971 ("university research should be applied to solve problems and improve health, quality of life, the environment, and agriculture for all citizens of the state")
- Bayh-Dole Act, 1980 (universities own and can commercialize intellectual property created)

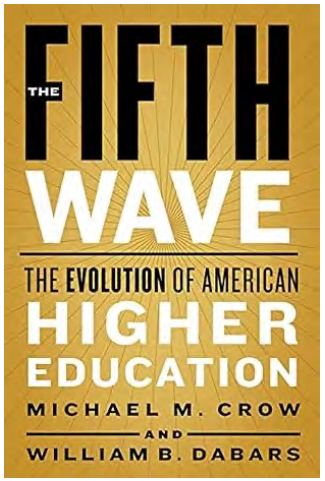




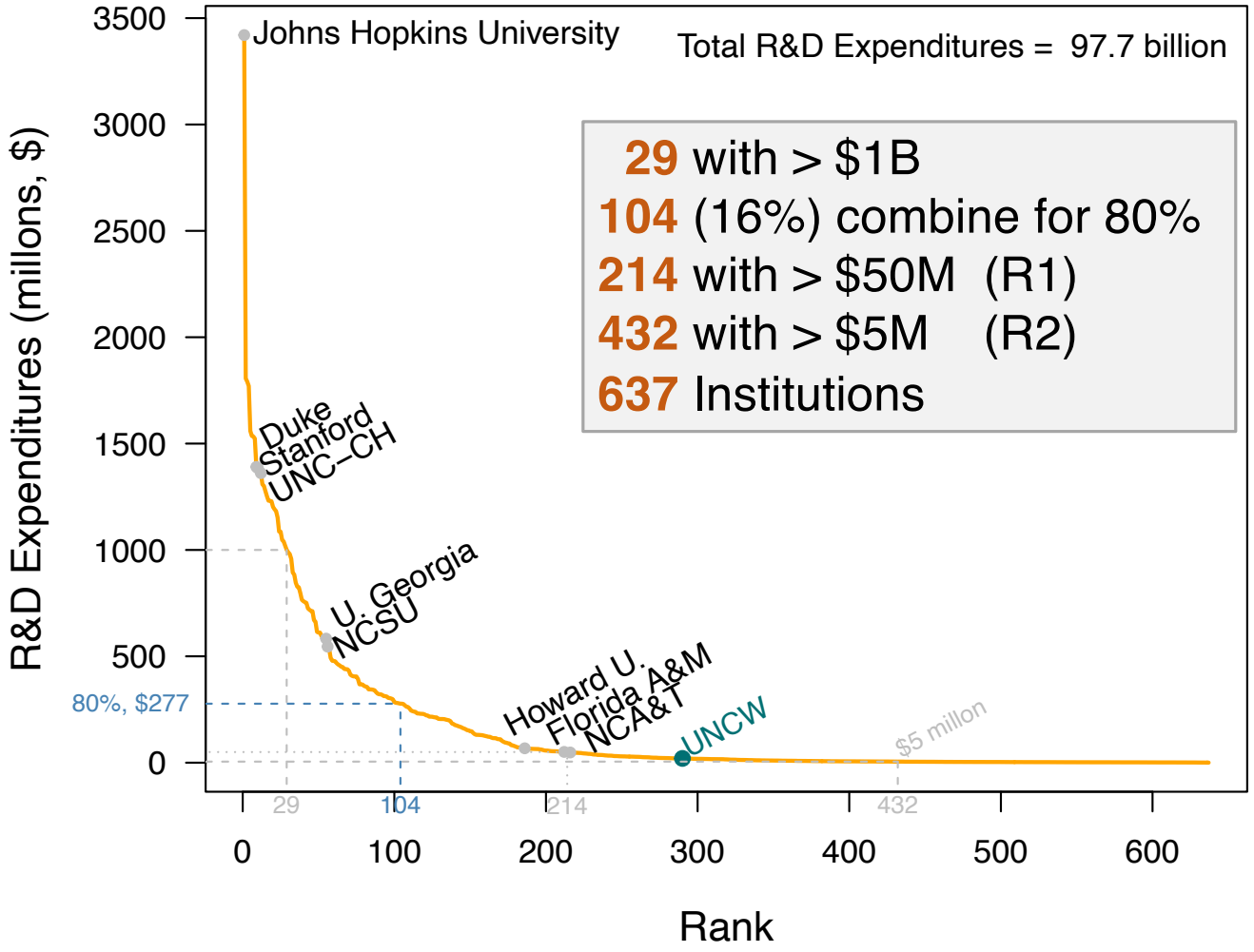








NSF HERD 2022 Research Expenditures



637 of ~ 4,000
Colleges and Universities

Variability in institution research activity, type, expertise population served, geographic location

Many institutions not reporting here still engage in research, scholarship, and creative activities.

Why Research at a University?

Knowledge for Knowledge's Sake is a Good unto Itself

Contemplating, researching, testing, and writing about ideas requires strong *habits of mind*. These habits lead to great works.

"The best minds exercise regularly," Dr. Dan Baden

New Knowledge is a Good unto Itself

"The creation of new knowledge is a *service to society*, and training others in the practice of curating and generating new knowledge is a core part of the academic mission"

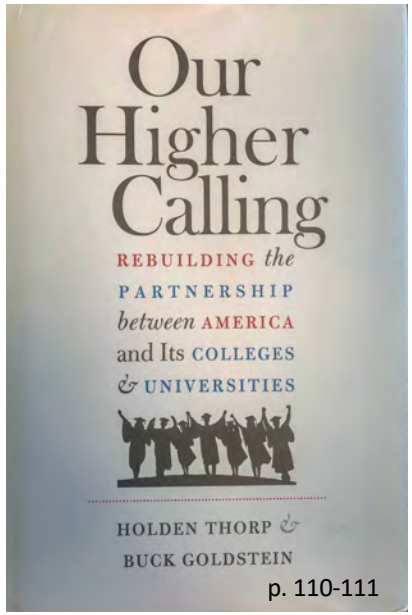
Innovators of the Future Need our Knowledge

Portfolio strategy. Curiosity driven research can lead to unanticipated discoveries whose values is not known *a priori*.

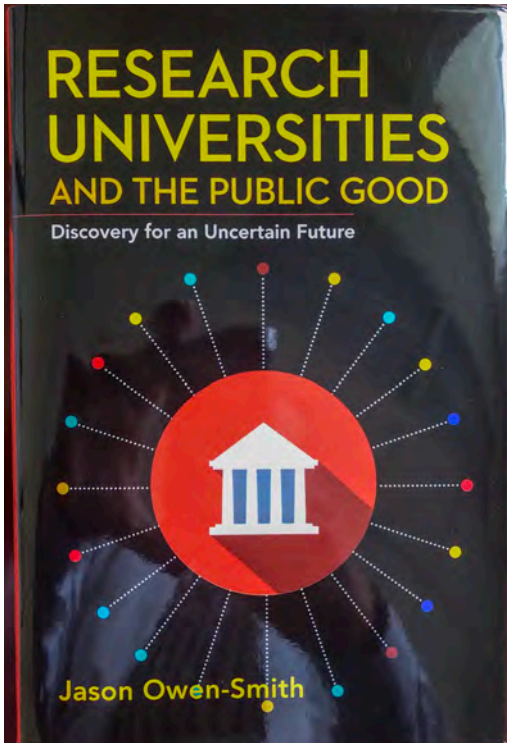
The Work We Do Is Useful Now

Some research leads to commercial developments and intellectual property. Thus, university research can be an economic engine.

Solving problems (e.g., shoreline stabilization, weather prediction, medicine)



Why Research at a University?



The purpose of the university is *knowledge.*

p. 6

Knowledge **Production**

Research and Innovation

Knowledge **Transfer**

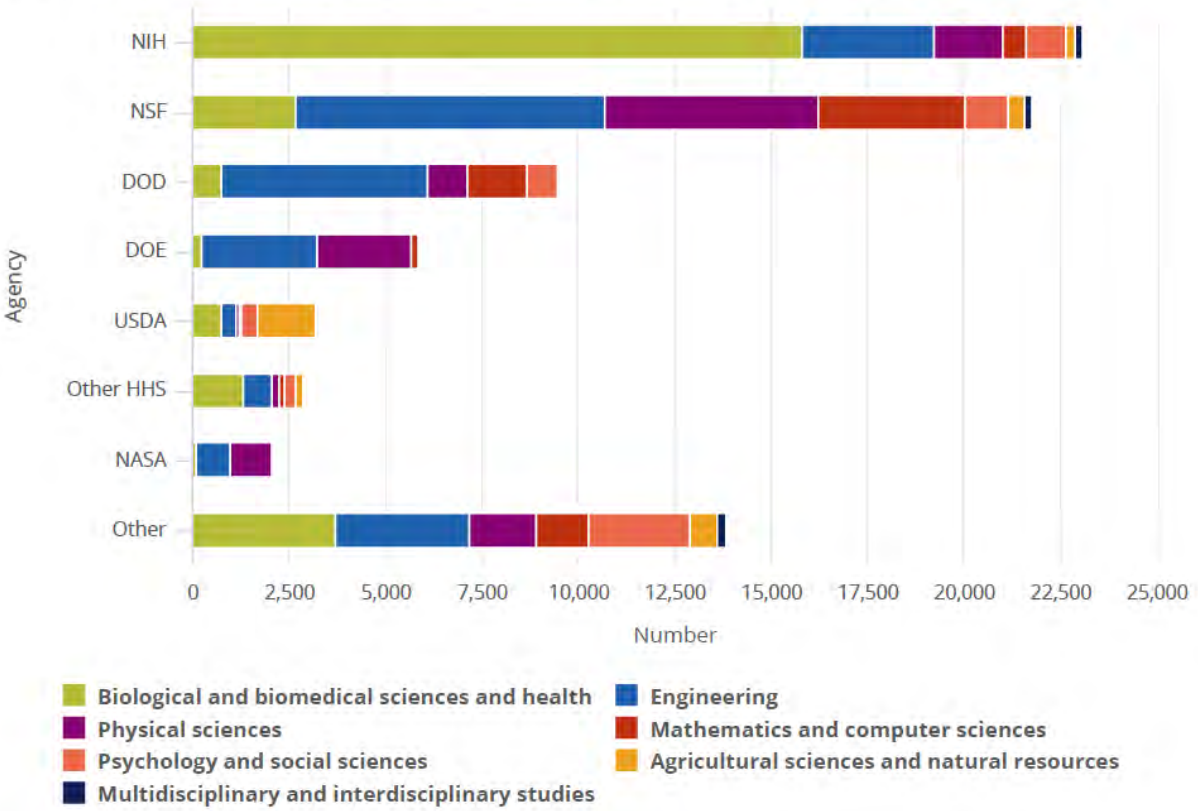
Teaching, Engagement, Application

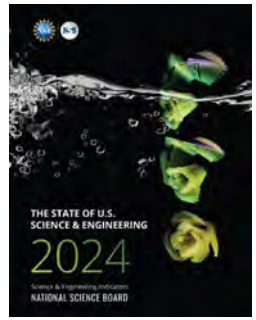
Coupling the *education* and *research* missions strengthens both

Value to Students

- Students learn cutting-edge knowledge in classes
  - Owen-Smith – graduating students is the biggest form of tech-transfer
- Research as learning opportunities
  - e.g. High Impact Practice
  - Course Embedded Research (CUR)
- Funded research enables larger programs to support more students (e.g., undergraduate, graduate, postdoc).
- Some students are funded directly from sponsored programs
  - Meeting student financial need

Support for Graduate Students





Note(s): DOD is Department of Defense. DOE is Department of Energy. HHS is Department of Health and Human Services, excluding NIH. NASA is National Aeronautics and Space Administration. NIH is National Institutes of Health. NSF is National Science Foundation. USDA is Department of Agriculture. S&E includes health fields. Physical sciences includes geosciences, atmospheric sciences, and ocean sciences. Agricultural sciences includes veterinary sciences; natural resources includes conservation. Mathematics includes statistics; computer sciences includes information sciences.

Source(s): NCSES, GSS, 2021. *Indicators 2024: Academic R&D*

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Things Come Apart, Todd McLellan

Assemble the key pieces

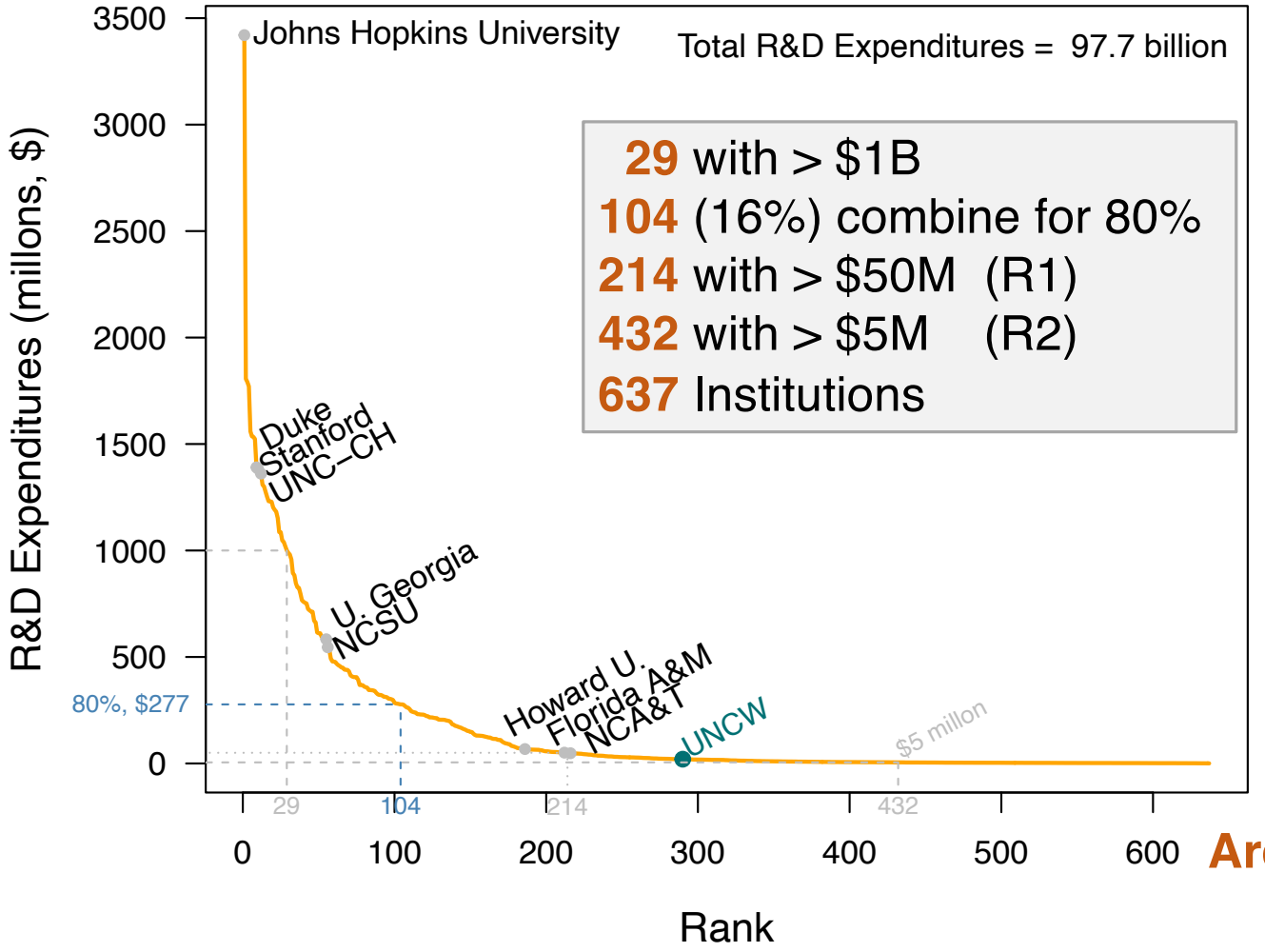
Take Home Points

Q&A

- US National Research Enterprise
  - Generates new knowledge – basic, applied, development
  - Many entities (e.g., Govt., National Labs, Business/Industry, non-profit organizations, IHE)
  - National Health, Prosperity, Welfare, Defense (e.g., technology development, medicine)
  - Estimated 25% of US business growth since WWII from non-defense federal investment
- Value of University Research
  - Federal investment in research at IHE supports most basic (or curiosity-driven) research. The utilitarian value of the knowledge is not necessarily known. High-Risk investment.
  - Valuable to student learning (HIP), and faculty/scholar exercise
  - Sponsored research also directly supports some student financial need (UG, Grad, Postdoc)
  - Network Source, Anchor Institution, Connecting Hubs

NSF HERD 2022 Research Expenditures

State of the R&D System



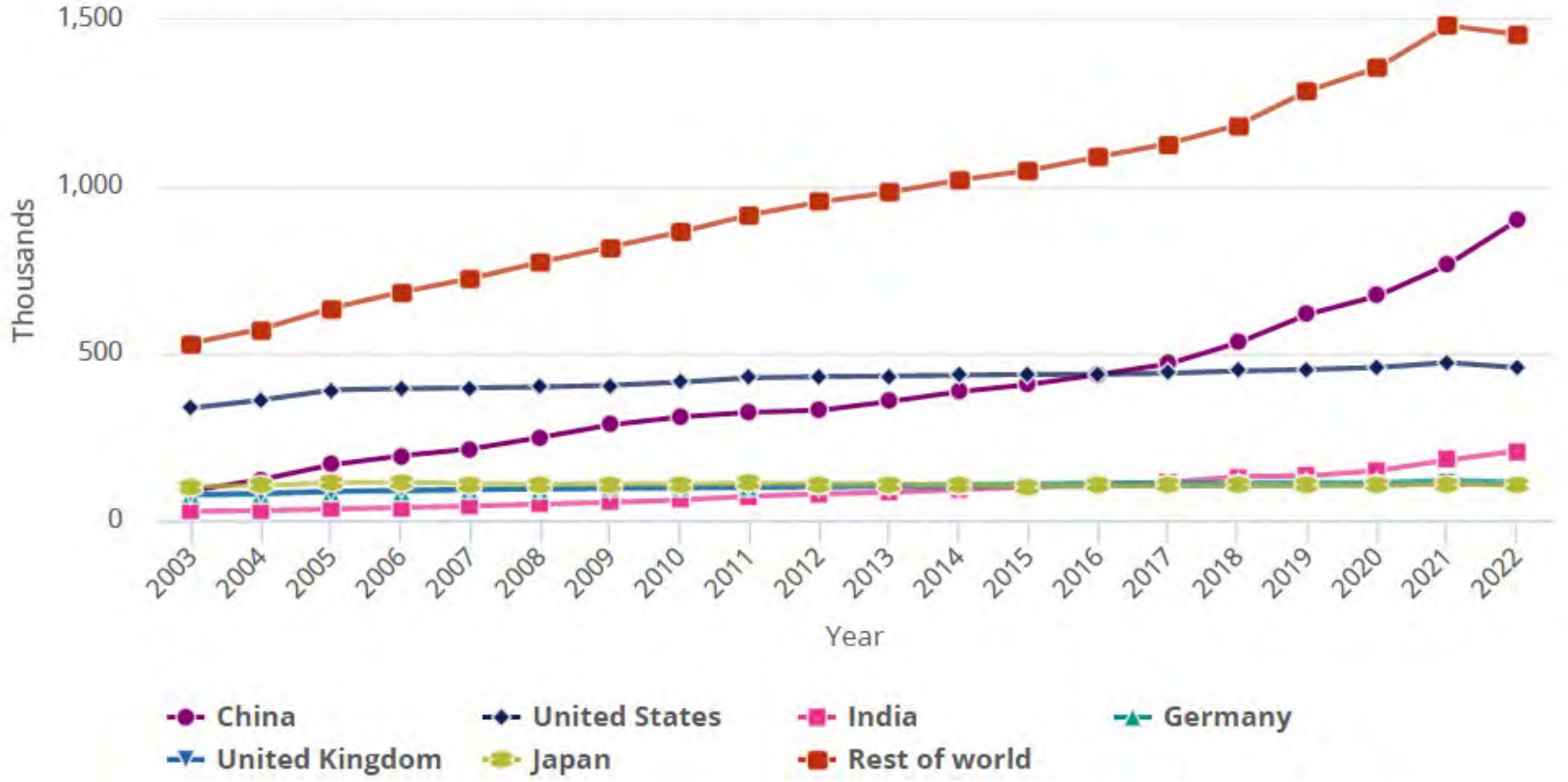
637 of ~ 4,000
Colleges and Universities

Variability in institution research activity, type, expertise population served, geographic location

Shannon Equitability Index
$(1 - E_h) = 0.20$
→ Not Diverse
→ Centralized

Are we getting all we can from the IHE R&D ecosystem?

International Context: S&E Articles, 2003-22



Note(s): Articles are fractionally counted and classified by publication year and assigned to a region, country, or economy by author's institutional address.

Source(s): NCSES, special tabulations (2023) by Science-Metrix of Elsevier's Scopus abstract and citation database. *Indicators 2024: Publications Output*

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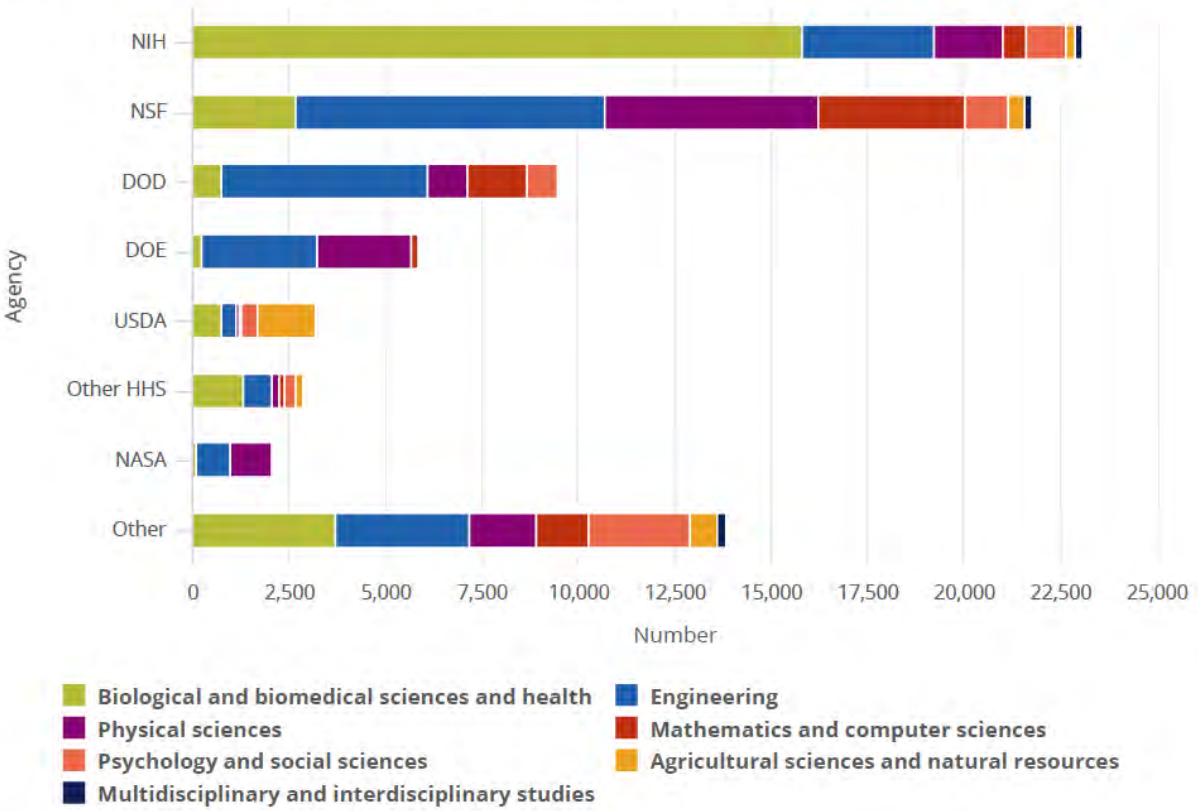
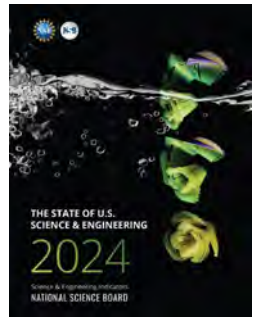
Support for Graduate Students





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