

NATIONAL SCIENCE FOUNDATION CENTERS

NSF supports a variety of centers programs that contribute to the Foundation's mission and vision. Centers exploit opportunities in science, engineering, and technology in which the complexity of the research program or the resources needed to solve the problem require the advantages of scope, scale, duration, equipment, facilities, and students. Centers are a principal means by which NSF fosters interdisciplinary research.

NSF Centers (Dollars in Millions)

	Program Initiation	Number of Centers in FY 2014	FY 2014 Actual	FY 2015 Estimate	FY 2016 Request	Change Over FY 2015 Estimate	
						Amount	Percent
Centers for Analysis & Synthesis	1995	4	\$21.55	\$20.90	\$18.60	-\$2.30	-11.0%
Centers for Chemical Innovation	1998	11	35.49	30.51	32.00	1.49	4.9%
Engineering Research Centers	1985	16	70.06	64.50	56.50	-8.00	-12.4%
Materials Centers ¹	1994	24	24.82	56.00	56.00	-	-
Nanoscale Science & Engineering Centers	2001	6	14.43	12.20	8.18	-4.02	-33.0%
Science & Technology Centers	1987	14	58.41	48.42	59.99	11.57	23.9%
Science of Learning Centers ²	2003	6	19.34	7.01	-	-7.01	-100.0%
Totals		81	\$244.11	\$239.54	\$231.27	-\$8.27	-3.5%

Totals may not add due to rounding.

¹ Due to end-of-fiscal year deadlines, \$29.81 million in funding for new Materials Center awards was carried over from FY 2014 and obligated in early FY 2015.

² The Science of Learning Centers program will sunset in FY 2015, when the last two centers reach the end of their ten-year funding cycles.

Description of Major Changes

Centers for Analysis and Synthesis – BIO

At the FY 2016 Request, three Centers for Analysis and Synthesis are expected to be funded at \$18.60 million (\$2.30 million below FY 2015 Estimate). These centers are described below.

Funding provided to the University of Maryland College Park for the Socio-Environmental Synthesis Center (SESync) is \$6.0 million, equal to the FY 2015 Estimate. This Center uses synthetic approaches to advance the frontiers of scientific understanding of environmental complexity in order to anticipate and manage emerging environmental change impacting many national and global issues, such as water security. This award will undergo renewal review in FY 2015 for FY 2016 funding, so support will be contingent upon a successful review.

Funding for the Plant Science Cyberinfrastructure Collaborative (iPlant) is \$9.0 million, a \$2.0 million decrease below the FY 2015 Estimate. The iPlant Center is led by scientists at the University of Arizona, the Texas Advanced Computing Center, Cold Spring Harbor Laboratory and University of North Carolina at Wilmington and enables new conceptual advances through integrative, computational thinking to address an evolving array of grand challenges in the plant sciences, including innovative approaches to education, outreach, and the study of social networks. The \$2.0 million reduction is part of this center's planned ramp-down as FY 2016 is the penultimate year of its 10 years of funding.

NSF support to the University of Tennessee Knoxville for the National Institute for Mathematical and Biological Synthesis (NIMBioS) is \$3.60 million, a \$300,000 decrease below the FY 2015 Estimate. This decrease is part of the planned ramp down phase of the center which will have its last year of funding in FY 2017. Funding includes a small contribution from the MPS Division of Mathematical Sciences. At NIMBioS, top researchers from around the world collaborate across disciplinary boundaries to find creative solutions to today's complex biological problems. A major goal of mathematical models and analysis in biology is to provide insight into the complexities arising from the non-linearity and hierarchical nature of biological systems. The education and outreach program focuses on the interface between mathematics and biology and promotes cross-disciplinary approaches to science for learners of all ages.

Centers for Chemical Innovation (CCI) – MPS

The CCI program is designed to address major, long-term fundamental chemical research challenges attracting broad scientific and public interest, as well as to provide a rich environment for education, outreach, and innovation. The CCIs deliver career-shaping educational opportunities for undergraduate and graduate students and for postdoctoral researchers, including collaborative research and mentoring, cross-disciplinary training, international research experiences, entrepreneurial and innovation training, and communication training. Beginning in 2014, two CCIs extended summer research opportunities to military veterans as part of their broadening participation plans.

CCIs are committed to broadening participation and use various strategies including institutional partnerships to meet their goals. The CCI Program supports the CCI Managing Directors Forum and the Education Coordinators Group and held a program-wide meeting in November 2014. The CCI Program is planning a comprehensive program evaluation in FY 2016 - 2017.

The program is currently structured as a two-phase competition. Phase I centers are funded for three years and may compete for larger Phase II awards, which are funded for five years at a level of \$4.0 million per year with the opportunity to be renewed for an additional five years, after which they sunset.

Phase I competitions were not held in FY 2013 or FY 2014 and are not planned for FY 2015 or FY 2016. Three Phase I CCIs, funded as standard awards in FY 2012, will be competing for the new FY 2015 Phase II award. There will not be a new competition for Phase II awards in FY 2016, although one existing Phase II award will be under consideration for renewal. The anticipated CCI Phase II portfolio in FY 2016 will include seven continuing awards and up to two awards (new/renewal) from the FY 2015 competition.

In FY 2016 no more than nine Phase II CCIs will be funded at \$32.0 million (\$1.49 million below FY 2015 Request). Total funding required to support nine CCIs in FY 2016 is \$36.0 million. Of this total, \$32.0 million is provided in this submission. The remaining \$4.0 million will be provided via co-funding and forward funding in previous years.

Engineering Research Centers (ERC) – ENG

NSF's ERCs enable innovation, bridging the energy and intellectual curiosity of university research focused on discovery with real-world engineered systems and technology opportunities through partnerships with industry. These centers also are successful in educating a technology-enabled workforce with hands-on real-world experience. ERCs can be funded for up to ten years if they clear two renewal reviews, one in year-three to determine if they are structured effectively to deliver on program goals, and another in year-six to determine if they are delivering effectively, making an impact, and tackling challenging tasks to warrant further support.

The ERC program periodically commissions external, program-level evaluations to determine the effectiveness of ERC graduates in industry and the benefits of ERC membership to industry and others.¹ This includes the Post-Graduation Status of Engineering Research Centers – 2010 (SciTech Communications). This study, augmented by a recent update, found that of the 35 ERCs that graduated from NSF support after 10 years, 29 (83 percent) are self-sustaining with strong financial support and most ERC features in place.

At FY 2016 Request, 15 ERCs will be funded at \$56.50 million (\$8.0 million below the FY 2015 Estimate). Decreased support from the FY 2015 Estimate will result in a reduction in the number of centers from 19 to 15 as the program is between competition years in FY 2016. The next class of ERCs will be funded in FY 2017. Funding and numbers of centers include three Nanosystems ERCs that were first supported in FY 2012. This funding level will also allow supplemental funding opportunities creating links with industry and/or other stakeholders to be established or restored within this program.

Materials Centers – MPS

Materials Research Science and Engineering Centers (MRSECs) advance materials research and provide students with an interdisciplinary education, including global experiences. These centers address fundamental research problems of intellectual and strategic importance that will advance U.S. competitiveness and the development of new technologies.

At FY 2016 Request, \$56.0 million (no change from the FY 2015 Estimate) will support 21 MRSECs. There are nine continuing awards from the FY 2011 competition, and one new award and eleven (2008 cohort) renewals from the 2014 competition. Three MRSECs were provided phase-out money as a result of the FY 2014 competition. MRSEC competitions are usually held every three years, the latest in FY 2014. Awards are typically \$1.60 to \$3.60 million per year.

The MRSEC program continues support of the Materials Research Facilities Network (MRFN), which links the instrumentation and subject matter expertise of MRSECs to the larger materials community as well as encourages MRSEC-to-MRSEC collaborations. The MRSEC program also continues to support the interaction of MRSEC Education Coordinators with the NSF Directorate for Education and Human Resources/Division of Research on Learning in Formal and Informal Settings to formulate methodologies for standardizing outreach program assessment and evaluation.

Finally, MRSECs interact with minority serving institutions through the Partnership for Research and Education in Materials (PREM) program. In FY 2015, there will be 14 active PREM awards at NSF, all of which are connected to MRSECs. Awards to eight of the 14 PREMs will expire, so they must compete with new applicants in FY 2015. The total number of PREMs is not expected to significantly change with the FY 2015 competition. MRSECs are encouraged to develop initiatives and/or educational programs to broaden participation. One example is the MRSEC to Harvard University, which, in partnership with Bunker Hill Community College, encourages military veterans to participate in STEM fields.

Nanoscale Science and Engineering Centers (NSEC) – ENG

Nanotechnology, which addresses the smallest of scales, is projected to be one of the largest drivers of technological innovation for the next decade and beyond. This potential was recognized in the National Nanotechnology Initiative (NNI), particularly in the burgeoning area of nanomanufacturing. Research at the nanoscale, through NSF-funded NSECs, aims to advance the development of the ultra-small technology that will transform electronics, materials, medicine, environmental science, and many other fields. Each center has an extended vision for research. Together they provide coherence and a long-term outlook to U.S. nanotechnology research and education and also address the social and ethical

¹ <http://erc-assoc.org/content/erc-program-evaluations-and-case-studies-program-impact>

implications of such research. NSEC funding supports education and outreach programs from K-12 to the graduate level, which is designed to develop a highly skilled workforce, advance pre-college training, and further public understanding of nanoscale science and engineering. NSECs have strong partnerships with industry, national laboratories, and international centers of excellence, which puts in place the necessary elements to bring discoveries in the laboratory to real-world, marketable innovations and technologies.

The FY 2016 Request is \$8.18 million (\$4.02 million below the FY 2015 Estimate). This will support two continuing NSECs. The decrease is primarily due to one center receiving the final year of NSF funding in FY 2015. NSEC support will continue to decline as NSECs graduate and transition to Nanosystems Engineering Research Centers (see the Engineering Research Center section above). No new NSEC competitions are planned.

Science and Technology Centers: Integrative Partnerships (STCs) - multi-directorate

The Science and Technology Centers: Integrative Partnerships program advances interdisciplinary discovery and innovation in science and engineering through the integration of cutting-edge research, excellence in education, targeted knowledge transfer, and the development of a diverse workforce. The STC portfolio reflects NSF-supported disciplines. Examples include: understanding the brain; engineering of biological systems; energy-efficient electronics; global and regional environmental systems – sustainability and change; new ways of handling the extraction, manipulation, and exchange of information; cyber security; and new materials for optical and electronic applications. STCs engage the Nation’s intellectual talent and collaborate with partners in academia, industry, national laboratories, and government. STCs strengthen the caliber of the Nation’s science, technology, engineering, and mathematics workforce through challenging research experiences for students, postdoctoral fellows, researchers, and educators; and advance public scientific understanding through partnerships with K-12 and informal education communities.

The FY 2016 Request of \$59.99 million will support eight existing STCs and the administrative costs associated with program management and oversight. Awards range from \$4.09 million per year for an award in the 2010 cohort to \$5.0 million per year for remaining 2010 and 2013 cohorts. Awards are for five years, with possible renewal for an added five years, or ten years total. In FY 2014, a solicitation for a new STC class was issued to replace the sunsetting 2005/2006 cohort. About 260 proposals were received with the expectation of making four new awards in FY 2016 for a total of \$20.0 million.

Estimates for Centers Participation in 2014

	Number of Participating Institutions	Number of Partners	Total FY 2014 NSF Support (in millions)	Total Leveraged Support (in millions)	Number of Participants
Centers for Analysis & Synthesis	1,978	744	\$22	\$21	12,423
Centers for Chemical Innovation	81	75	\$35	\$3	741
Engineering Research Centers	719	388	\$70	\$131	4,863
Materials Centers ¹	394	301	\$25	\$47	4,512
Nanoscale Science & Engineering Centers	653	590	\$14	\$44	4,500
Science & Technology Centers	201	218	\$58	\$38	2,166
Science of Learning Centers	79	102	\$19	\$34	952

¹ Total FY 2014 NSF Support excludes \$29.81 million carried over from FY 2014 to FY 2015.

No. of Participating Institutions: All academic institutions participating in activities at the centers.

No. of Partners: The total number of non-academic participants, including industry, states, and other federal agencies at the centers.

Total Leveraged Support: Funding for centers from sources other than NSF.

Number of Participants: The total number of people who use center facilities, not just persons directly support by NSF.

Centers Supported by NSF in FY 2014

Center	Institution	State
Centers for Analysis and Synthesis		
National Evolutionary Synthesis Center	Duke, NC State U, U of N. Carolina	NC
National Institute for Mathematical & Biological Synthesis	U of Tennessee	TN
Plant Science Cyberinfrastructure Collaborative	U of Arizona	AZ
SocioEnvironmental Synthesis Center	U of Maryland	MD
Centers for Chemical Innovation		
CCI Solar Fuels (phase II)	California Institute of Tech	CA
Center for Aerosol Impacts on Climate and Environment (phase I)	U of California-San Diego	CA
Center for Chemical Evolution (phase II)	Georgia Institute of Tech	GA
Center for Enabling New Technologies through Catalysis (phase II)	U of Washington	WA
Center for Selective C-H Functionalization (phase II)	Emory	GA
Center for Sustainable Materials Chemistry (phase II)	Oregon State	OH
Center for Sustainable Nanotechnology (phase I)	U of Wisconsin	WI
Center for Sustainable Polymers (phase I)	U of Minnesota-Twin Cities	MN
Center for Sustainable Renewable Feedstocks (phase I)	U of California-Santa Barbara	CA
Chemistry at the Space-Time Limit (phase II)	U of California-Irvine	CA
CO ² as a Sustainable Feedstock for Chemical Commodities (phase I)	Brown	RI
Engineering Research Centers		
Advanced Self-Powered Systems of Integrated Sensors and Technologies	North Carolina State U	NC
Biorenewable Chemicals	Iowa State	IA
Center for Ultra-wide-area Resilient Electric Energy Transmission Network (CURENT)	U of Tennessee	TN
Compact and Efficient Fluid Power	U of Minnesota	MN
Future Renewable Electric Energy Delivery and Management Systems	North Carolina State	NC
Integrated Access Networks	U of Arizona	AZ
Mid-Infrared Technologies for Health and the Environment	Princeton	NJ
Nanomanufacturing Systems for Mobile Computing and Mobile Energy Technologies	University of Texas-Austin	TX
Quantum Energy and Sustainable Solar Technologies (QESST)	Arizona State	AZ
Re-inventing the Nation's Urban Water Infrastructure	Stanford	CA
Revolutionizing Metallic Biomaterials	North Carolina A&T U	NC
Sensorimotor Neural Engineering	U of Washington	WA
Smart Lighting	Rensselaer Polytechnic Institute	NY
Structured Organic Particulate Systems	Rutgers	NJ
Synthetic Biology	U of California-Berkeley	CA
Translational Applications of Nanoscale Multiferroic Systems	U of California-Los Angeles	CA
Materials Centers		
Brandeis Materials Research Science and Engineering Center	Brandeis	MA
Columbia University Materials Research Science and Engineering Center ²	Columbia	NY
Center for Emergent Materials	Ohio State	OH
Cornell Center for Materials Research	Cornell	NY
Center for Materials Science and Engineering	Massachusetts Institute of Tech	MA
Center for Multifunctional Nanoscale Materials Structures	Northwestern	IL
Quantum and Spin Phenomena in Nanomagnetic Structures	U of Nebraska	NE
Center for Nanoscale Science	Pennsylvania State	PA
Center for Nanostructured Interfaces	U of Wisconsin	WI
Center for Interface Structures and Phenomena	Yale	CT

² This Materials Center was given a no-cost extension to its award in FY 2014 but received no additional funding.

NSF Centers

Center for Photonics and Multiscale Nanomaterials	U of Michigan	MI
Liquid Crystals Materials Research Center	U of Colorado	CO
Laboratory for Research on the Structure of Matter	U of Pennsylvania	PA
Materials Research Center	U of Chicago	IL
Materials Research Science and Engineering Center	Harvard	MA
Materials Research Science and Engineering Center	Georgia Institute of Tech	GA
Materials Research Science and Engineering Center	New York U	NY
Materials Research Science and Engineering Center	U of California-Santa Barbara	CA
Materials Research Science and Engineering Center	U of Minnesota	MN
Materials Research Science and Engineering Center	U of Utah	UT
Materials Research Science and Engineering Center on Polymers	U of Massachusetts-Amherst	MA
Princeton Center for Complex Materials	Princeton	NJ
Renewable Energy Materials Science and Engineering Center	Colorado School of Mines	CO
Triangle Materials Research Science and Engineering Center	Duke	NC
Nanoscale Science and Engineering Centers		
Affordable Nanoengineering of Polymer Biomedical Devices	Ohio State	OH
Center for Environmental Implications of Nanotechnology (CEIN)	Duke	NC
Nanotechnology in Society Network: Center at ASU	Arizona State U	AZ
Nanotechnology in Society Network: Center at UCSB	U of California-Santa Barbara	CA
National Nanomanufacturing Network: Center for Hierarchical Manufacturing	U of Massachusetts-Amherst	MA
Predictive Toxicology Assessment & Safe Implementation of Nanotechnology in the Environment (CEIN)	U of California-Los Angeles	CA
Science and Technology Centers		
BEACON: An NSF Center for the Study of Evolution in Action	Michigan State U	MI
Biology with X-Ray Lasers	SUNY Buffalo	NY
Center for Brains, Minds, and Machines: The Science and the Technology of Intelligence	Massachusetts Institute of Tech	MA
Center for Coastal Margin Observation and Prediction	Oregon Health and Science U	OR
Center for Dark Energy Biosphere Investigations	U of Southern California	CA
Center for Energy Efficient Electronics Science	U of California-Berkeley	CA
Center for Integrated Quantum Materials	Harvard	MA
Center for Layered Polymeric Systems	Case Western Reserve	OH
Center for Microbial Oceanography: Research and Education	U of Hawaii-Manoa	HI
Center for Multi-Scale Modeling of Atmospheric Processes	Colorado State	CO
Center for Remote Sensing of Ice Sheets	U of Kansas	KS
Emergent Behaviors of Integrated Cellular Systems	Massachusetts Institute of Tech	MA
Emerging Frontiers of Science Information	Purdue	IN
Team for Research in Ubiquitous Secure Technology	U of California-Berkeley	CA
Science of Learning Centers		
Center for Excellence for Learning in Education, Science, and Technology	Boston U	MA
Pittsburgh Science of Learning Center - Studying Robust Learning with Learning Experiments in Real Classrooms	Carnegie Mellon	PA
LIFE Center - Learning in Formal and Informal Environments	U of Washington	WA
Spatial Intelligence and Learning Center	Temple	PA
The Temporal Dynamics of Learning Center	U of California-San Diego	CA
Visual Language and Visual Learning	Gallaudet	DC