NSF CENTERS PROGRAMS

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 Funding
(Dollars in Millions)

	Program Initiation	Number of Centers in FY 2021	FY 2021 Actual	FY 2022 (TBD)	FY 2023 Request	Change over FY 2021 Actual Amount	Percent
AI Research Institutes	2020	14	$62.70	-	$70.31	$7.61	12.1%
Biology Integration Institutes	2020	10	19.95	-	49.50	29.55	148.1%
Centers for Analysis & Synthesis	1995	2	-	-	5.00	5.00	N/A
Centers for Chemical Innovation	1998	8	27.64	-	27.70	0.06	0.2%
Engineering Research Centers	1985	14	56.26	-	71.50	15.24	27.1%
Materials Centers	1994	23	50.08	-	56.80	6.72	13.4%
Quantum Leap Challenge Insts[1]	2020	5	32.05	-	32.00	-0.05	-0.2%
Regional Innovation Engines	2023	0	-	-	200.00	200.00	N/A
Science & Technology Centers	1987	18	61.03	-	77.60	16.57	27.2%
Spectrum Innovation Initiative Ctr	2021	1	7.79	-	5.00	-2.79	-35.8%
Total			**$317.50**	**-**	**$595.41**	**$277.91**	**87.5%**

[1] Since FY 2020, funding for the Quantum Leap Challenge Institutes has been a vital part of NSF's overall $50+ million investment in multidisciplinary centers for quantum research and education. Also see the Engineering Research Center narrative below and the MPS narrative for additional information on quantum center activities.

Description of Major Changes

Artificial Intelligence Research Institutes – multi-directorate

The FY 2023 Request of $70.31 million will support up to 21 National AI Research Institutes—five institutes launched in FY 2020, nine awarded in FY 2021, and up to seven additional institutes planned in FY 2023. In addition, two FY 2020 institutes and two FY 2021 institutes are wholly funded by the U.S. Department of Agriculture National Institute of Food and Agriculture (USDA NIFA).

The National AI Research Institutes program, a multisector collaboration among government, industry, and academia, supports multidisciplinary advances on challenges in both foundational and use-inspired AI research. Each funded institute has three missions: (1) to advance fundamental knowledge of AI; (2) to advance use-inspired work on using AI to solve real-world problems of importance to the U.S. economy; and (3) to grow the U.S. AI workforce and build pathways for students from diverse backgrounds. More specifically, the funded institutes provide sustained, large-scale support for academic research groups to work on real-world problems, while also creating national AI infrastructure in the form of living laboratories. They serve as nexus points for academic, government, and industry interaction, and integrate research with the development of the next-generation AI workforce. A key motivation for the program is to maintain and grow U.S. leadership and competitiveness in AI at a time when other nations are making massive investments in the field. The

National AI Research Institutes program is led by CISE and includes contributions from all NSF directorates along with external partners, including federal agencies and industry. Each year, the program solicits proposals that respond to one of a given set of themes. For institutes launched in FY 2020 and FY 2021, these themes included Foundations of Machine Learning; Trustworthy AI; AI-Driven Innovation in Agriculture and the Food System; AI-Augmented Learning; AI for Accelerating Molecular Synthesis and Manufacturing; Human-AI Interaction and Collaboration; AI and Advanced Cyberinfrastructure; Advances in AI and Computer and Network Systems; and others. Each institute is funded at up to $4.0 million per year for up to five years. The latest solicitation issued in summer 2021 for awards in FY 2023 continues the ongoing collaboration with USDA NIFA as well as new partnerships with the DOD Office of the Undersecretary of Defense for Research and Engineering, the National Institute of Standards and Technology, the Institute for Education Sciences, and IBM.

Biology Integration Institutes – BIO

The FY 2023 Request of $49.50 million is expected to support 20 Biology Integration Institutes (BII). This will include fifteen continuing BII awards and five new awards.

The BII program supports collaborative teams of researchers investigating frontier questions about life that span multiple disciplines within and beyond the biological sciences. The goal is to foster creative integration of diverse fields using innovative experimental, theoretical, and modeling approaches to discover underlying principles operating across multiple levels of life; from molecules to cells, organisms, species, and ecosystems. Each institute has unique research themes centered around a compelling biological question poised for breakthroughs by collaboration across biological disciplines. The themes address fundamental and use-inspired research that serve to advance discovery and understanding in the life sciences and expand capabilities in biotechnology to control and utilize living systems. Outcomes from BII awards will foster innovation and applications that benefit U.S. security and health, mitigate the impacts of climate change, and spur economic growth.

BII awards support team-science and training environments that are fully integrated with the research theme and conducive to addressing complex science challenges, leveraging new ideas, expertise and infrastructure, and exploration of new modes of collaboration, which will prepare the next generation of biological scientists to pursue multidisciplinary research throughout their careers. Typically, BII awards bring together multiple organizations to leverage interdisciplinary talent and infrastructure, and to broaden participation of undergraduate and graduate students from underrepresented groups in the life sciences. In this way, BII awards build a diverse and inclusive workforce that can address the challenges of climate change and emerging infectious diseases, and that fulfill the needs of an expanding U.S. bioeconomy.

Centers for Analysis and Synthesis - BIO

The FY 2023 Request of $5.0 million for Centers for Analysis and Synthesis is expected to provide continuing support ($3.0 million) for a new center in environmental science and eco-forecasting (award will be issued in FY 2022). The Center will develop the teams, concepts, resources, and expertise to enable inclusive, effective, and coordinated efforts to answer broad scientific questions that emerge at interfaces between biological and environmental sciences, including climate change, land use change, biodiversity loss, and ecosystem services. The center will leverage data being provided by the National Ecological Observatory Network (NEON), Long-Term Ecological Research (LTER) and other environmental observatories and databases to support community efforts in ecological modeling to develop a national capability for eco-forecasting. A new funding competition

for BIO's first Center for Analysis and Synthesis in the area of molecular and cellular biosciences is being planned for completion in FY 2023 with an initial year funding of $2.0 million. Its goal is to achieve a comprehensive understanding of cell biology that relates molecular structure, function and interactions to cellular properties in ways that predict the emergent behavior of cells in a dynamic environment. The Center will aim to provide a catalytic role to advance the integrated knowledge of the workings of cells, metabolism, information processing, growth, senescence, proliferation and differentiation by analysis and synthesis of diverse molecular and cellular data.

Centers for Chemical Innovation - MPS

The FY 2023 Request of $27.70 million will fund up to seven Phase II Centers for Chemical Innovation (CCI). This includes up to six continuing centers and one new center. Each Phase II center is slated to be funded at $4.0 million per year (five-year awards with potential for renewal up to a total of ten years). An eighth center remains active and will sunset in FY 2023.

CCIs are developed through a two-phase process. Phase I CCIs conduct research, pilot broader impact activities, and complete key center development activities before submitting their Phase II proposal. There are currently nine Phase I awards supported by the Division of Chemistry.

CCIs focus on major, long-term fundamental chemical research challenges. CCIs are agile, collaborative entities that respond rapidly to emerging opportunities by integrating research with innovation, higher education, broadening participation, and informal science communication. The themes of the CCIs are varied and include Administration priorities such as clean energy technologies, climate solution, AI, QIS, biotechnology, advanced manufacturing, as well as sustainable chemistry, along with training for students at all levels. CCIs are also actively engaged in knowledge transfer to industry and the commercialization of their discoveries and new technologies. Several CCIs are studying various aspects of sustainability and clean energy technologies: the Center for Sustainable Nanotechnology (CSN) is examining how technologically important nanoparticles found in batteries interact with biological systems and how those nanoparticles can be redesigned to be environmentally benign; the Center for Synthetic Organic Electrochemistry (CSOE) is developing new electrosynthesis reactions that are safer, more energy-efficient, and generate less waste; and the Center for Sustainable Polymers (CSP) works on the discovery and development of new sustainable, degradable, and chemically recyclable plastics with improved performance, providing alternative solutions to the growing global plastics crisis.

Each year, CCIs include more than 70 participating academic institutions, 70 non-academic partner institutions, 150 Senior Personnel, 110 Postdoctoral Associates, 250 Graduate Students, and 70 Undergraduate Students.

Engineering Research Centers - ENG

The FY 2023 request is $71.50 million to support 15 NSF Engineering Research Centers (ERC), which aim to advance clean energy and climate change mitigation, biotechnology, quantum technology, semiconductors and microelectronics, and other national priorities. The investment includes support for four Gen-4 ERCs, funded as part of the Class of 2022, that will conduct convergent engineering research to tackle high-impact challenges with the potential to benefit U.S. security, prosperity, health, and society. The Class of FY 2022 ERCs will implement strategies for effective team formation and engagement with stakeholder communities to maximize their impacts. Three centers from the Class of 2012 will receive their final year of NSF funding in FY 2022.

All NSF ERCs combine the intellectual curiosity of university research focused on discovery with real-world engineered systems and technology opportunities through partnerships with industry. Each ERC has interacting foundational components that go beyond the research project, including engineering workforce development at all participant stages, a culture of diversity and inclusion where all participants gain mutual benefit, and value creation within an innovation ecosystem that will outlast the lifetime of the ERC.

Since the program began in 1985, products of ERC innovation include more than 2,600 inventions disclosures, over 2,300 patent applications filed, more than 900 patents awarded, and 1,381 licenses, as well as more than 240 spinoff companies. ERCs also have a successful track record for educating a technology-enabled workforce with hands-on, real-world experience. On average, NSF ERCs graduate over 130 Bachelor's, 123 Master's, and 150 Doctoral degree students each year. Over that time, they have also impacted, on average over 2,500 K-12 teachers and students. NSF ERCs are also effective at broadening participation from underrepresented groups. For example, across currently active ERCs, women comprise approximately 36 percent of those involved in center activities, in comparison to the national average of 24 percent across engineering. Also, the percentage of people from underrepresented groups participating is more than double that of engineering's national average.

Materials Centers - MPS

The FY 2023 Request level of $56.80 million is expected to support up to 19 Materials Research Science and Engineering Centers (MRSEC). The triennial MRSEC competition that will begin in June of FY 2022 is expected to end at the end of FY 2023. Funding in FY 2023 will continue support of 11 new centers established in FY 2020 and up to 8 new centers from the FY 2023 competition.

MRSECs function as hubs for solving complex grand-challenge materials problems requiring broad multidisciplinary expertise within the physical sciences and engineering to understand materials phenomena, exploit materials properties, and to create and discover new materials. Research in materials science is inherently interdisciplinary and the MRSEC program is a prime example of convergent research encompassing physics, chemistry, mathematics, biology, materials science, and engineering. Through collaborative efforts involving academics, industry, national laboratories experts, and international and educational partners, MRSECs advance materials research and education in the United States, and in many cases are international leaders. MRSECs have served as partners with more than 50 MSIs and develop new pathways for underrepresented groups, aiming to educate and train a diverse materials workforce across the U.S.

MRSECs have six major coordinated components: (1) interdisciplinary research groups, (2) education and outreach, (3) industrial and international outreach/partnerships, (4) diversity and broadening participation – serving as a major partner with Minority-Serving Institutions in MPS/DMR Partnerships in Research and Education in Materials (PREM) program, (5) the Materials Research Facilities Network—providing access to more than 1,250 state-of-the art equipment instrumentation to materials researchers across the Nation—and (6) the seed program, which enables MRSECs to rapidly react to and move into new high-risk and potentially transformative areas not yet fully explored.

Each year, MRSECs produce over 180 Ph.Ds. in STEM fields, mentor nearly 400 Research Experiences for Undergraduate students and 60 Research Experiences for Teachers participants, and impact over one million students and their parents through outreach activities such as summer camps, K-12 science curriculum development, K-12 in-school science demonstrations, development and

deployment of science kits, and partnering with the Nation's top museums to create STEM-related exhibits that impact the public. Since 1994, the program has created approximately 180 startups and annually produces about 60 awarded patents and 35 patent licensures. MRSECs engage and assist more than 500 other individuals from industry, national laboratories, and international partners per year in advancing fundamental materials research that can be translated into the marketplace.

Quantum Leap Challenge Institutes – MPS

The FY 2023 Request level of $32.0 million will support the fourth year of the three Quantum Leap Challenge Institutes (QLCI) established in FY 2020 along with the third year of additional institutes that resulted from the second phase of the QLCI competition held in FY 2021. Each of the existing institutes is addressing a different key area of QIS research, one in sensing, one in computing, and one in networking. The FY 2021 competition expanded the areas covered to include quantum simulation and the potential applications in biology and bioengineering. Total award sizes for each institute are $25.0 million over five years. In FY 2023 NSF will continue the Expand QISE thrust begun in FY 2022, which focuses on enhancing the participation of academic institutions not currently participating in the national QISE initiative and promoting the inclusion of members of groups currently underrepresented in the field.

Quantum information science and engineering utilizes profound aspects of quantum physics such as superposition, interference, and entanglement to develop revolutionary approaches for information processing. Such approaches include quantum computation, quantum communication, quantum simulation and quantum sensing. These rapidly developing fields have been bolstered by recent discoveries and breakthroughs. However, several foundational and technological challenges must be overcome before the full potential of quantum information science and engineering can be realized. The QLCI's program goal is to support timely and bold research agendas aimed at making breakthroughs on one of these clearly identified and compelling challenges within a five-year period. QLCIs are expected to: engage an intellectually-diverse community in the pursuit of identified challenges; develop cohesive, collaborative and national-scale approaches to research in quantum information science and engineering; and enable the development of a well-trained workforce with strong cross-disciplinary skill sets needed for quantum information science and engineering.

The QLCI program, along with other NSF multidisciplinary centers related to quantum research and education, collectively address Section 302 of the 2018 National Quantum Initiative Act. In addition, as all of the institutes funded under the QLCI program address topics that have been identified by the NSTC Subcommittee on Quantum Information Science as being critical to the U.S. investment in QIS, the program exercises a key role in the NSF response to this need.

Regional Innovation Engines – TIP

The FY 2023 Request level of $200.0 million will support up to 10 NSF Regional Innovation Engines (NSF Engines) in FY 2023. The NSF Engines program constitutes a bold new initiative that aims to create regional-scale innovation ecosystems throughout the United States and spur economic growth by bringing together the science and technology research enterprise and regional-level resources to address societal and economic challenges and promote long-term national competitiveness. NSF is providing funding to support activities focused on use-inspired research, entrepreneurship, and workforce development to nurture and accelerate regional industries. The NSF Engines program specifically emphasizes the meaningful engagement of the consumers of research outcomes in research as well as in the subsequent prototyping and piloting of research-based solutions (i.e., co-

design and co-creation), along with the translation of research results to practice, entrepreneurship, and direct economic growth.

In particular, the NSF Engines will aim to advance use-inspired, solutions-oriented research and innovation in a range of emerging technologies (e.g., advanced manufacturing, advanced wireless, AI, biotechnology, QIS, semiconductors) as well as in a diverse set of national challenges (e.g., climate change and the bioeconomy). They will bring together multiple disciplines, institutions, and sectors. They will balance technical and geographic (i.e., local and regional challenges, capabilities, and perspectives) innovation as well as individual, organizational, and geographic diversity; incentivize partnerships between NSF, other federal agencies, academia, industry, nonprofits, state, local, and tribal governments, civil society, and communities of practice; and serve as hubs for NSF's broader portfolios of investment in their respective areas of focus.

The bold nature of this effort is reflected in the program's goals, as described above; the nature and types of partnerships expected; the outputs that are being tracked and assessed (notably an emphasis on technology and workforce capabilities); the level of post-award oversight; the budgets of the NSF Engines, which are an order of magnitude greater than traditional NSF center-scale awards; and the duration of NSF funding for the NSF Engines, i.e., a ten-year award lifetime, paired with an intentional focus on longer-term sustainability from day one. Notably, the NSF Engines are funded at levels ranging from $145 million to $160 million over eight to ten years, depending on the initial stage of a given NSF Engine at the time of its proposal.

Science and Technology Centers: Integrative Partnerships – multi-directorate

The FY 2023 Request level of $77.60 million will support at least 15 Science and Technology Centers (STC) and the administrative costs associated with program management and oversight. These include STCs from the FY 2016 and FY 2021 cohorts and new centers to be funded in FY 2023, which will replace the sunsetting cohort funded in FY 2013. Preliminary proposals for the Class of FY 2023 were received in February 2022. Currently, STC awards are for five years, with possible renewal for an additional five years, or ten years total. The award sizes of the existing STCs are approximately $5.0 million per year with ramp down in years nine and ten. The current STC competition requests proposals with budgets of up to $6 million per year.

The STC 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: improving agricultural production via programmable plants based on digital biology; new technologies and solutions to limit the need for phosphorus usage in agricultural practice while reducing its harmful environmental impacts by enabling phosphorus recovery from the environment; advancing the understanding of Earth's climate; realizing a new generation of optoelectronic materials and devices; creating atomic-scale devices and systems based on quantum materials; and elucidating the mechanisms and architecture of intelligence in the human brain.

STCs conduct world-class research through partnerships among institutions of higher education, national laboratories, industry, other public or private entities, and via international collaborations. STCs strengthen the caliber of the Nation's STEM workforce through intellectually challenging research experiences for students, postdoctoral fellows, researchers, and educators. One of the goals of STCs is to increase involvement of traditionally underrepresented groups and institutions in science and

engineering, which they achieve through dedicated mentoring and partnerships, most notably with MSIs and emerging research institutions. Proposals describe institutional commitment to diversity and inclusion within the participating institutions. Additionally, STCs advance public scientific understanding through partnerships with K-12 and informal education communities. The knowledge transfer activities focus on engaging stakeholders with the intent of supporting innovation, providing information to policymakers, and disseminating knowledge across scientific disciplines. The STC program uses a network of evaluators working with the centers to share information and lessons learned about the most effective way to measure progress.

Spectrum Innovation Initiative: National Center for Wireless Spectrum Research (SII-Center) – MPS
The FY 2023 Request level of $5.0 million is to fund the continuing operations of the SII-Center program. In FY 2020, NSF began the process of standing up a National Center for Wireless Spectrum Research through the provision of 17 SII-Center planning grants and established one SII-Center in FY 2021.

The worldwide growth of wireless communication, navigation, and telemetry has provided immense societal benefits including mobile broadband data, Internet of Things (IoT), mobile healthcare, and intelligent transportation systems. These and other applications call for innovations that can circumvent the challenges of radio spectrum scarcity and interference, and foster the growth of ubiquitous, high speed, low latency connectivity. Commercial applications like the above must operate in harmony with scientific uses of spectrum (e.g., radio astronomy, Earth and atmospheric sciences, and polar research) and other nationally vital spectrum-dependent services (e.g., weather prediction). NSF continues to support wireless spectrum research and the scientific uses of the electromagnetic spectrum through multiple programs that enable fast, accurate, dynamic coordination and usage of the limited spectrum resource. These programs have created an opportune ground to build and create a large center-based ecosystem for spectrum research, which is the target of this SII-Center program. The goal of this program is to chart out a trajectory to ensure United States leadership in future wireless technologies, systems, and applications in science and engineering through the efficient use and sharing of the radio spectrum. A key expectation is establishing harmony between scientific uses of the electromagnetic spectrum and the forthcoming technological advances for high-speed, low latency, secure connectivity among pervasive devices, autonomous vehicles, and numerous other platforms. SII-Center will serve as a focal point for sustained research in the most challenging topics in spectrum. Research in these areas is expected to create advanced wireless technologies and systems that benefit society, of which 5G and future wireless broadband networks are an example. SII-Center is also expected to facilitate the education and development of an agile workforce needed to support emerging industries. These industries will rely heavily on wireless technologies and will require new advanced and automated spectrum management techniques. NSF's goal is to promote transformative use and management of the electromagnetic spectrum, resulting in profound benefits for science, engineering, industry, and other national interests.

NSF is working closely with the Federal Communications Commission and the National Telecommunications Information Administration to ensure that NSF SII investments in spectrum research and development are in alignment with national spectrum regulatory and policy objectives, principles, and strategies.[1]

[1] www.fcc.gov/document/fcc-federal-partners-sign-spectrum-innovation-cooperation-agreement

Estimates for Centers Participation in 2021

	Number of Participating Institutions[1]	Number of Partners[2]	Total FY 2021 NSF Support ($ in millions)	Total Leveraged Support ($ in millions)[3]	Number of Participants[4]
AI Research Institutes	104	203	$62.70	$16.00	NA
Biology Integration Institutes	9	4	$19.95	N/A	270
Centers for Analysis & Synthesis	39	20	N/A	N/A	1,448
Centers for Chemical Innovation	72	73	$27.64	$6.13	628
Engineering Research Centers	793	263	$56.26	$71.93	3,470
Materials Centers	157	146	$50.08	$23.48	3,000
Quantum Leap Challenge Insts	26	51	$32.05	$0.00	183
Regional Innovation Engines[5]	N/A	N/A	N/A	N/A	N/A
Science & Technology Centers	177	222	$61.03	$55.00	2,031
Spectrum Innovation Initiative Ctr[6]	28	1	$7.79	$0	*TBD*

[1] All academic institutions participating in activities at the centers.

[2] The total number of non-academic participants, including industry, states, and other federal agencies at the centers.

[3] Funding for centers from sources other than NSF.

[4] The total number of people who use center facilities, not just persons directly support by NSF.

[5] New NSF Centers activity in FY 2022.

[6] New NSF Centers activity in FY 2020. Full estimates for Centers Participation are not available at this time.

Centers Supported by NSF in FY 2021

Center	Institution	State
Artificial Intelligence Research Institutes		
Artificial Intelligence for Environmental Sciences (AI2ES)	U of Oklahoma	OK
Institute for Foundations of Machine Learning	U of Texas at Austin	TX
Institute for Student-AI Teaming	U of Colorado at Boulder	CO
Molecule Maker Lab Institute (MMLI): An AI Institute for Molecular Discovery, Synthetic Strategy, and Mfg.	U of Illinois Urbana-Champaign	IL
AI Research Institute for Fundamental Interactions	MIT	MA
AI Institute for Collaborative Assistance and Responsive Interaction for Networked Groups (AI-CARING)	Georgia Tech Research Corp.	GA
AI Institute for Learning-enabled Optimization at Scale (TILOS)	U of California-San Diego	CA
AI Institute for Advances in Optimization	Georgia Tech Research Corp.	GA
AI Institute for Intelligent CyberInfrastructure with Computational Learning in the Environment (ICICLE)	Ohio State University	OH
AI Institute for Future Edge Networks and Distributed Intelligence (AI-EDGE)	Ohio State University	OH
AI Institute for Edge Computing Leveraging Next Generation Networks (Athena)	Duke University	NC
AI Institute in Dynamic Systems	University of Washington	WA
AI Institute for Engaged Learning	North Carolina State University	NC
AI Institute for Adult Learning and Online Education	Georgia Research Alliance	GA
Biology Integration Institutes		
Behavioral Plasticity Research Institute (BPRI)	Baylor College of Medicine	TX
Emergent Ecosystem Responses through Genes-to-Systems Institute (EMERGE)	Ohio State University	OH
Advancing Spectral biology in Changing Environments to understand Diversity (ASCEND)	University of Minnesota-Twin Cities	MN
Genomics and Eco-evolution of Multi-scale Symbioses Institute (GEMS)	University of Illinois at Urbana-Champaign	IL
Host-Virus Evolutionary Dynamics Institute (HVEDI)	University of Arkansas	AR
Mechanisms of Cellular Evolution	Arizona State University	AZ
New Roots for Restoration	Donald Danforth Plant Sci. Ctr.	MO
Uncovering mechanisms of amphibian resilience to global change from molecules to landscapes	University of Pittsburgh	PA
Emergent Mechanisms in Biology of Robustness, Integrations & Organization (EMBRIO)	Purdue University	IN
Regional OneHealth Aerobiome Discovery Network	Colorado State University	CO
Centers for Analysis and Synthesis[2]		
Nat'l Inst. for Mathematical & Biological Syn. NIMBios)	U of Tennessee	TN
Socio-Environmental Synthesis Center (SESYNC)	U of Maryland	MD

[2] NIMBioS and SESYNC are operating on no-cost extensions. No funds were obligated for the centers in FY 2021.

Centers for Chemical Innovation (Phase II awards only)[3]		
Center for Chemical Evolution (CCE)	Georgia Institute of Tech	GA
NSF Center for Sustainable Nanotechnology (CSN)	U of Wisconsin	WI
NSF Center for Sustainable Polymers (CSP)	U of Minnesota	MN
NSF Center for Aerosol Impacts on the Chemistry of the Environment (CAICE)	U of California-San Diego	CA
NSF Center for Selective C-H Functionalization (CCHF)	Emory	GA
NSF Center for Genomically Encoded Materials (CGEM)	U of California-Berkeley	CA
NSF Center for Synthetic Organic Electrochemistry (CSOE)	U of Utah	UT
NSF Center for the Chemistry of Molecularly Optimized Networks (MONET)	Duke University	NC
Engineering Research Centers		
Advanced Self-Powered Systems of Integrated Sensors and Technologies (ASSIST)	North Carolina State	NC
Bio-mediated and Bio-inspired Geotechnics (CBBG)	Arizona State	AZ
Engineering Research Center for Innovative and Strategic Transformation of Alkane Resources (CISTAR)	Purdue	IN
Engineering Research Center for Precise Advanced Technologies and Health Systems for Underserved Populations (PATHS-UP)	Texas A&M	TX
Nanomanufacturing Systems for Mobile Computing and Mobile Energy Technologies (NASCENT)	U of Texas	TX
Nanosystems Engineering Research Center for Directed Multiscale Assembly of Cellular Metamaterials with Nanoscale Precision (CELL-MET)	Boston College	MA
Nanotechnology Enabled-Water Treatment System	Rice University	TX
NSF Engineering Research Center for Cell Manufacturing Technologies (CMaT)	Georgia Institute of Tech	GA
Optimization for Electro-thermal Systems (POETS)	U of Illinois	IL
Translational Applications of Nanoscale Multiferroic Systems (TANMS)	U of California-Los Angeles	CA
NSF Engineering Center for Quantum Networks (CQN)	U of Arizona	AZ
NSF Engineering Research Center for the Internet of Things for Precision Agriculture (IoT4Ag)	U of Pennsylvania	PA
NSF Engineering Research Center for Advancing Sustainability Through Powered Infrastructure for Roadway Electrification (ASPIRE)	Utah State University	UT
NSF Engineering Research Center for Advanced Technologies For Preservation of Biological Systems (ATP-Bio)	U of Minnesota	MN
Materials Centers		
Brandeis Bioinspired Soft Materials Center	Brandeis	MA
Center for Complex and Active Materials	U of California-Irvine	CA
Center for Dynamics and Control of Materials	U of Texas at Austin	TX

[3] Smaller, developmental Phase I awards do not meet the criteria as formal NSF Centers and so are not captured here.

Center for Emergent Materials	Ohio State University	OH
Center for Hybrid, Active and Responsive Materials	U of Delaware	DE
Center for Multifunctional Materials	Northwestern	IL
Center for Nanoscale Science	Pennsylvania State	PA
Center for Polarization and Spin Phenomena in Nanoferroic Structures	U of Nebraska	NE
Chicago Materials Research Centers	U of Chicago	IL
Columbia Center for Precision Assembly of Superstratic and Superatomic Solids	Columbia	NY
Cornell Center for Materials Research	Cornell	NY
Harvard Materials Research Center	Harvard	MA
Illinois Materials Research Center	U of Illinois at U/C	IL
Laboratory for Research on the Structure of Matter	U of Pennsylvania	PA
Materials Research Science and Engineering Ctr at UCSB	U of California-Santa Barbara	CA
Materials Research Science and Engineering Center	U of California-San Diego	CA
Materials Research Science and Engineering Center	U of Minnesota	MN
MIT Center for Materials Science and Engineering	Massachusetts Institute of Tech	MA
NYU Materials Research Science and Engineering Center	New York U	NY
Princeton Center for Complex Materials	Princeton	NJ
Soft Materials Research Center	U of Colorado	CO
UW Molecular Engineering Materials Center	U of Washington	WA
Wisconsin Materials Research Center	U of Wisconsin	WI
Quantum Leap Challenge Institutes		
Enhanced Sensing and Distribution Using Correlated Quantum States	U of Colorado Boulder	CO
Hybrid Quantum Architectures and Networks	U of Illinois-Urbana Champaign	IL
Present and Future Quantum Computing	U of California-Berkeley	CA
Quantum Sensing in Biophysics and Bioengineering	U of Chicago	IL
Robust Quantum Simulation	U of Maryland-College Park	MD
Nanoscale Science and Engineering Centers[4]		
Center for the Environmental Implications of Nanotechnology (CEINT)	Duke	NC
Predictive Toxicology Assessment & Safe Implementation of Nanotechnology in the Environment (CEIN)	U of California-Los Angeles	CA
Science and Technology Centers		
BEACON: An NSF Ctr. for the Study of Evolution in Action	Michigan State	MI
Biology with X-Ray Free Electron Lasers	SUNY Buffalo	NY
Center for Brains, Minds, and Machines: The Science and the Technology of Intelligence	Massachusetts Institute of Tech	MA
Center for Bright Beams	Cornell	NY
Center for Cellular Construction	U of California-San Francisco	CA
Center for Chemical Currencies of a Microbial Planet	Woods Hole Ocean. Inst	MA
Center for Dark Energy Biosphere Investigations	U of Southern California	CA
Center for Emergent Behaviors of Integrated Cellular Systems	Massachusetts Institute of Tech	MA

[4] CEINT and CEIN are operating on no-cost extensions. No funds were obligated for the centers in FY 2020.

Center for Energy Efficient Electronics Science	U of California-Berkeley	CA
Center for Engineering MechanoBiology	U of Pennsylvania	PA
Center for Integrated Quantum Materials	Harvard	MA
Center for Integration of Modern Optoelectronic Materials on Demand	U of Washington	WA
Center for Learning the Earth with Artificial Intelligence and Physics	Columbia U	NY
Center for OLDest Ice Exploration	Oregon State U	OR
Center for Research On Programmable Plant Systems	Cornell	NY
Center for Science of Information	Purdue	IN
S&T Center on Real-Time Functional Imaging	University of Colorado	CO
S&T Technologies for Phosphorus Sustainability Center	North Carolina State U	NC
Spectrum Innovation Initiative		
Spectrum X – An NSF Spectrum Innovation Center	University of Notre Dame	IN