March 2, 2016

Guide to FY2017 Research Funding at the National Science Foundation (NSF)

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Since NSF is reasonably familiar to most people at USC, this Guide addresses only the new, or significantly changed, opportunities. NSF's FY 2017 President's Budget Request is $7.96 billion, an increase of $500 million (6.7 percent) over the FY 2016 Estimate. But $400M of the increase is to be realized by "mandatory funding," a budgetary "supplement" that bypasses the agreed upon caps on discretionary funds and is unlikely to be supported by Congress. NSF's FY 2017 Budget Request includes two areas of major emphasis: Clean Energy R&D and, with the $400M, strengthening support for core activities, with a special focus on support for early career investigators.

NSF Directorate Budgets ($M)

Account	FY2015 Actual	FY2016 Estimate	FY2016 Request	FY2017 request
BIO	736	744	748	791
CISE	933	936	954	994
ENG	924	916	949	1003
GEO	1319	1318	1365	1399
MPS	1376	1349	1366	1436
SBE	276	272	291	289
EHR	886	880	963	953
OISE	48	49	51	52
IA	427	447	425	460
Total, NSF	7398	7463	7724	7964

NSF-wide FY2017 Programs ($M)

Program	**Total**	**BIO**	**CISE**	**ENG**	**GEO**	**MPS**	**SBE**	**OISE**	**EHR**	**IA**
Cross-Foundation										
INFEWS	62 (+14)	10	6	13	10	6	5	1	6	
Risk and Resilience	43 (+2)		6	14	18	1	5			
INCLUDES	16 (+0.5)	1	2	1	2	3	1			2
Foundation-Wide										
UtB	142 (-5)	46	24	17		19	25	1	11	
SaTC	150 (+20)		71	3		2	4		70	
Presidential Initiative										
NSCI (follow on to CIF21)	33		20	10	4					
Clean Energy	512 (+141)	79	46	177		195		2		

Those programs that have a precedent in FY2016 indicate the program change in the parenthesis

Cross Foundation

Innovations at the Nexus of Food, Energy, and Water Systems (INFEWS)
From $49M to $62M in 2017
Investments to understand, design, and model the interconnected food, energy, and water system through an interdisciplinary research effort that incorporates all areas of science and engineering and addresses the natural, social, and human-built factors involved. This is a follow-on program to Science Engineering and Education for Sustainability (SEES).

Risk and Resilience
From $41M to $43M in 2017
Investments to improve predictability and risk assessment and increase resilience to extreme natural and manmade events in order to reduce their impact on quality of life, society, and the economy.

Inclusion across the Nation of Communities of Learners that have been Underrepresented for Diversity in Engineering and Science (INCLUDES)
From $16M to $16M in 2017
A six year NSF program initiated in FY2016. Investments toward attaining an integrated, national initiative to increase the preparation, participation, advancement, and potential contributions of those who have been traditionally underserved and/or underrepresented in the science, technology, engineering, and mathematics (STEM) enterprise. It is expected to pilot two different models (NSF 16-544)

- Network Pilot – collective impact via professional and social networks & use of effective technologies
- Youth Empowerment Pilot – engaging youth in STEM through innovative, discipline-specific initiatives

In FY2017 NSF will invite proposals to form Alliances. The formation of these alliances will build on the activities started in FY 2016. It is expected that up to five alliances will be funded for 5 years, at up to $2.5M/yr each. There will be an expectation that each Alliance proposal will build from a Design and Development Launch Pilot that develops and adds new partners, collaborators, or networks.

Foundation Wide

Understanding the Brain (UtB)
From $147M to $142M in 2017
Investments to enable scientific understanding of the full complexity of the brain in action and in context. Priorities include: development of innovative technologies, tools and instrumentation, computational infrastructure, theory, and models to understand the brain; increased understanding of relationships between neuronal activity, cognitive processes, and behavior; exploration of links between environment, behavior, and brain function; and training for the next generation of neuroscientists and neuroengineers. A

new solicitation for Neuro-Tech Hubs, in partnership with BIO, MPS and CISE, will be issued to further support the development of a brain observatory.

Secure and Trustworthy Cyberspace (SaTC)
From $130M to $150M
Through a focus on long-term, foundational research, SaTC will develop the scientific foundations for cybersecurity research for years to come. SaTC also focuses on the training of the next generation cybersecurity workforce, especially for government.

Presidential Initiative

National Strategic Computing Initiative (NSCI)
From "0" to $33M
As the Cyberinfrastructure for the 21st Century (CIF21) program sunsets in FY 2017, NSF will develop a subsequent, focused set of activities aligned with the Administration's new NSCI in order to focus efforts on advancing the Nation's computational infrastructure for science and engineering research. Since there will be redirection of some funds, this effort does not truly start from zero dollars.

CISE will co-lead the NSF-wide NSCI activity with MPS, and will represent NSF in its leadership role across the federal government. The goal of NSCI is to maximize the benefits of HPC for scientific discovery and economic competitiveness. Under NSCI, CISE will enable advances in HPC systems and maximize their benefits through deep integration of HPC cyberinfrastructure with science and engineering research along a number of key fronts, including increasing coherence between the technology base used for modeling and simulation and that used for data analytics; establishing a viable path forward for HPC systems in the post Moore's Law device and hardware era; and increasing Directorate for Computer and Information Science and Engineering the capacity, capability, and sustainability of an enduring national HPC ecosystem, including addressing foundational algorithms and software, networking technology, accessibility, workflow, and workforce development.

ENG will support research to enable low-power computing and future high-performance computing (HPC) systems in the post-Moore's Law device and hardware systems era, partially supported by funds redirected from CIF21.

GEO will emphasize, through NSCI, activities to analyze the large complex data sets generated through modeling and simulations, and to assimilate real-time data into models and forecasts.

Clean energy
From "0" to $79M
The President joined other world leaders at the recent Paris climate negotiations to launch Mission Innovation, a landmark commitment to dramatically accelerate public and private global clean energy innovation, by investing in new technologies that will define a clean,

affordable, and reliable global power mix. NSF's clean energy portfolio supports research and education in innovative renewable and alternative energy sources for electricity (solar, wind, wave, geothermal) and fuels (chemical and biofuels). NSF funding also addresses the collection, conversion, storage, and distribution of energy from diverse power sources, including smart grids; the science and engineering of energy materials; and energy use and efficiency, including for computing systems. Since there will be redirection of funds, this effort does not truly start from zero dollars.

BIO support for fundamental research in areas such as systems and synthetic biology to streamline and scale the metabolic and energetic potential of living organisms (e.g., microbes, fungi, algae, and plants) to produce non-petroleum based sources of important chemicals/materials, feed stocks, and fuels. Bioinspired design of new proteins and other complex biomaterials that can transform light into energy will also be supported. Investigations to assess the impact of fuel and/or bio-renewable chemical production on genome stability, fitness, and phenotype of the production organisms are of interest, as are studies to assess the potential environmental impacts of these technologies.

CISE support for foundational research in energy-intelligent computing; the development of new theory, algorithms, and design principles to investigate energy versus computation and communication tradeoffs; and the scalability and sustainability of smart energy production software and hardware.

CHE funding includes hydrogen, fuel cells, biomass, solar energy, hydrocarbon conversion, the capture and use of CO2, and energy storage

DMS funding will support fundamental materials research that enables advances in hydrogen production, fuel cells, biomass, solar energy, hydrocarbon conversion, the capture and use of CO2, and energy storage

ENG support of clean energy technology-related activities will enhance the fundamental scientific and engineering knowledge base to enable future clean energy technologies.

Directorate Programs

BIO

Rules of Life (+$13M)

Support for this new emphasis includes research areas such as the genotype to phenotype challenge, plant and microbial sciences, including the study of microbiomes, synthetic biology, origins of life, and developing biological theory as a framework for the rules of life. Quantitative approaches that integrate the mathematical and physical sciences, computer science, and engineering into advancing basic biological understanding underpinning the study of the rules of life will be encouraged.

National Ecological Observatory Network (NEON) (+$21M)
Funding for early NEON science, including continuing support for the MacroSystems Biology (MSB) program, remains a priority. NSF is in the process of evaluating new managing organizations for NEON operations and maintenance.

CISE

Data for Scientific Discovery and Action (D4SDA)
Data for Scientific Discovery and Action (D4SDA) is a cross-directorate investment supporting Large-Scale Data Management and Analysis. CISE will lead the D4SDA activity, which will begin enabling 21st-century science, engineering and education to move toward effective use of digital data to advance discovery through activities that promote foundational research in critical techniques and technologies; supporting high-priority, data-intensive science with innovative, reusable data and knowledge infrastructures; enabling and incenting scientific communities to address data governance issues and research data lifecycle issues in alignment with NSF's Public Access Plan; and educating the future data-savvy workforce of scientists, engineers, and educators.

ENG

There will be a FY2017 competition for 4 new Engineering Research Centers.
In FY 2015, NSF funded the National Academy of Engineering (NAE) in collaboration with the National Research Council (NRC) to study "The Future of Center-Based, Multidisciplinary Engineering Research." This topic arises from discussions NAE held with the NRC on the future of NSF's center-based, multidisciplinary engineering research. The project will articulate a new vision for NSF's center-based research over the next two decades, identify needs and gaps in current NSF Centers approaches, and provide guiding principles and possible strategies for implementing the new vision. A report is expected in FY 2017.

GEO

OCE's budget for disciplinary and interdisciplinary research will increase by $17M, which reflects bolstering ocean science research programs as per Sea Change recommendations, and also through specific investment in studying ocean-based mechanisms active along the land/ocean interface (e.g., sea level change over local, regional, and global scales).

MPS

Centers for Chemical Innovation
Funding is expected to support nine Phase II centers and up to three Phase I awards selected in a new competition planned for FY 2017. In FY 2017, CHE will initiate an evaluation of the Centers for Chemical Innovation (CCI) program. Results are expected to be used to inform the design of future solicitations and center oversight. Final results are expected in FY 2019.

Materials Research Science and Engineering Centers (MRSEC)
To be funded in FY 2017 through the solicitation, NSF 16-545, nine current centers are expected to re-compete along with about 80 new applicants.

EHR

STEM Learning (+$27M)

This program will continue to expand and deepen the portfolio of foundational STEM education research on learning, learning environments, broadening participation, and the STEM professional workforce. An area of emphasis within the learning and learning environments theme for FYs 2016 and 2017 will be early childhood STEM learning, which will be highlighted in EHR Core Research (ECR) along with the Research in Disabilities Education and Research on Gender in Science and Engineering emphases. Increased funding will enable more strategic and coordinated research investment in areas of high importance for improving STEM learning across all of the Nation's demographics, including new knowledge about how to successfully develop talent in groups that have traditionally been underrepresented in STEM. The Research on Learning in Formal and Informal Settings Division (DRL) will also provide new direction for partnerships with science-rich entities funded across the NSF, such as large facilities, and centers, in order to explore the potential of these learning environments for engaging and exciting STEM learners of all ages, and for enhancing data infrastructure to advance STEM education research.

STEM Learning Environments (+$8M)

The Division of Undergraduate Education (DUE) has leadership for this ECR focus area. The increase will support foundational research and related development for the improvement of STEM learning environments, including cyberlearning, as well as the use of data science to understand and improve learning environments.

Acronyms

BIO	Biological Sciences Directorate
CHE	Chemistry Division (in MPS)
CIF21	Cyberinfrastructure for the 21st Century (NSF program)
CISE	Computer and Information Sciences Directorate
D4SDA	Data for Scientific Discovery and Action
DMS	Division of Mathematical Sciences (in MPS)
DRL	Division of Research in Learning (in EHR)
DUE	Division of Undergraduate Educations (in EHR)
ECR	Education Core Research (in EHR)
EHR	Education and Human Resources Directorate
ENG	Engineering Directorate
GEO	Geosciences Directorate
HPC	High Performance Computing
IA	Integrative Activities, in the Office of International and Integrative Activities
INCLUDES	Inclusion across the Nation of Communities of Learners that have been Underrepresented for Diversity in Engineering and Science (NSF program)
INFEWS	Innovations at the Nexus of Food, Energy and Water Systems
MPS	Mathematics and Physical Sciences Directorate
MRSEC	Materials Research Science and Engineering Center
MSB	Macro Systems Biology
NEON	National Ecological Observatory Network
NSCI	National Strategic Computing Initiative
OCE	Ocean Science Division (in GEO)
OISE	Office of International Science and Engineering
SaTC	Secure and Trustworthy Cyberspace
SBE	Social, Behavioral and Economics Directorate
SEES	Science, Engineering, and Education for Sustainability
STEM	Science, Technology, Engineering and Mathematics
UtB	Understanding the Brain