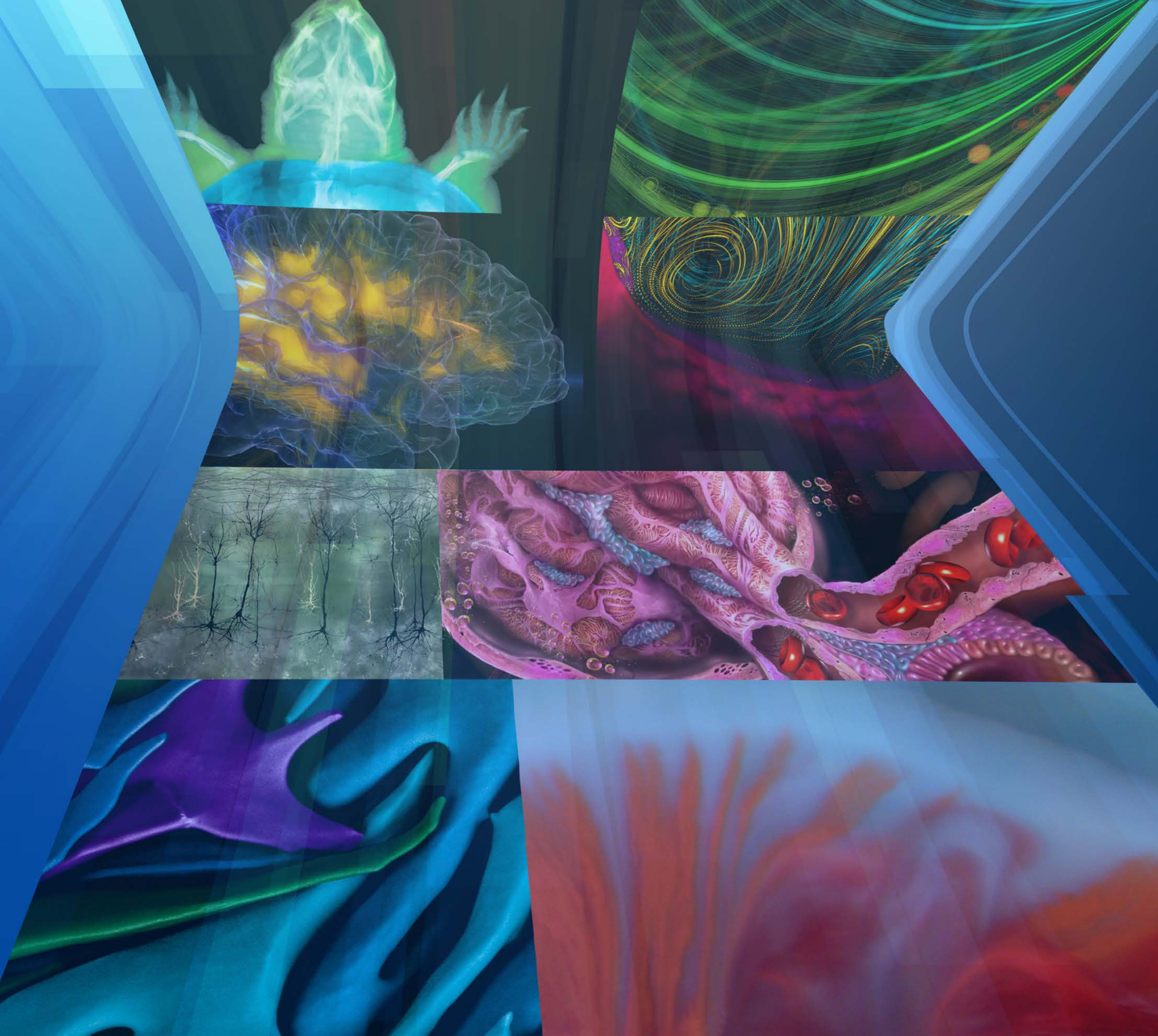


NSF
Supporting Research to Benefit the Nation

Richard Buckius
Chief Operating Office
Senior Science Advisor

May 2016

NSF Core Mission: Fundamental Research

Strategic Goals

Transform the Frontiers

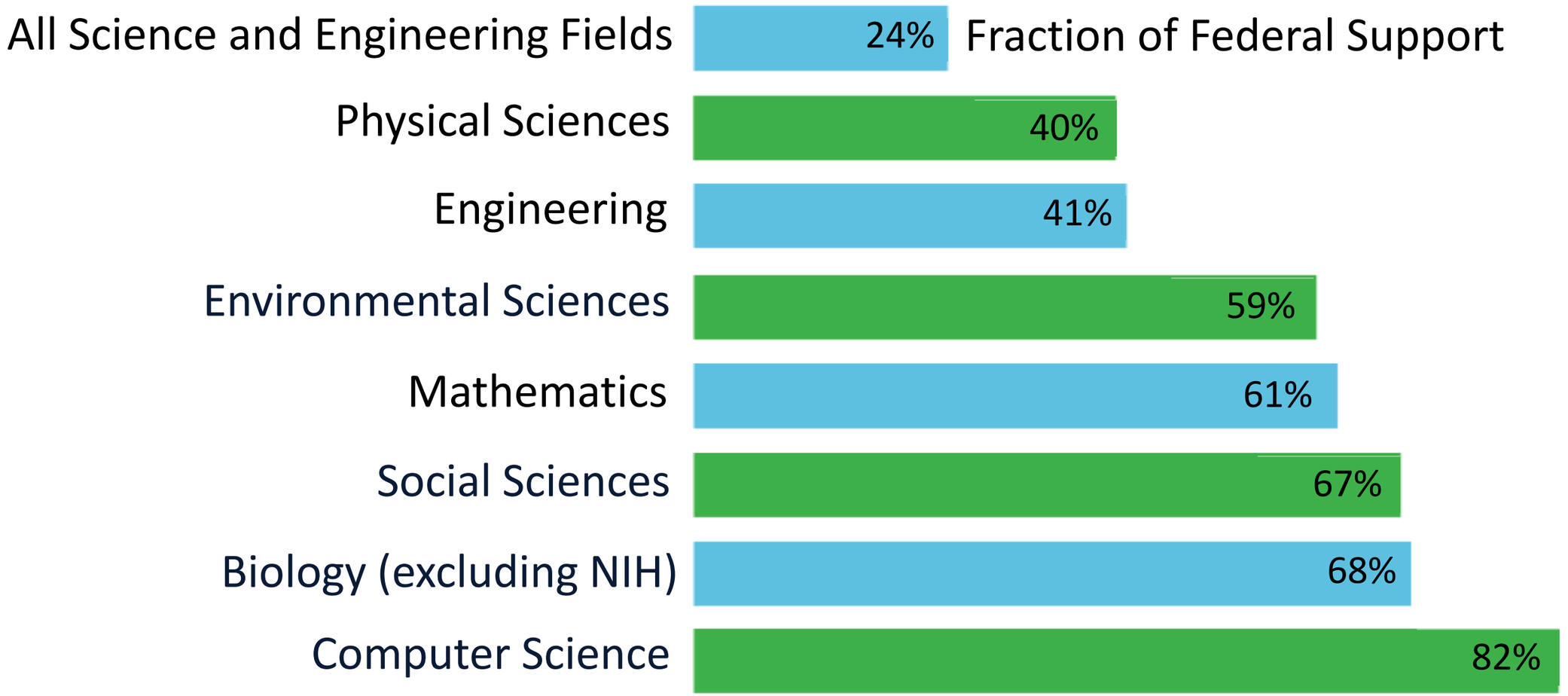
Innovate for Society

Perform as a Model Organization

NSF by the Numbers

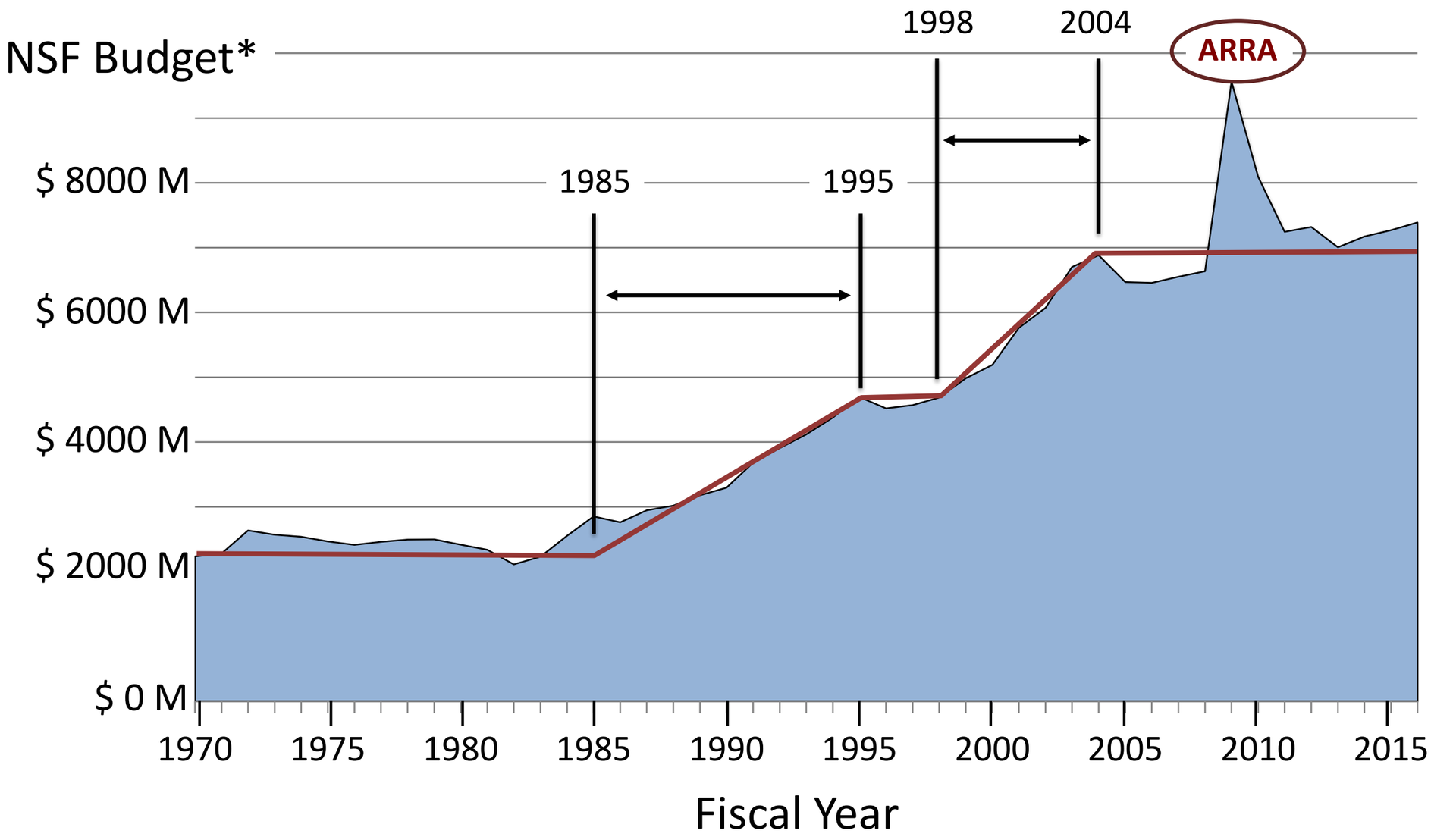
- $8B — FY 2017 budget request
- 93% — funds research, education and related activities
- 50,000 proposals
- 12,000 awards funded
- 2,000 NSF-funded institutions
- 350,000 NSF-supported researchers
- Fund research in all S&E disciplines
- Fund STEM education & workforce
- 217 Nobel Prize winners

NSF Supports Academic Basic Research: FY 2014



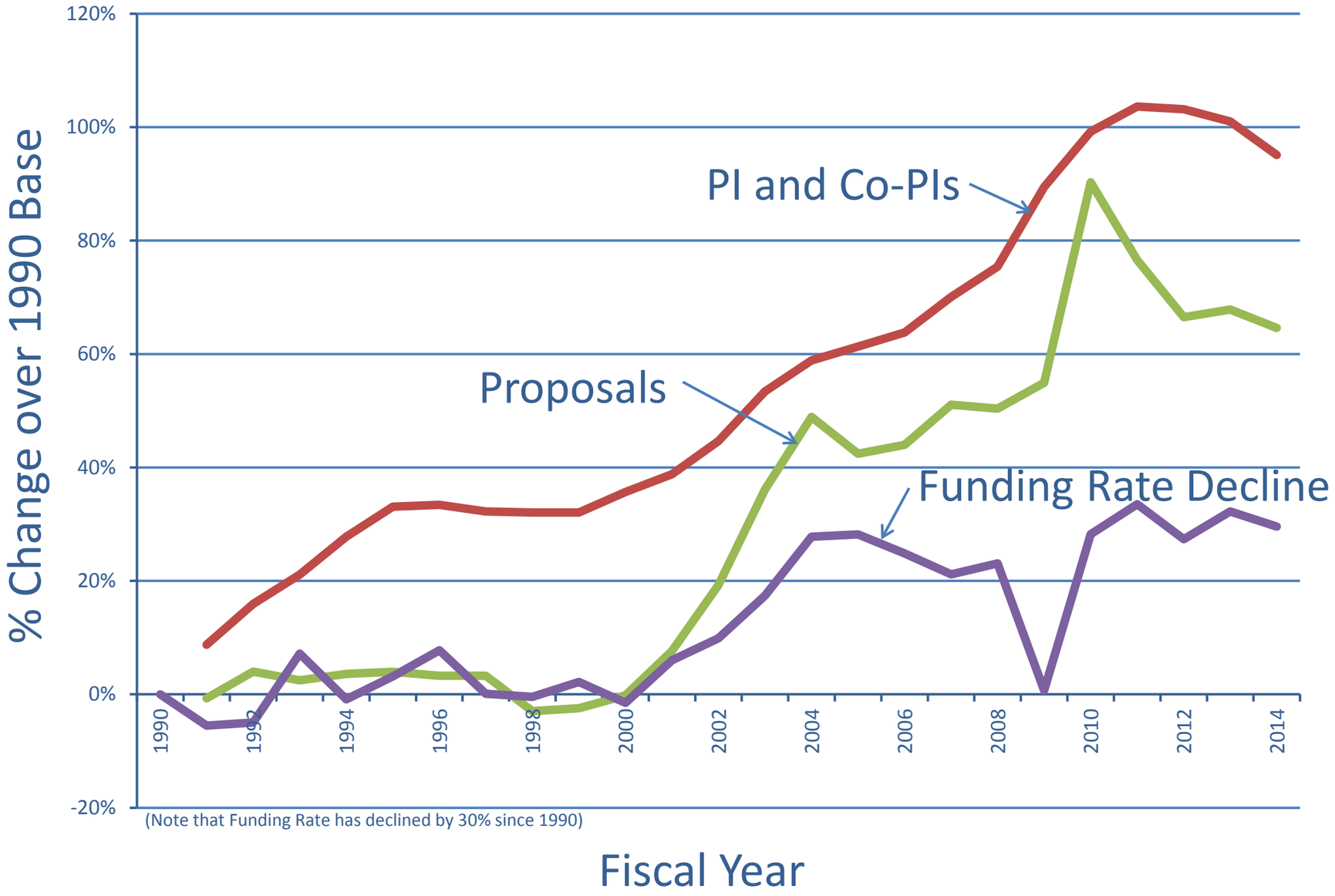
Source: NSF/ Center for National Science and Engineering Statistics, FY 2014

NSF Funding History



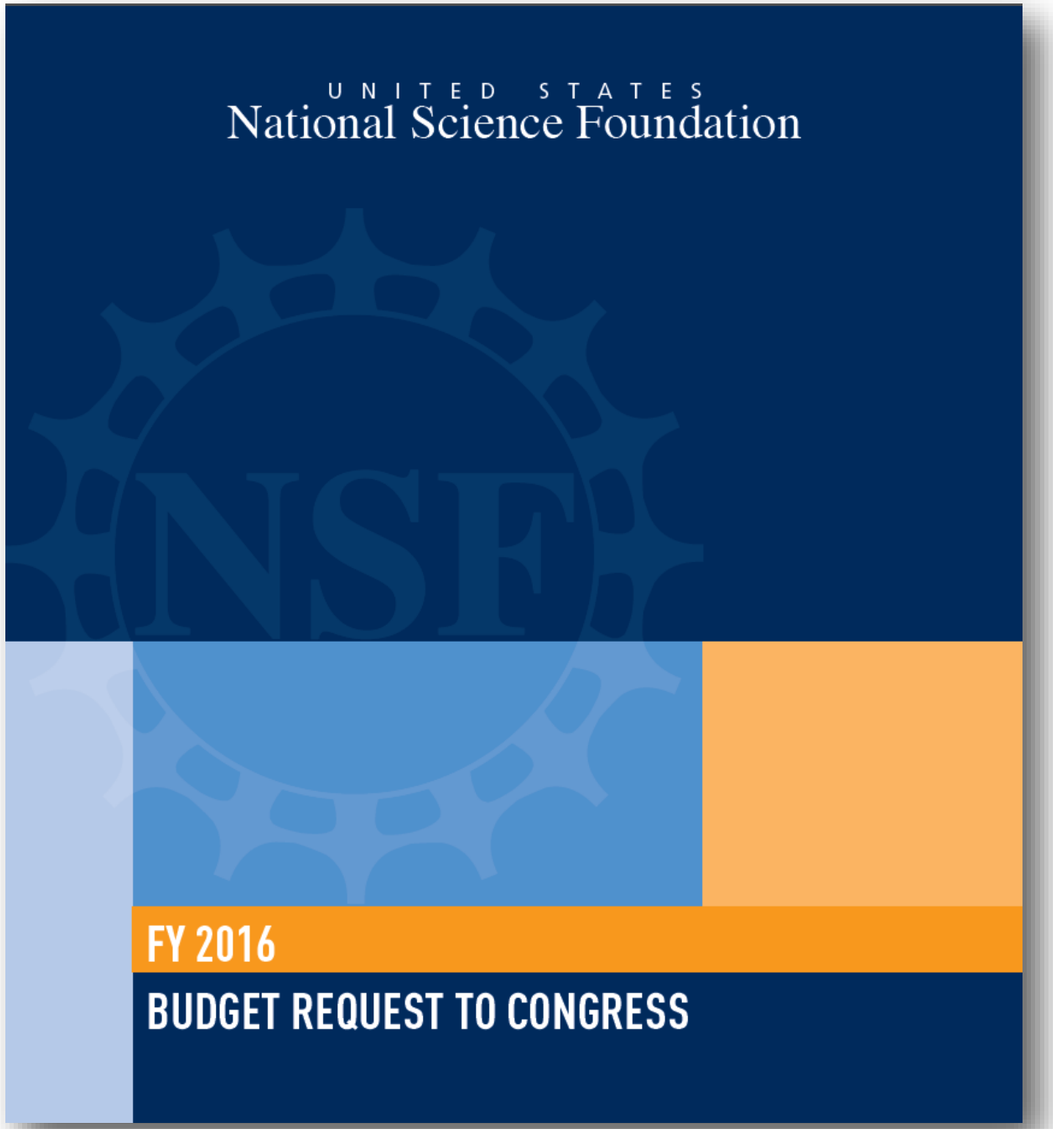
*Constant 2014$

NSF Funding History



(Note that Funding Rate has declined by 30% since 1990)

NSF FY 2016 Funding



	FY 2015 Appropriation	FY 2016 Request	
NSF	$ 7,344 M	$ 7,724 M	5.2%
R&RA	$ 5,934 M	$ 6,186 M	4.2%

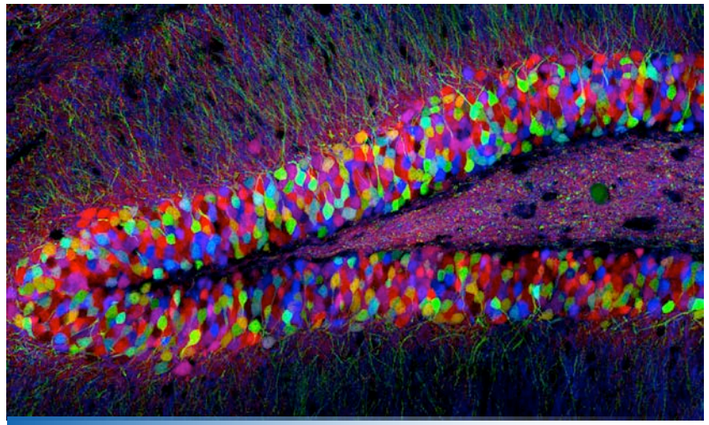
	FY 2016 Plan	
NSF	$ 7,463 M	1.6%
R&RA[1]	$ 6,010 M	1.3%

[1] The FY 2016 Plan for R&RA includes a $24 million transfer to AOAM.

NSF Addressing National Priorities

Food/Energy/Water

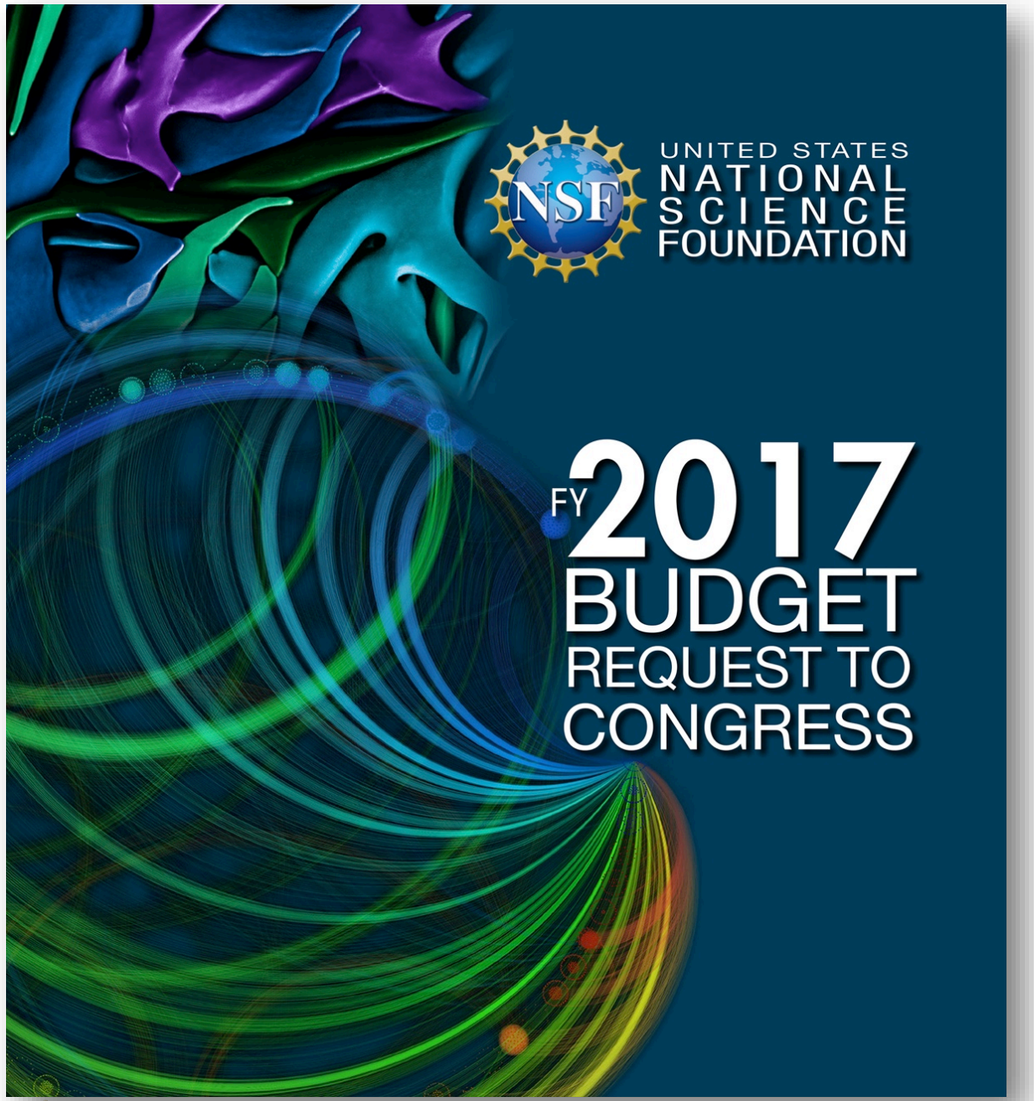
Risk and Resilience



Understanding the Brain

INCLUDES

FY 2017 Budget Request to Congress



	FY 2016 Plan	FY 2017 Request	
NSF	$ 7,463 M	$ 7,964 M	6.7%
R&RA[1]	$ 6,010 M	$ 6,425 M	6.9%
Two Components to R&RA			
Discretionary	$ 6,010 M	$ 6,079 M	1.1%
Mandatory*	--	$ 346 M	--
Total	$ 6,010 M	$ 6,425 M	6.9%

*Congress not considering Administration's proposal for this new mandatory funding.

[1] The FY 2016 Plan for R&RA includes a $24 million transfer to AOAM.

FY 2017 Request by Appropriation

	FY 2016 Estimate	FY 2017 Discretionary		FY 2017 Mandatory	FY 2017 Total	
BIO	$ 744	$ 746	0.2%	$ 45	$ 790	6.2%
CISE	936	938	0.3%	56	995	6.3%
ENG	916	946	3.3%	56	1003	9.4%
ENG Programs	*728*	*745*	*2.4%*	*45*	*789*	*8.5%*
SBIR/STTR	*189*	*202*	*7.0%*	*12*	*213*	*13.1%*
GEO	1319	1320	0.1%	79	1399	6.1%
MPS	1349	1355	0.4%	81	1437	6.5%
SBE	272	272	0.1%	16	289	6.1%
ISE	49	49	0.0%	3	52	6.0%
IA	447	451	0.9%	9	460	2.9%
US Artic Research Commission	1	1	0.0%	0	1	0.0%
Research and Related Activities	**6034**	**6079**	**0.9%**	**346**	**6425**	**6.5%**

Totals may not add because of rounding ($ in millions)

NSF Ideas for Future Investment

RESEARCH IDEAS

- Harnessing Data for 21st Century Science and Engineering
- Shaping the New Human – Technology Frontier
- Understanding the Rules of Life – Predicting Phenotype
- The Quantum Leap – Leading the Next Quantum Revolution
- Navigating the New Arctic
- Windows on the Universe – The Era of Multi-messenger Astrophysics

PROCESS IDEAS

- Growing Convergent Research at NSF
- Mid-scale Research Infrastructure
- NSF 2050

Harnessing Data for 21st Century Science and Engineering

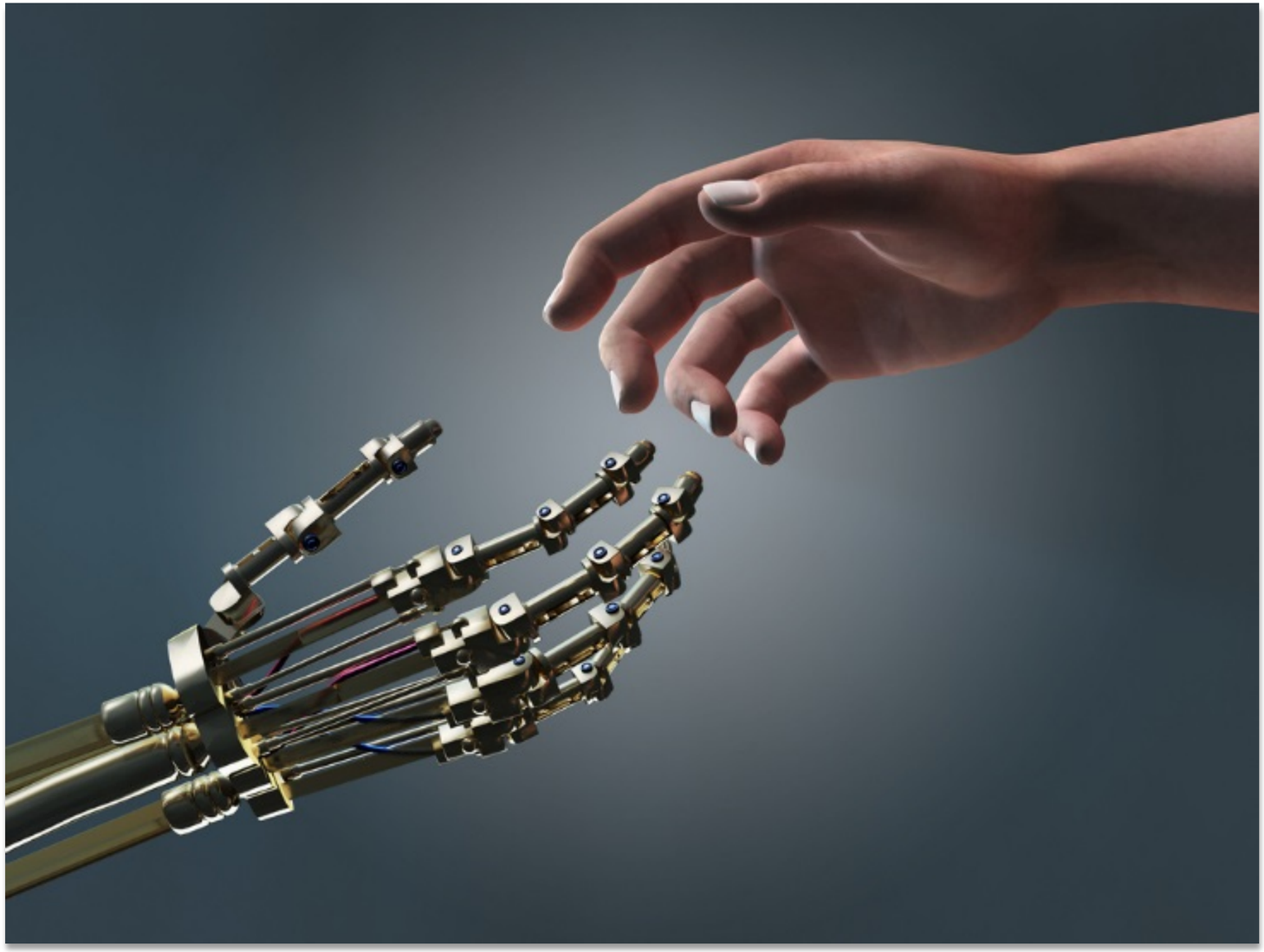
Pursue fundamental research in data science and engineering, the development of a cohesive, federated, national-scale approach to research data infrastructure, and the development of a 21st-century data-capable workforce.

NSF can uniquely lead a bold initiative to create a data-enabled future for the Nation's science, engineering and educational enterprises, and for the country more broadly.

Shaping the New Human — Technology Frontier

Designing, building and deploying the human-centered engineered systems with cognitive and adaptive capacities that are best matched to collaboration with humans, individually and in their smart-and-connected communities.

Seek to understand how technologies affect human behavior and social organizations and how technologies are and can be shaped through interactions with people and designers.

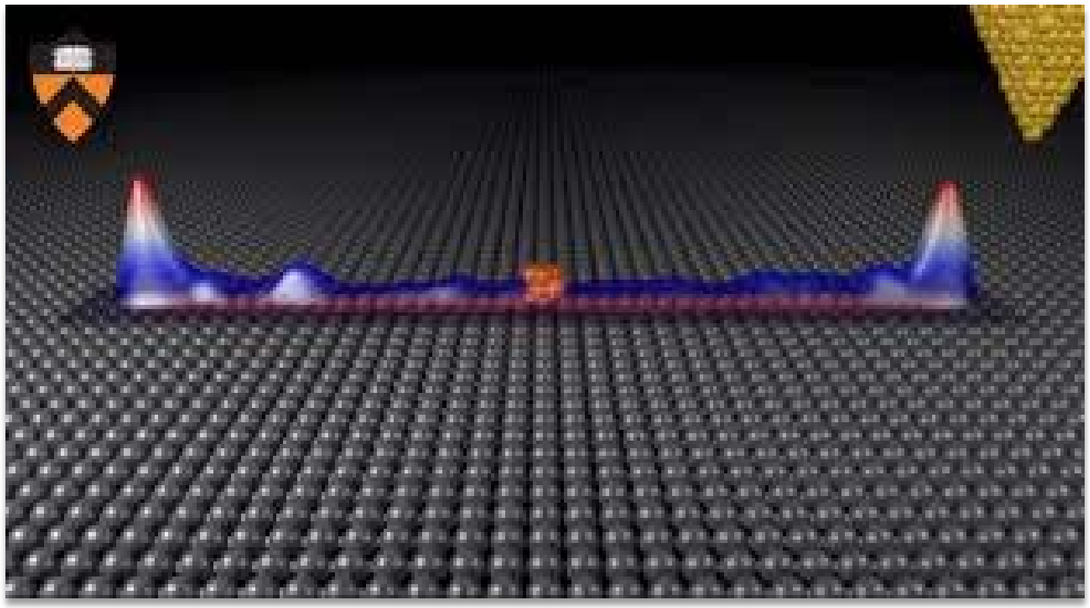


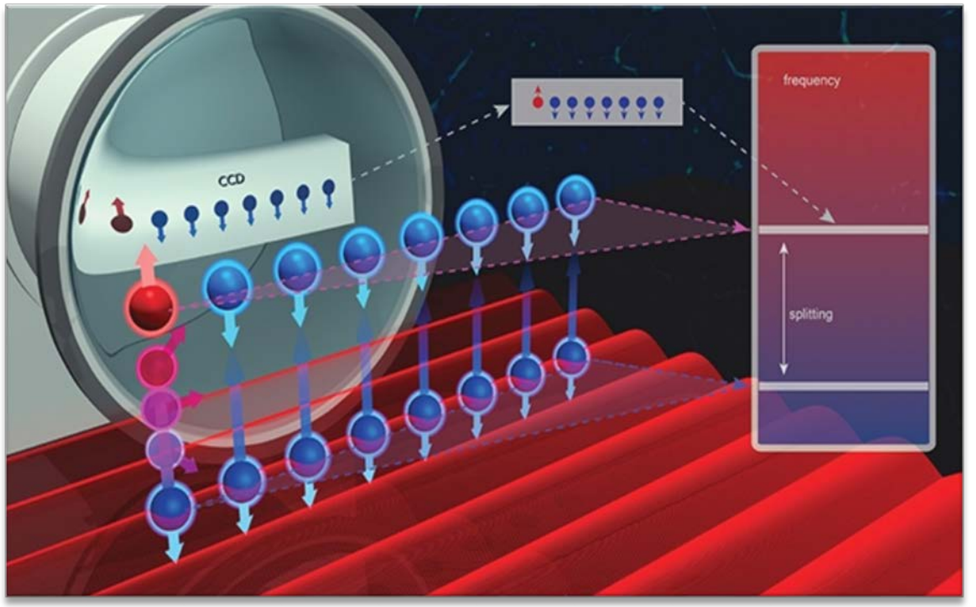
Understanding the Rules of Life – Predicting Phenotype

The universally recognized **biggest gap** in our biological knowledge **is our inability to predict the phenotype of a cell or organism** from what we know about the genome and environment.

We simply **do not understand the rules** that govern phenotypic emergence at this scale. To understand the "rules of life" will require fundamental research across biology, computer science, mathematics, the physical sciences, behavioral sciences and engineering

The Quantum Leap – Leading the Next Quantum Revolution





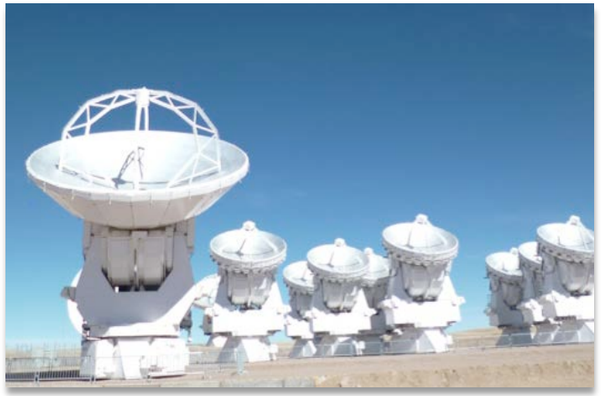
Quantum mechanics is a powerful concept that has led to many of the transformative technologies of today. The **next quantum revolution will exploit quantum phenomena**, such as superposition, entanglement, and squeezing, to capitalize on the rich behavior of many---body systems.

Navigating the New Arctic

Vast and rapid environmental changes in the Arctic will have a **climactic effect** on the rest of the planet and also bring **new global access** to the Arctic's natural resources. Knowledge of the changes underway and their potential local and global effects is incomplete.

An observing network of mobile and fixed platforms and tools across the Arctic is needed to **document** biological, physical and social changes, and **invest further in theory, modeling and simulation** of this changing ecosystem and its broader effects on the planet.

Windows on the Universe –
The Era of Multi-messenger Astrophysics



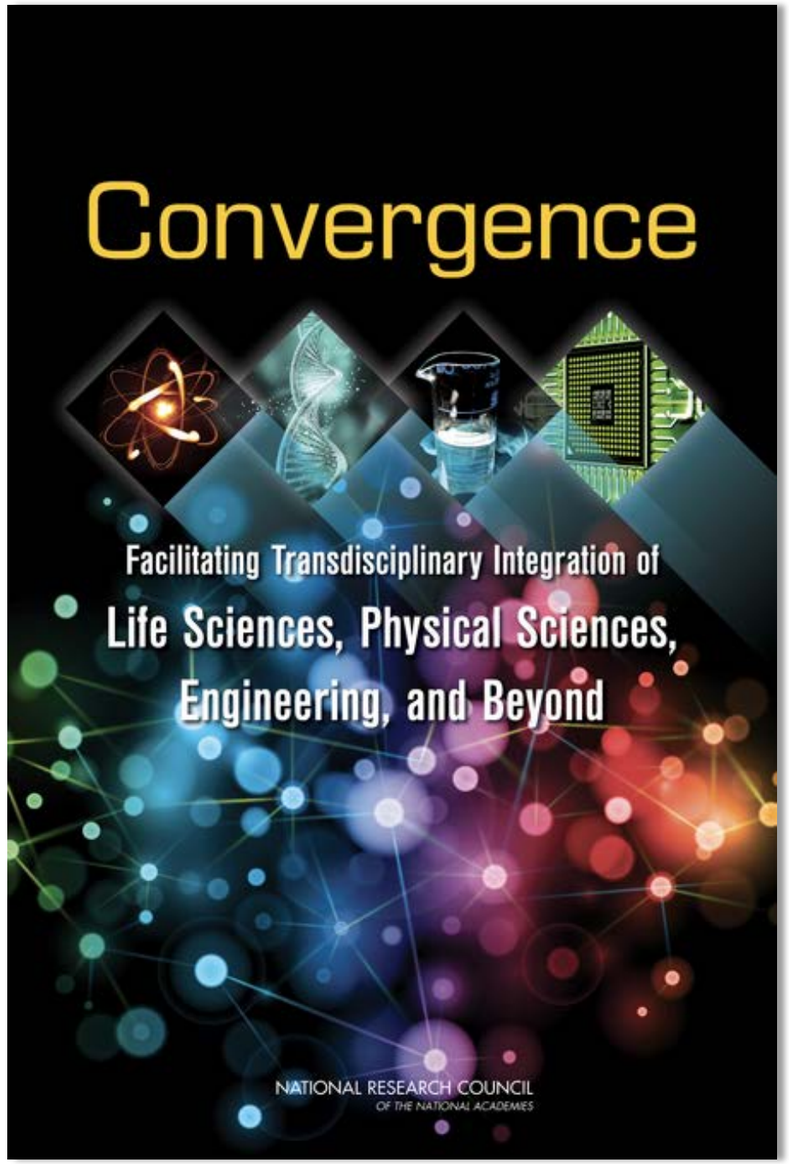
Observing the cosmos through **three different windows** – opened by detecting electromagnetic waves, gravitational waves, and particles – can answer some of the most profound questions before humankind.

- How did the universe begin?
- What is the unseen matter that constitutes much of the universe?

Growing Convergent Research at NSF

"The key message of convergence, however, is that **merging ideas, approaches, and technologies from widely diverse fields of knowledge at a high level of integration** is one crucial strategy for solving complex problems and addressing complex intellectual questions underlying emerging disciplines." – **NAS report**

To support convergence research, **NSF would address the key technical, organizational and logistical challenges** that hinder truly interdisciplinary research.



Mid-scale Research Infrastructure

Rapidly changing patterns of research require a **new approach to research infrastructure** for NSF'S science and engineering activities.

The funding structure available at NSF ranges from relatively small research infrastructure projects through the **Major Research Instrumentation** (MRI) program, to larger projects through the **Major Research Equipment and Facilities Construction** (MREFC) funding. Missing that opportunity leaves essential science undone.

NSF 2050

NSF wants to create a breakthrough scientific pathway to its centennial in 2050. With this initiative NSF would **dedicate a special fund to invest in bold foundational research questions that are large in scope, innovative in character, originate outside of any particular directorate, and require a long-term commitment**.

NSF 2050 would **invite community input** into long-term program development, and capture the imagination of critical stakeholders.

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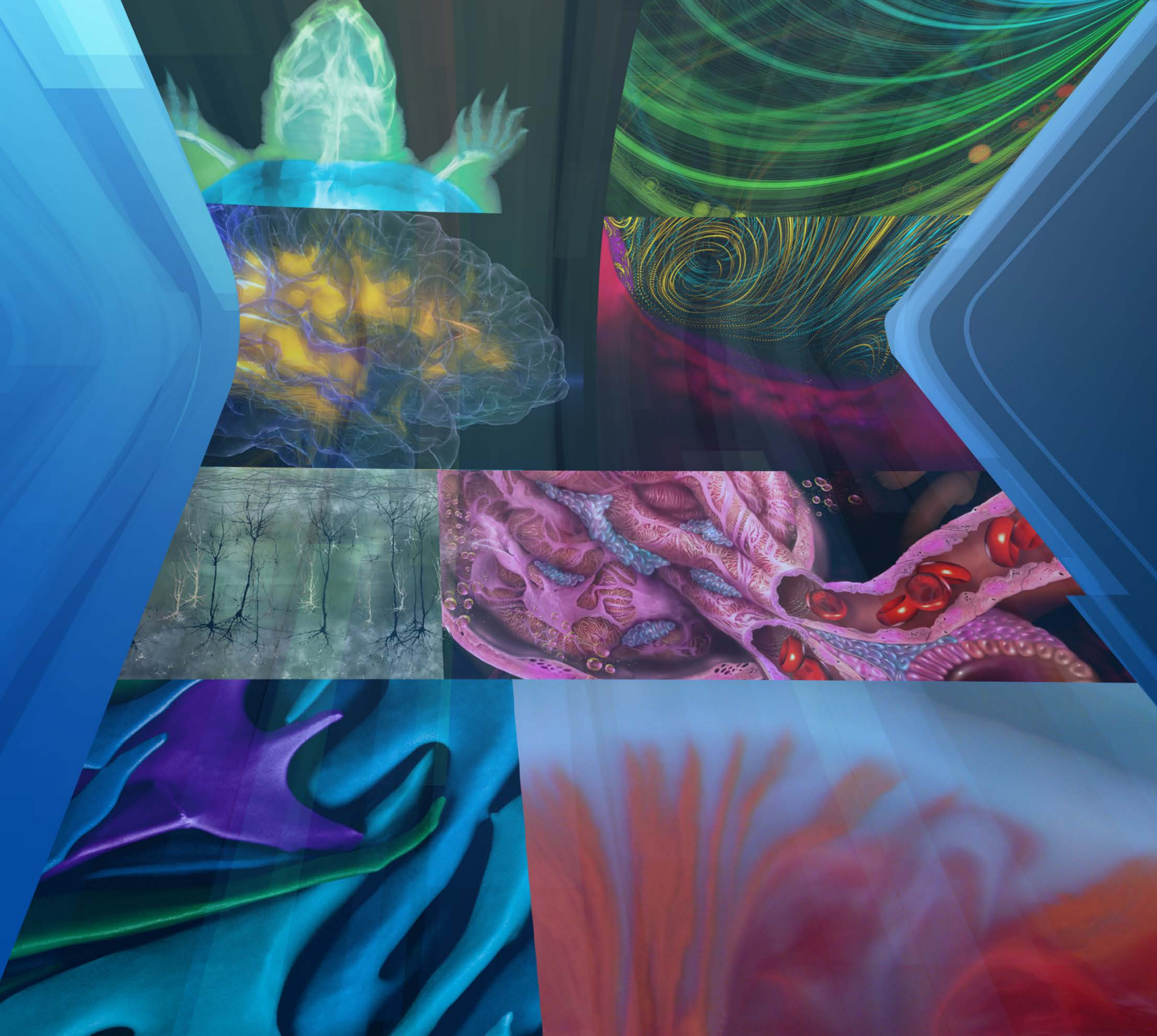

Supporting basic research
to create knowledge that
transforms our future

⬇

Drives the economy
Enhances our security
Sustains global leadership

FY 2017 Request by Appropriation

	FY 2016 Estimate	FY 2017 Discretionary		FY 2017 Mandatory	FY 2017 Total	
Research & Related Activities	$ 6034	$ 6079	0.8%	$ 346	$ 6425	6.5%
Education & Human Resources	880	899	2.1%	54	953	8.3%
Major Res Equip & Facilities Const.	200	193	-3.6%		193	-3.6%
Agency Operations & Award Mgmt.	330	373	13%		373	13%
National Science Board	4	4			4	
Office of the Inspector General	15	15			15	
Total NSF	**$ 7463**	**$ 7564**	**1.3%**	**$ 400**	**$ 7964**	**6.7%**

Totals may not add because of rounding ($ in millions)