Science outside the lab:

Alternate career paths for Physics Ph.D.

Robert Streubel

Physics and Astronomy

Links in colloquium flyer:

- Generative AI and the future of work in America (McKinsey)
- American Institute of Physics FYI
- National Nanotechnology Initiative
- Science & Technology Policy Fellowships (AAAS)
- Science Outside the Lab workshops

Financial support by NSF DMR under grant #2203933.

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7.12.2023

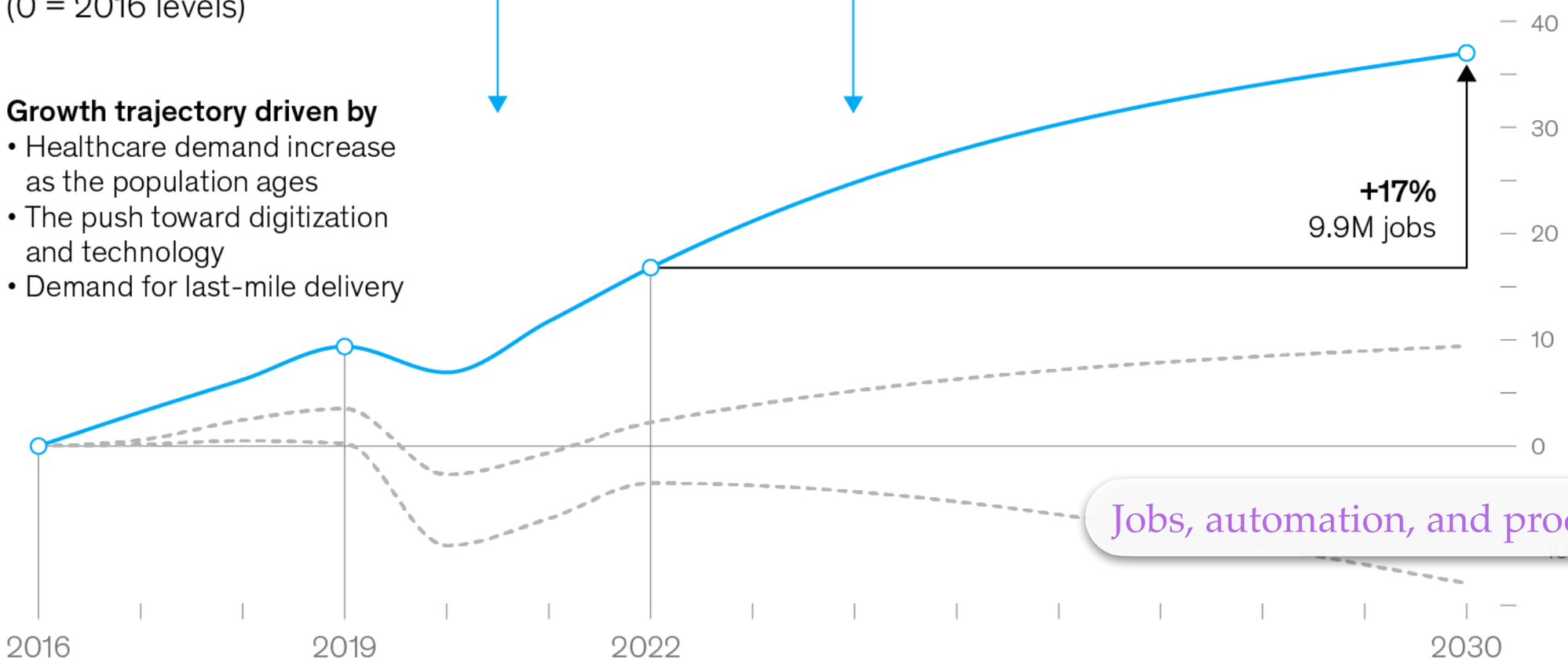
Web: https://streubel.unl.edu

Generative AI Boosts STEM Professions

US job growth,
index
(0 = 2016 levels)

Resilient and growing occupations

Growth trajectory driven by
- Healthcare demand increase as the population ages
- The push toward digitization and technology
- Demand for last-mile delivery

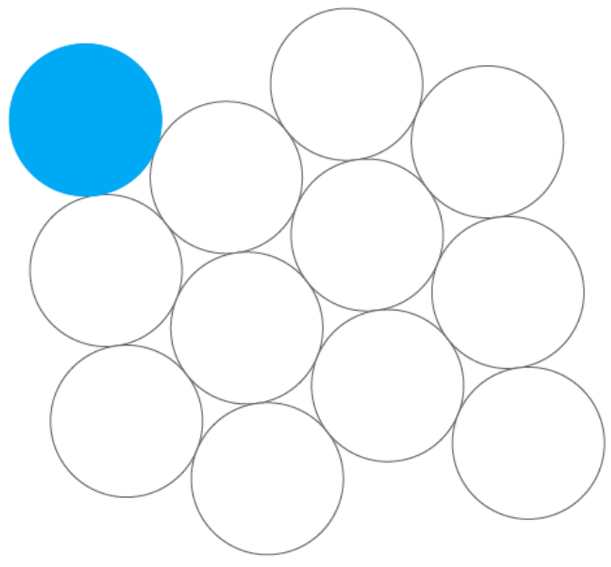


Share of US workers in resilient and growing occupations, 2022, %

Occupations where generative AI could accelerate automation significantly

- Health professionals
- Health aides, technicians, and wellness
- STEM professionals
- Transportation and warehousing
- Managers
- Business and legal professionals

Projected transitions to new occupations, 2022–30



1 million

From a resilient and growing occupation to any other occupation

Physics Education

Your physics education prepares you in a unique way to take on virtually any job.

It is your responsibility to *be aware of career opportunities* and the necessary steps.

You learn to

- *Identify and solve problems* in an analytical, qualitative, and quantitative manner
- Articulate, present, and write scientifically to different audiences

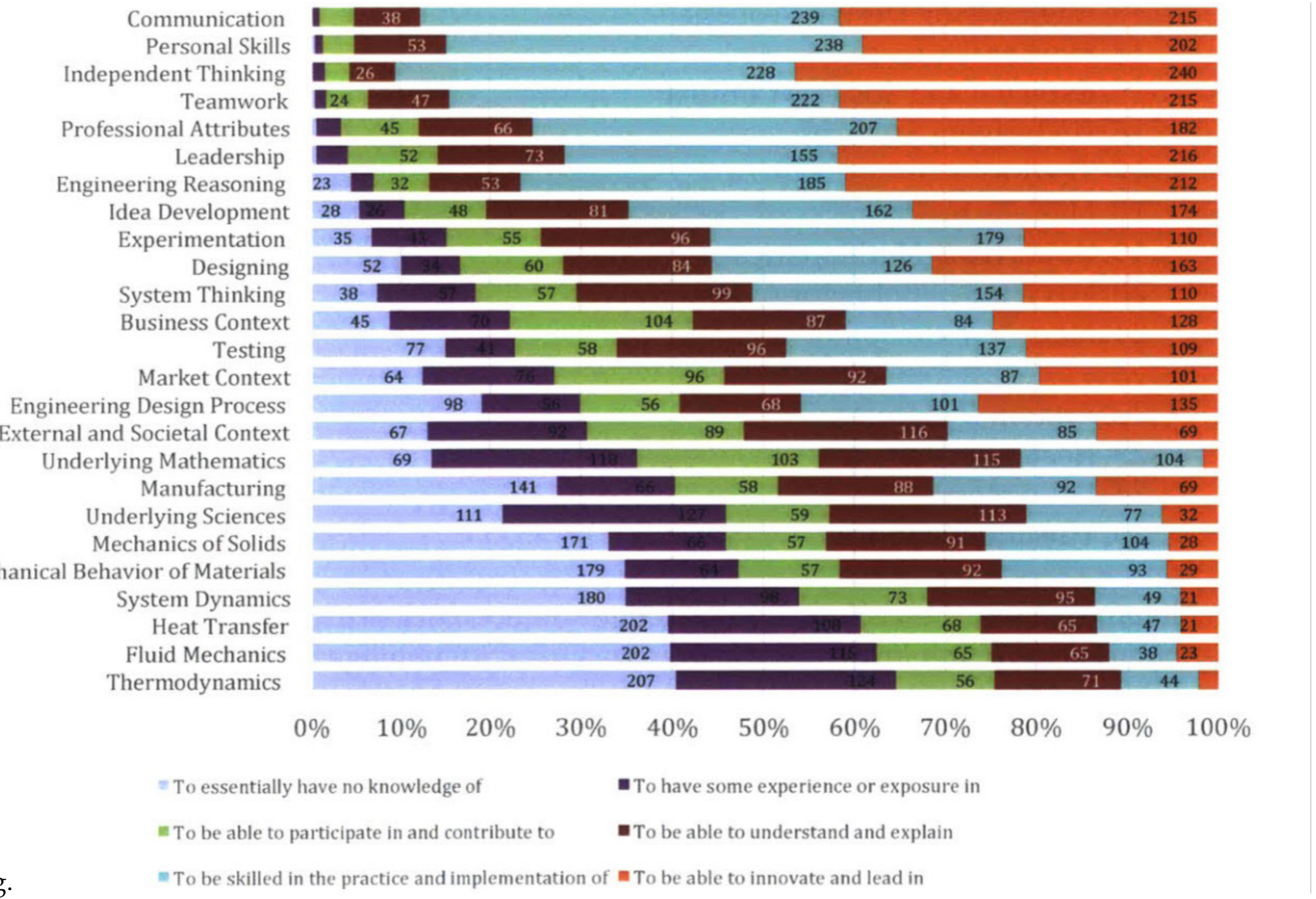
You demonstrate

Creativity Independence Productivity Perseverance

At the end of your Ph.D. and before writing your dissertation and defending, *you*—not your supervisor—*will be the expert*

- To get the job of your choice, you need several meaningful first-author papers and talks
- Duration and university do not matter (as much as you think)
- Discipline and topic do not matter

Expected Proficiency

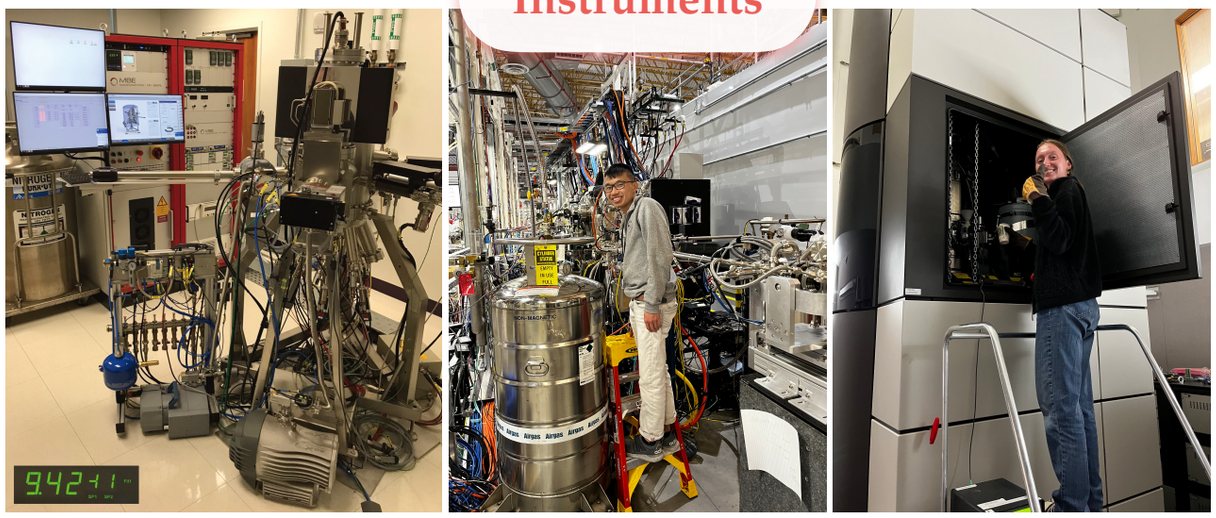


Survey:
MIT Eng.

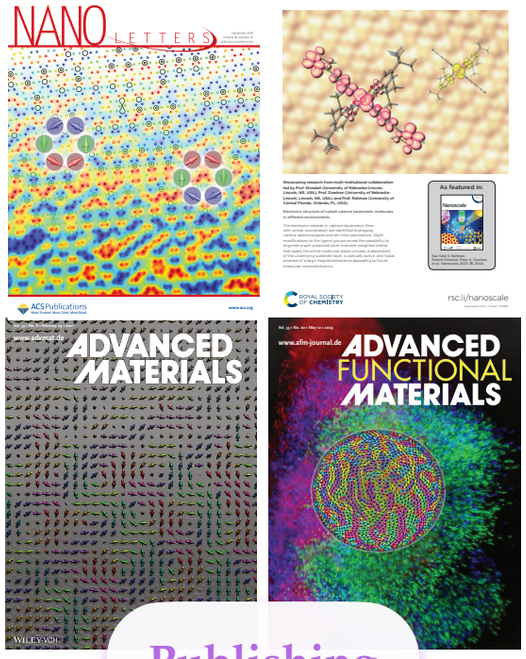
Motivation and Aspiration

- Why do you want a Physics degree?
- Determines priorities, assigned tasks, and skills needed independent of topic

- Draw from *your own accomplishments* as undergraduate or graduate researcher

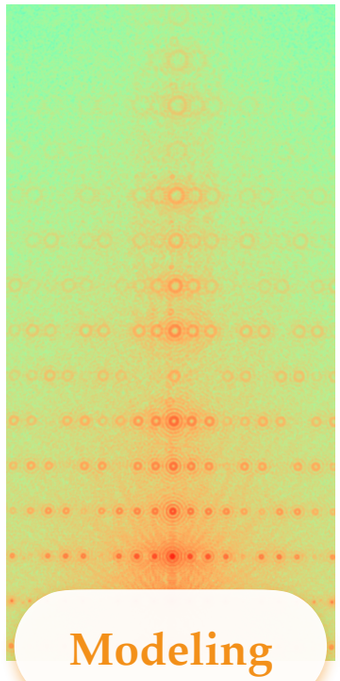


Instruments

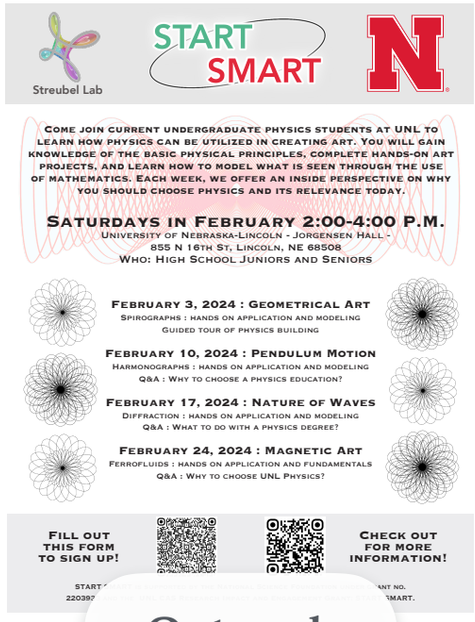


Publishing

Invited talks



Modeling



Outreach

Consulting

Possible Career Paths

Plan during undergraduate, graduate, and postdoctoral level of your career

Consider personal interests and funding landscape in the U.S.

Traditional

- Research scientist and technician at national labs and government agencies
- Faculty and research professor

Limited number of open positions and a lot of work

- Industry research and development

Alternate

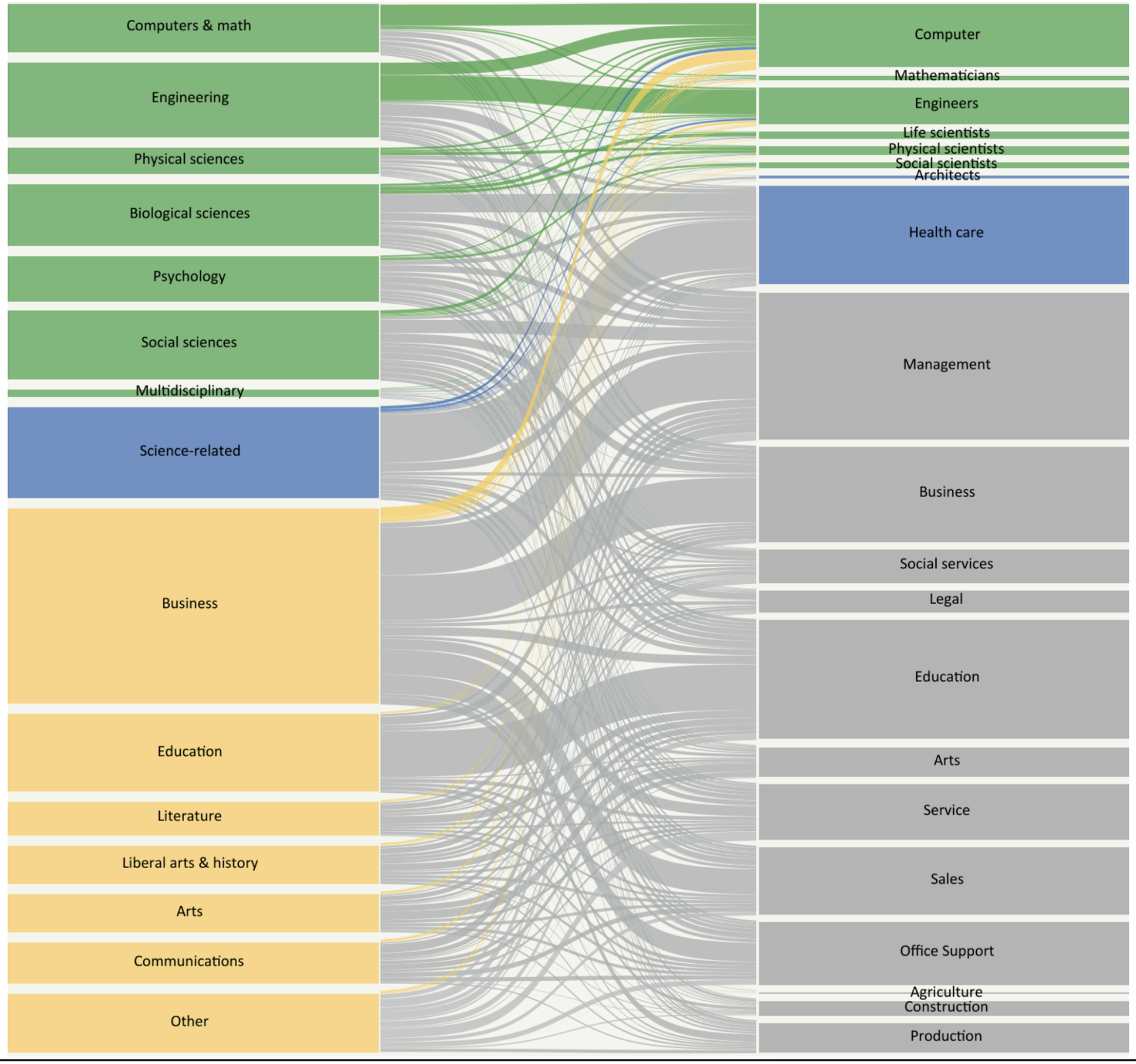
- Software engineer and developer
- Consultant in private or non-profit companies or for government
- Clerk and attorney
- Editor and program manager
- Management

- *Identify and solve problems* in an analytical, qualitative, and quantitative manner
- Articulate, present, and write scientifically to different audiences

Creativity **Independence** **Productivity** **Perseverance**

Entails project, time, and people management skills.

From College to Jobs: Pathways in STEM



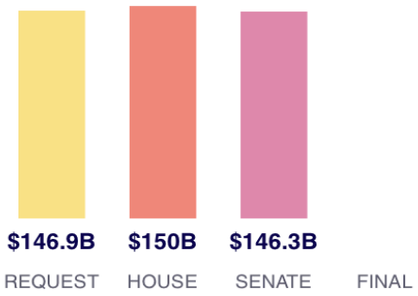
U.S. Government Research Budget

Everything is about money (entirely political decision—lobbying, no analytical procedure)

U.S. government *R&D* funding is roughly 10% of total budget (for past 70 years)

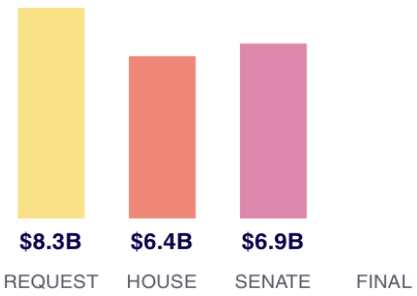
FYI / BUDGET TRACKER

FY2024 Department of Defense



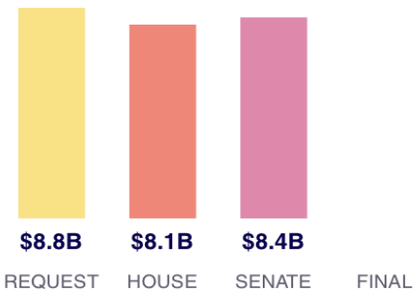
FYI / BUDGET TRACKER

FY2024 DOE Applied Energy Offices



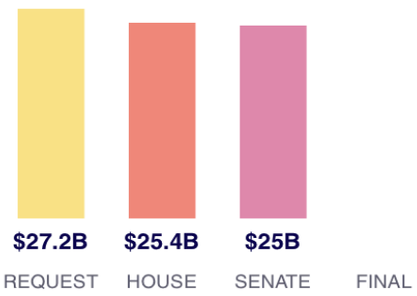
FYI / BUDGET TRACKER

FY2024 DOE Office of Science



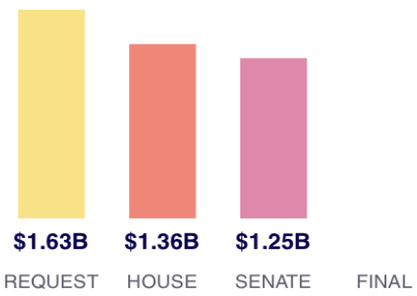
FYI / BUDGET TRACKER

FY2024 National Aeronautics and Space Administration



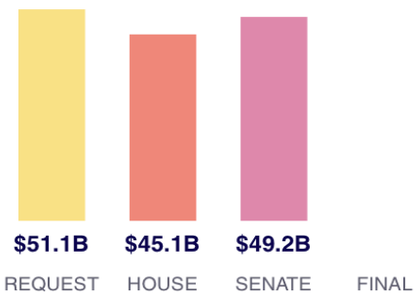
FYI / BUDGET TRACKER

FY2024 National Institute of Standards and Technology



FYI / BUDGET TRACKER

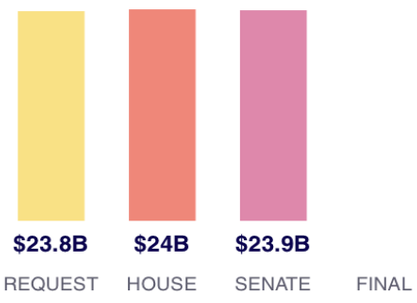
FY2024 National Institutes of Health



FYI / BUDGET TRACKER

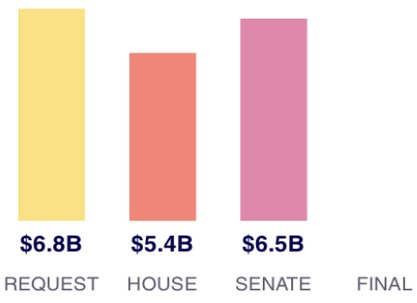
FY2024 National Nuclear Security Administration

Maintenance



FYI / BUDGET TRACKER

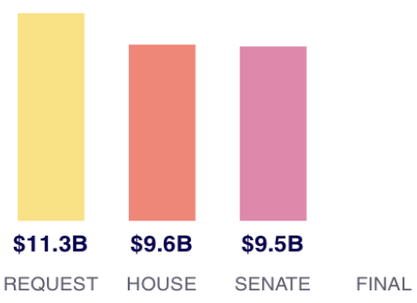
FY2024 National Oceanic and Atmospheric Administration



FYI / BUDGET TRACKER

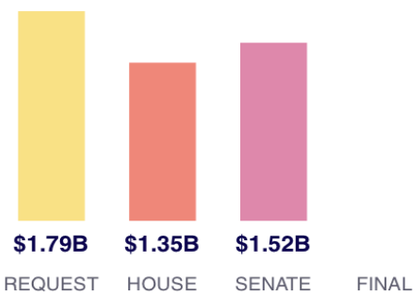
FY2024 National Science Foundation

Academia



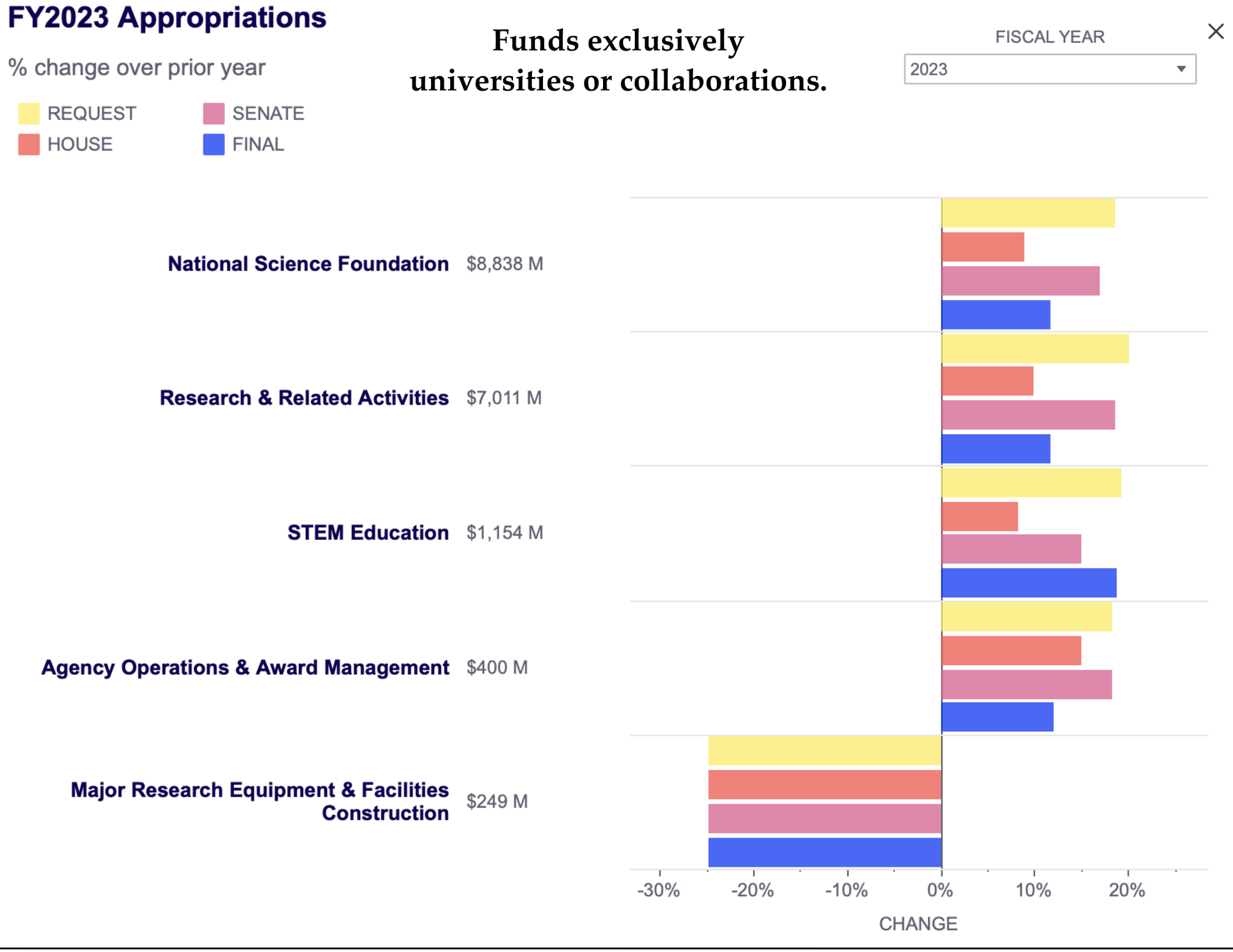
FYI / BUDGET TRACKER

FY2024 U.S. Geological Survey



U.S. National Science Foundation

Funds exclusively universities or collaborations.



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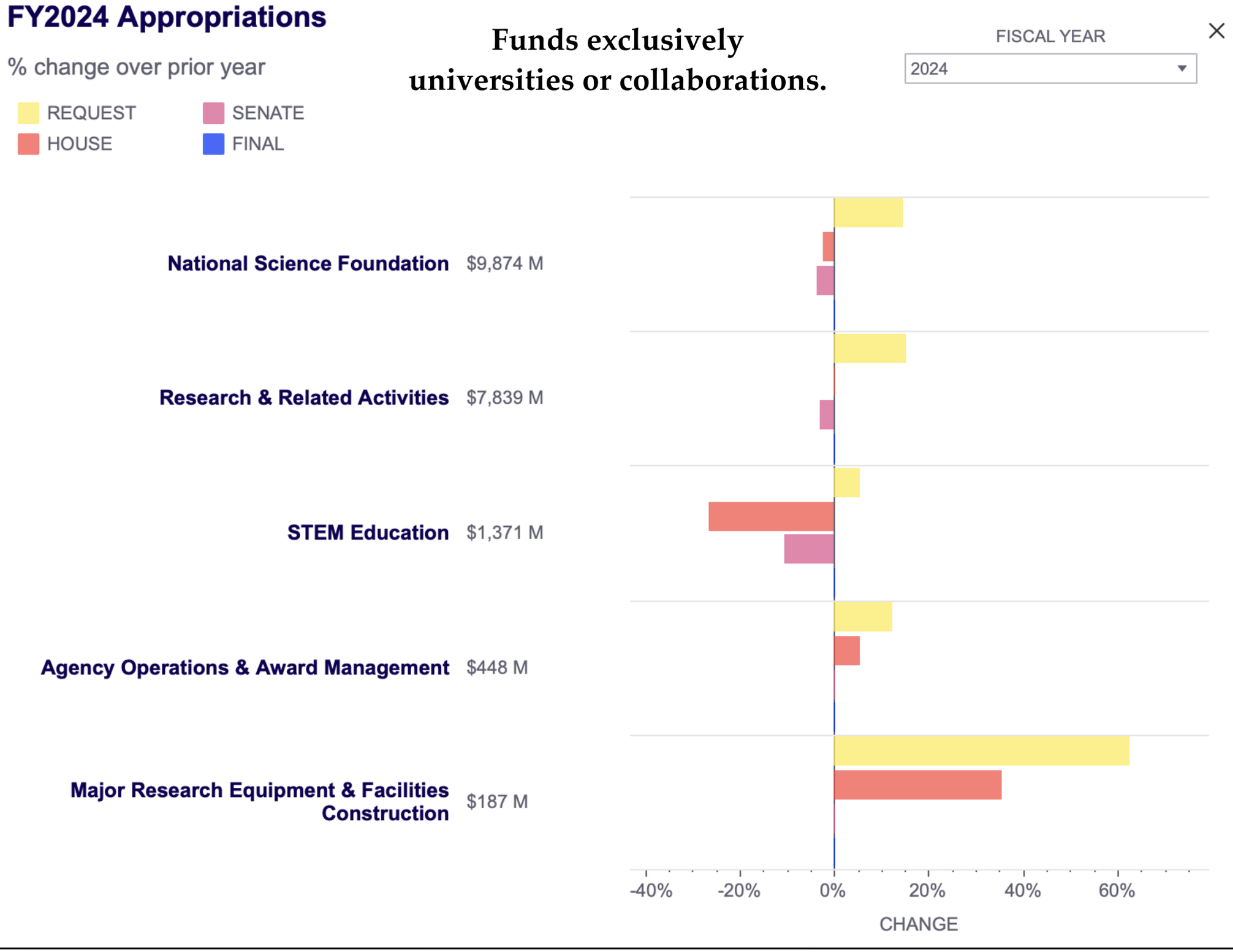
Funds exclusively universities or collaborations.



U.S. Department of Energy, Office of Science

Funds national labs, universities, and collaborations.

FY2024 Budget Details

Selected programs ($, millions)
% change over prior year enacted

FISCAL YEAR: 2024

- (•) Show summary view
- ( ) Show all subprograms

Click rows for subprogram details

PROGRAM	ENACTED	REQUEST	HOUSE	SENATE	FINAL
Office of Science	$8,100	$8,800	$8,100	$8,430	
Basic Energy Sciences	$2,534	$2,693	$2,587	$2,679	
High Energy Physics	$1,166	$1,226	$1,192	$1,226	
Advanced Scientific Computing Research	$1,068	$1,126	$1,016	$1,016	
Biological & Environmental Research	$909	$932	$827	$941	
Nuclear Physics	$805	$811	$800	$818	
Fusion Energy Sciences	$763	$1,010	$778	$792	
Science Laboratories Infrastructure	$281	$322	$288	$309	
Science Program Direction	$211	$226	$211	$237	
Safeguards and Security	$184	$200	$200	$185	
Isotope R&D and Production	$109	$173	$140	$151	
Workforce Dev. for Teachers & Scientists	$42	$46	$32	$42	
Accelerator R&D and Production	$27	$34	$28	$34	

Funds national labs, universities, and companies.

FY2023 Budget Details

Selected programs ($, millions)
% change over prior year enacted

FISCAL YEAR: 2023

- (•) Show summary view
- ( ) Show all subprograms

Click rows for subprogram details

PROGRAM	ENACTED	REQUEST	HOUSE	SENATE	FINAL
DOD Research, Development, Test, & Evaluation	$122,846	$131,983	$134,983	$137,602	$143,777
Title IV RDT&E	$119,211	$130,097	$131,667	$134,625	$139,761
Title IV Non-S&T Accounts (6.4 - 6.8)	$100,319	$113,643	$113,343	$114,094	$117,435
Title IV Science & Technology (6.1 - 6.3)	$18,892	$16,455	$18,324	$20,532	$22,326
Air Force S&T	$3,095	$2,680	$2,946	$3,203	$3,453
Army S&T	$4,333	$2,743	$3,617	$4,149	$4,950
Defense-Wide S&T	$7,936	$7,798	$8,035	$8,769	$9,477
Navy S&T	$2,954	$2,427	$2,859	$3,265	$3,415
Space Force S&T	$575	$808	$867	$1,146	$1,031

FYI: Science Policy News

FYI Bulletin

Stay informed with our deep-dive updates.

2 to 4 emails per week

FYI This Week

Start your week with a preview of what's ahead and a recap of recent news.

Weekly - Mondays

FYI Monthly Digest

Catch up on everything FYI published in the previous month.

Monthly - Once per month

Send the above selected newsletters straight to my inbox!

Your Email Address

Sign Up →

By signing up you agree to allow AIP to send you email newsletters. You further agree to our privacy policy and terms of service.

AAAS Launches STPF Rapid Response Cohort in AI to Support Policy Development in Congress

October 05, 2023

The AI cohort is comprised of six scientists who will serve as expert staff in a congressional office or committee with most starting their yearlong placements this week to provide guidance on pressing issues such as AI ethics, information integrity, intellectual property, human rights and algorithmic risk.

AAAS Science & Technology Policy Fellowships (STPF) provide opportunities to outstanding scientists and engineers to learn first-hand about policymaking while contributing their *knowledge and analytical skills to the federal policymaking process*.

Fellows serve yearlong assignments in the *executive, legislative and judicial branches* of the federal government in Washington [of their choice].

$89,000 to $116,000 per year plus support for relocation and health care insurance.

U.S. citizenship required to work as STPF fellow.

Policy Fellowships in Congress and White House

Everything is about money (entirely political decision—lobbying)

Science policy == budget policy

- Data, statistics, and science welcome for decision making process *as long as they serve agenda*
- Most reports will never be read or used
- Information and data from personal connections in D.C. or Library of Congress

Congressional staffer

- U.S. Senate or House of Representatives
- Assigned to committee or elected official
- Writing reports, response, and speeches (timeline: *hours to weeks*)
- Taking phone calls
- Data analysis

Similar to paper submission, revision, rebuttal

Press staffer

- White House press secretary
- Press briefings
- Write speeches for (V)POTUS
- Find issues in news, analyze statements, and draft response (timeline: *minutes to few hours*)

U.S. citizenship required to work as STPF fellow.

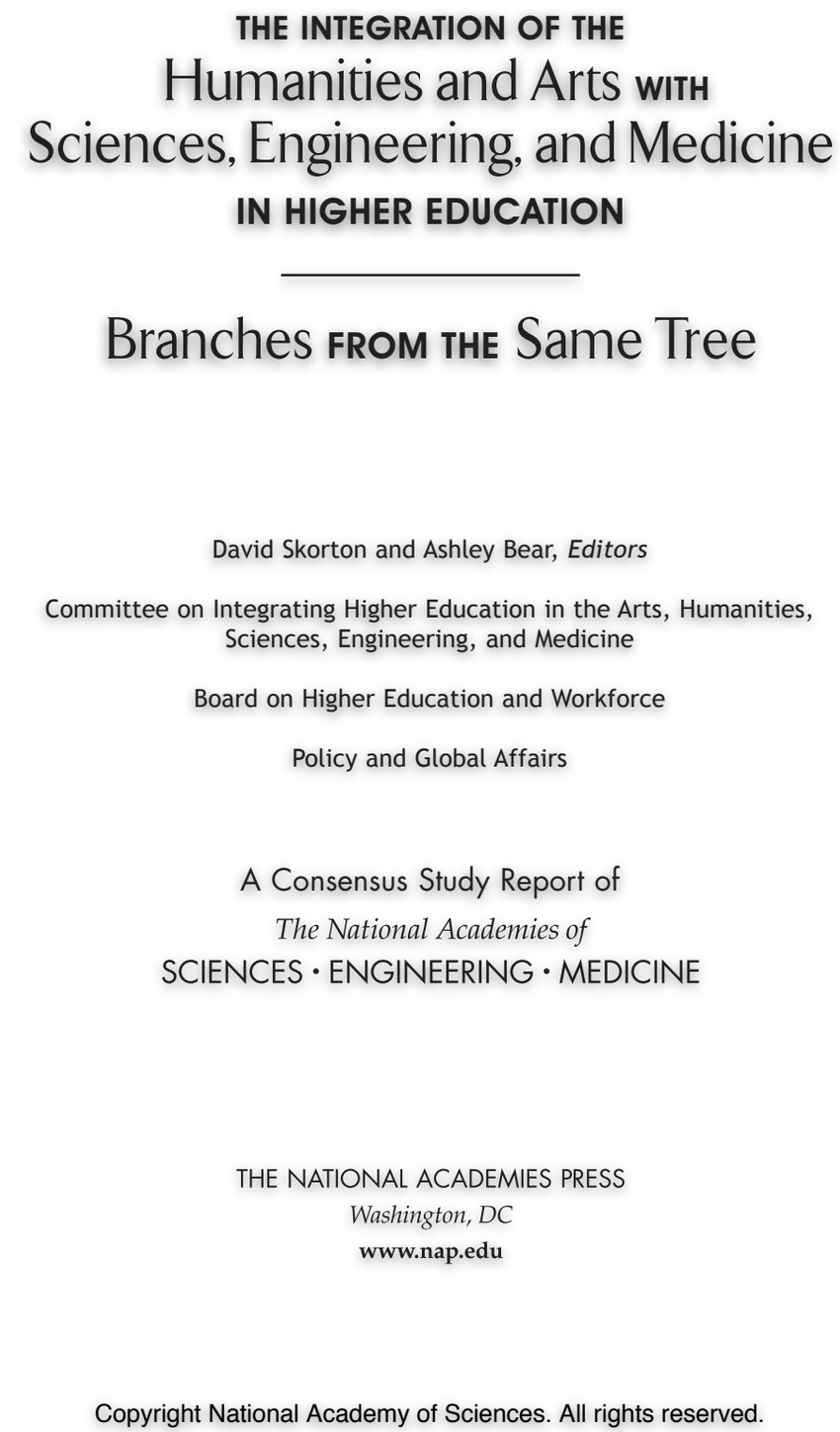
Program Officer at the National Academies

NATIONAL ACADEMIES *Sciences Engineering Medicine*

Independent institution established by Congress

Editorial position

- Science advisory, hosting committees, writing reports
- *All studies defined by U.S. Congress (open to the public)*
- Typically 2-year long, five meetings per year (1-2 days long)
- Each panelist prepares 10-15 pages for the report
- Editor invites panelists and revises, restructures, and finalizes report
- Timeline: *two to three years*


THE INTEGRATION OF THE
Humanities and Arts WITH
Sciences, Engineering, and Medicine
IN HIGHER EDUCATION

Branches FROM THE Same Tree

David Skorton and Ashley Bear, *Editors*

Committee on Integrating Higher Education in the Arts, Humanities, Sciences, Engineering, and Medicine

Board on Higher Education and Workforce

Policy and Global Affairs

A Consensus Study Report of
The National Academies of
SCIENCES · ENGINEERING · MEDICINE

THE NATIONAL ACADEMIES PRESS
Washington, DC
www.nap.edu

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White House Office of Science and Technology Policy (OSTP)

Science communication and coordination on behalf of POTUS

- Provides advice to POTUS and executive branch
- Works with federal departments and agencies and with Congress to create visions, strategies, policies, and programs for science and technology
- Engages with industry, academia, philanthropists, civil society, and governments

Procedure

- OSTP organizes and facilitates <-> agencies write and edit reports
- Request for information -> receive data -> analyze and set goals -> draft report -> obtain comments from public discussion (workshops) -> revise report

Policy transcends disciplines

Open Access

National Quantum Initiative

National Nanotechnology Initiative

CHIPS and Science Act

Enacted Policies

National Nanotechnology Initiative (NNI)

- Prioritizes strategic development (every 10-ish years)
- Nebraska Center for Materials and Nanoscience (NCMN) funded in parts by NNI

CHIPS and Science Act

- Microelectronics Commons accelerates domestic prototyping and growing a *pipeline of U.S.-based semiconductor talent*

Judicial Branch: Clerking

U.S. Court of Appeals for the Federal Circuit

- Any appeal of *intellectual property lawsuits* in the U.S. are handled in D.C.
- 98% of civil litigations resolved without trial (2-10 years of litigation till trial)
- Trial roughly one year

- Clerks, i.e., assistants to Judge (no science background), are Ph.D. with science and technology education
- Review literature of precedent, patents, journals, and news
- Analyze data and draft *layman recommendation* to Judge
- Take notes during trial and litigations
- Audience: jury of uneducated individuals

U.S. citizenship required to work as STPF fellow.

National Nanotechnology Coordinated Infrastructure

Science Outside the Lab

Wednesday May 31, 2023

8:30am – 9:00am
Breakfast

Location: Room 211, ASU Barbara Barrett and Sandra Day O'Connor Washington Center, 1800 I Street, NW

9:00am – 10:15am
Introduction and Welcome**, Jamey Wetmore** and **Martin Perez Comisso**

10:30 – Noon
Dan Sarewitz, Emeritus Professor, ASU, former House Science Committee Staffer

Noon – 1:00pm
Lunch at ASU Washington Center

1:00pm – 2:30pm
Rachel Levinson, Executive Director of National Research Initiatives, ASU

3:00pm – 5:00pm
Samantha Thompson, Curator of Science & Technology, National Air and Space Museum

Location: NASM, 6th Street and Independence Ave SW (Entrance on Independence Ave.) – L'Enfant Plaza Metro stop

6:30pm
Dinner
Location: Soy 38, 2101 L St. NW

Thursday June 1, 2023

9:00am – 10:30am
Celia Merzbacher, Executive Director, Quantum Economic Development Consortium, SRI Int'l

Location: 1100 Wilson Blvd, Arlington, VA (near Rosslyn Metro Stop) – arrive by 8:45am

11:15am – 12:30pm
Brittany Bishop, Program Officer, Transportation Research Board, National Academies of Science, Engineering, and Medicine

Location: NASEM Keck Center, 500 5th St, NW

12:45 – 1:15pm
Lunch

Location: Ronald Reagan Building Food Court

1:30pm – arrive early to EPA

1:45pm – 3:15pm
Jim Alwood, nanotechnology coordinator, EPA; **Susanna Blair**, Special assistant/ advisor for chemicals regulatory office **Alex Stanton**, Chemist, EPA

Location: EPA East, 1201 Constitution Avenue

4:00 – 5:00pm
Sindhu Nathan, Energy and Environment Policy Fellow, office of Sen. Tina Smith (Minn.) and **Luyi Cheng**, office of Sen. Elizabeth Warren (Mass.)

Location: Dirksen Senate Office Building

Friday June 2, 2023

8:30am – 9:15am
Tour of East Wing of White House

Location: 15th Street and Alexander Hamilton Place (SE corner of the complex at 15th St. and Penn Ave.)

9:30am – 10:30am
Branden Brough, Director of National Nanotechnology Coordination Office and **Quinn Spadola,** Deputy Director of NNCO

Location: Eisenhower Executive Office Building

11:00am – Noon
Judge Len Stark, Circuit Judge, U.S. Court of Appeals for the Federal Circuit

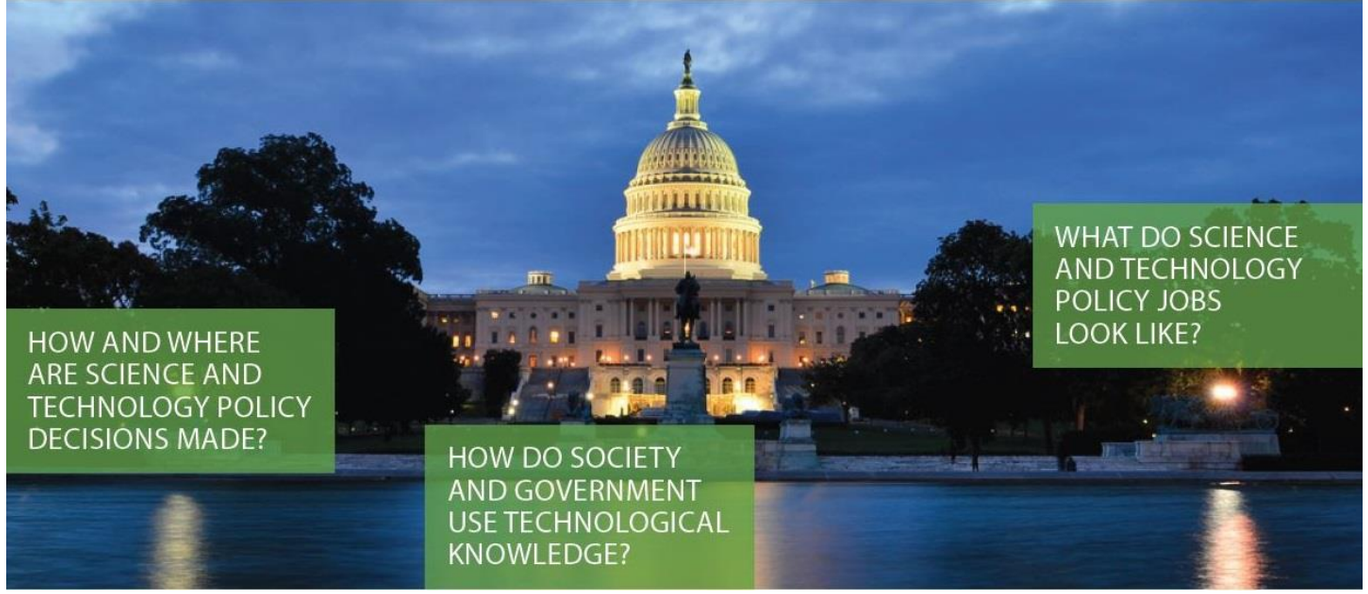
Location: 717 Madison Pl, NW (E side of Lafayette Sq.)

12:30 – 1:30pm
Lunch at ASU Washington Center

1:30pm – 3:00pm
Mitch Ambrose, Director of FYI, American Institute of Physics

3:30 – 5:00pm
Program debrief and evaluation

Faculty version



Science Outside the Lab

Nanotechnology and Policy

Faculty Program: May 29 – 31, 2024 (tentative)

Grad Student/Post doc Program: June 2 – 8, 2024 (tentative)

Science Outside the Lab brings a small cohort of scientists and engineers to Washington, D.C. to explore the relationships among science, innovation, and policy. The goal is to expose participants to as many different viewpoints as possible and help them understand how people and institutions influence and learn from the sciences.

In 2024 the Nanotechnology Collaborative Infrastructure Southwest (NCI-SW) and the NNCI Coordinating Office will sponsor two programs: one for faculty and one for PhD students and Post Docs. During the workshops, participants will investigate the context of science and technology decision-making with a focus on the US Federal Government. Participants will meet and interact with congressional staffers, funding agency officers, regulators, journalists, museum curators, and others to learn how and why nanotechnology and other emerging technologies are funded, regulated, shaped, critiqued, and publicized.

Graduate students and faculty affiliated with National Nanotechnology Coordinated Infrastructure universities (https://nnci.net/sites/view-all) are especially encouraged to apply to their respective programs. We are looking for candidates interested in how decisions are made about science and innovation funding, regulation, and policy. **Applications should open in January and will be due in February 2024.**

Graduate workshop is free of charge

For more information see: https://nnci.net/science-outside-lab
or contact Jamey Wetmore Wetmore@asu.edu

National Nanotechnology Coordinated Infrastructure

ASU Arizona State University

NSF