GROWING CONVERGENCE RESEARCH (GCR)

GCR Funding		
(Dollars in Millions)		
	FY 2018 Actual	FY 2019 (TBD)	FY 2020 Request
IA	$5.00	-	$16.00

Overview

GCR 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. GCR is an "enabling" Idea within NSF's 10 Big Ideas.

The grand challenges of today—such as exploring the universe at all scales; developing infrastructure resilient to extreme events and geo-hazards; combining biology, chemistry, engineering, and computer 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. Key reports describing the importance of convergence for the research ecosystem include Massachusetts Institute of Technology (MIT) reports from 2011[1] and 2016,[2] National Academies of Science, Engineering, and Medicine reports from 2014[3] and 2017,[4] and a 2013 report published by Springer.[5] These reports emphasized the importance of convergence approaches to S&E research to address grand challenges and underlined the importance of team science to such efforts. These reports also emphasized the role of federal funding agencies in realizing the benefits of convergence, namely, that federal agencies should expand mechanisms for funding convergence research.

Convergence research is a means of solving vexing research problems. The unifying characteristics of these problems are that: (a) if successfully answered, they are likely to have a large impact, either on fundamental understanding in S&E or on the Nation's ability to meet pressing societal challenges, or both; and (b) they require the integration of knowledge, tools, and ways of thinking from multiple disciplines.

Goals

The goals of the GCR Big Idea are:
1. Catalyze convergence approaches to 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.

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[1] The Third Revolution: The Convergence of the Life Sciences Physical Sciences, and Engineering. Cambridge, MA: Massachusetts Institute of Technology. www.aplu.org/projects-and-initiatives/research-science-and-technology/hibar/resources/MITwhitepaper.pdf

[2] Convergence: The Future of Health. Cambridge, MA: Massachusetts Institute of Technology. www.convergencerevolution.net/s/Convergence-The-Future-of-Health-2016-Report-55pf.pdf

[3] 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

[4] *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

[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 will enhance its review processes by addressing 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 the training of a new generation of convergence researchers.

GCR will use several mechanisms to accomplish programmatic goals, including:
- Capacity-Building Activities: GCR will seek to broaden the range of those engaged in convergence efforts. A portion of the GCR funds will be 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 will be 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 will be to broaden the demographic diversity of teams participating in convergence research. GCR began in FY 2017 by funding capacity-building activities aimed at addressing grand challenges within NSF's 10 Big Ideas.[6]
- Exploration Grants: NSF will fund exploratory grants to enable research teams to demonstrate their ability to collaborate effectively; resolve epistemological and ontological differences between disciplines; begin the process of integrating 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[7] for awards in FY 2018 and FY 2019. In February 2019, GCR released a new solicitation, NSF 19-551, announcing opportunities for funding in FY 2019 and FY 2020. [8]
- Enhanced Merit Review Process: An enhanced merit review process will be employed for convergence research projects. NSF will identify a cadre of experienced convergence researchers using data-mining tools, the knowledge of program staff, and suggestions from learned societies. Within this group, NSF will ask a diverse pool of researchers to participate in a College of Reviewers (CoR). The CoR will be a resource that will enable NSF staff to recruit appropriate reviewers for convergence research.

FY 2020 Investments

GCR funded activities in FY 2020 include:
- Targeted, capacity-building activities in emerging convergence research themes will emphasize activities that strengthen links between researchers and other stakeholders (up to $1.60 million). Up to four such activities are anticipated.
- Exploration grant support will continue into FY 2020, giving teams opportunities to explore emerging convergence research challenges and begin integration of tools, techniques, data archives, and knowledge. About 10 to 12 awards are anticipated. Initial funding for these awards is expected to total

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[6] GCR funded 23 new activities including: a Quantum Science Summer School; a RCN that brings together natural, physical, social, and information scientists, and indigenous scholars to advance the understanding of rapid changes in the Arctic; and a RCN in which early- and mid-career scientists explore one of the most profound and persistent topics in biology, the origins of life.
[7] "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. Five to six additional awards are anticipated in FY 2019.
[8] www.nsf.gov/publications/pub_summ.jsp?WT.z_pims_id=505637&ods_key=nsf19551

approximately $14 million.

- Additional experts will be recruited to expand the Convergence CoR.