

GROWING CONVERGENCE RESEARCH (GCR)

GCR Funding (Dollars in Millions)		
FY 2019	FY 2020	FY 2021
Actual	(TBD)	Request
\$15.80	-	\$15.20

Overview

Growing Convergence Research (GCR) is an enabling idea within NSF’s Big Ideas that empowers the U.S. research community to leverage multiple scientific and engineering (S&E) disciplines and develop novel research strategies to address extremely challenging and complex problems. GCR research challenges are inspired by deep scientific questions or pressing societal needs and require the integration of multi-disciplinary perspectives.

The grand challenges of today—such as exploring the universe at all scales; developing infrastructure resilient to extreme events and geo-hazards; combining biology, physical sciences, engineering, computer and cognitive science to produce the machines and materials of the future; and creating the breakthroughs that will enable the industries of the future—will not be solved by one discipline alone. They require convergence: the merging of ideas, approaches, tools, and technologies from widely diverse fields of knowledge to stimulate innovation and discovery. Convergence research is a means of solving complex research problems that have two unifying characteristics: (1) they have the potential to make a significant impact, either on fundamental understanding in S&E or on the Nation’s ability to meet pressing societal challenges, or both; and (2) they require the integration of knowledge, tools, and ways of thinking from multiple disciplines.

NSF’s GCR responds in part to recommendations from major reports describing the importance of convergence for the research ecosystem. Key reports include National Academies of Science, Engineering, and Medicine reports from 2014¹ and 2017,² Massachusetts Institute of Technology (MIT) reports from 2011³ and 2016,⁴ and a 2013 report published by Springer.⁵ These reports emphasize the importance of convergence approaches to S&E research to address grand challenges and underline the importance of team science to such efforts. These reports also emphasize the role of federal funding agencies in realizing the benefits of convergence by expanding mechanisms for funding convergence research.

Goals

Since the GCR Big Idea began in FY 2017, the goals of GCR are to:

1. Catalyze convergence approaches to solve compelling scientific and engineering research problems at the intersection of existing disciplines; and
2. Enhance NSF’s review process to more effectively assess the merit of convergence research proposals.

¹ Convergence: Facilitating Transdisciplinary Integration of Life Sciences, Physical Sciences, Engineering, and Beyond. Washington, D.C.: The National Academies Press. www.nap.edu/catalog/18722/convergence-facilitating-transdisciplinary-integration-of-life-sciences-physical-sciences-engineering

² *A New Vision for Center-Based Engineering Research*. Washington, DC: The National Academies Press. www.nap.edu/catalog/24767/a-new-vision-for-center-based-engineering-research

³ *The Third Revolution: The Convergence of the Life Sciences Physical Sciences, and Engineering*. Cambridge, MA: MIT www.aplu.org/projects-and-initiatives/research-science-and-technology/hibar/resources/MITwhitepaper.pdf

⁴ *Convergence: The Future of Health*. Cambridge, MA: MIT. www.convergencerevolution.net/s/Convergence-The-Future-of-Health-2016-Report-55pf.pdf

⁵ *Convergence of Knowledge, Technology, and Society*. www.springer.com/us/book/9783319022031

Approach

GCR will strengthen the global competitiveness of the U.S. S&E enterprise by growing a new generation of convergence researchers skilled at working in teams and able to respond rapidly to new research challenges. To support convergence research, NSF is enhancing its review processes to address the key technical, organizational, and logistical challenges that hinder the evaluation of truly integrative research. GCR's strategic investments in emerging convergence research themes will support the development of new fields of inquiry, discovery of the knowledge necessary for society to develop solutions or technologies to address important societal challenges, and training in convergence research.

GCR uses several mechanisms to accomplish programmatic goals, including:

- *Capacity-Building Activities*: GCR seeks to broaden the range of those engaged in convergence efforts. A portion of GCR funds is invested in capacity-building activities, such as workshops, Ideas Labs, and Research Coordination Networks (RCNs). NSF remains open to novel approaches to capacity-building that may be suggested by researchers and other stakeholders. One goal of capacity-building is to foster new partnerships between U.S. academic researchers and other sectors such as industry, federal laboratories, non-profit research organizations, and the international research community. Another emphasis is to broaden demographic diversity of teams participating in convergence research. GCR began by funding capacity-building activities to address grand challenges within NSF's Big Ideas.
- *Exploratory Grants*: GCR exploratory research grants enable research teams to: demonstrate their ability to collaborate effectively; resolve epistemological and ontological differences between disciplines; integrate conceptual models, tools, methodologies, and infrastructure; and show progress on their convergence research projects. Exploratory grants are expected to have budgets of up to \$3.60 million and durations of up to five years. Exploratory grants will prepare research teams for larger scale convergence research awards through programs such as Science and Technology Centers, Engineering Research Centers, and NSF Research Traineeships. NSF announced the first exploratory grant opportunity in FY 2018.⁶ In February 2019, NSF released a GCR solicitation, NSF 19-551,⁷ which announced funding opportunities for FY 2019 and FY 2020.
- *Enhanced Merit Review Process*: An enhanced merit review process is employed for convergence research projects. NSF identified a cadre of experienced convergence researchers using data-mining tools, the knowledge of program staff, and suggestions from learned societies to evaluate GCR research projects. A diverse pool of researchers to participate were then invited in a College of Reviewers (CoR), which is a group of about 100 distinguished researchers that enables NSF staff to recruit appropriate reviewers for convergence research and was used to review proposals submitted in response to the FY 2019 GCR solicitation.

FY 2021 Investments

- *Capacity-Building Activities*: As part of catalyzing convergence, up to four capacity-building activities in emerging convergence research themes are anticipated, each at up to \$150,000.
- *Exploratory Grants*: Investments will focus on two phases: (1) catalyzing convergence of new teams at the intersection of existing disciplines (six to eight new research collaborations, each funded at up to \$600,000 per year for the first two years); and (2) continuing support of teams funded in 2019 who have demonstrated significant progress on their convergence research projects.⁸
- *Enhanced Merit Review Process*: Additional experts will be recruited to expand the Convergence CoR.

⁶ "Dear Colleague Letter: Growing Convergence Research," (NSF 18-058) www.nsf.gov/pubs/2018/nsf18058/nsf18058.jsp. This resulted in seven awards in FY 2018 and three in FY 2019.

⁷ www.nsf.gov/publications/pub_summ.jsp?WT.z_pims_id=505637&ods_key=nsf19551. In FY 2019, this led to 11 collaborative research project awards.

⁸ The second phase of projects will be funded up to \$800,000 per year and may continue for up to three years pending successful yearly progress.