



National Science Foundation
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NSF 14-063

Dear Colleague Letter - Mathematical Sciences Innovation Incubator (MSII)

April 22, 2014

Dear Colleagues:

The National Science Foundation (NSF) Division of Mathematical Sciences (DMS) aims to enhance the synergistic relationships between the mathematical sciences and other NSF-supported disciplines through the Mathematical Sciences Innovation Incubator (MSII) activity. The MSII activity encourages and supports new research collaborations among mathematical scientists and other scientists and engineers working in NSF-supported research areas of high national priority by:

- facilitating DMS co-review and co-funding of multi-disciplinary research collaborations involving mathematical scientists;
- providing leverage for investments of non-DMS NSF programs in projects that include mathematical scientists; and
- providing a uniform mechanism through which collaborative research teams involving mathematical scientists can request DMS co-review.

The ideas, tools, and language of mathematics and statistics play important roles in every area of science and engineering research supported by the NSF, and it is widely recognized that interactions between the mathematical sciences and other fields catalyze developments in both.

Examples of this mutual influence abound. For instance, probability and statistics arose and developed from observations about games of chance in the 16th century, mortality in the 18th century, Brownian motion in the 19th century, and genetics in the 20th century. The observations both provoked questions about the physical world and sparked new mathematical and statistical ideas and methods that helped answer those questions. But these new developments in the mathematical sciences reached far beyond the initial questions and areas; they helped to solve new problems in physics, biology, engineering, geosciences, and economics, and in combination with other areas of mathematics, they gave rise to entirely new fields of research. Uncertainty, stochasticity, and enormous volumes of data are salient aspects of 21st century problems; coping with these features builds on the advances of the previous 500 years. A similar history appears for most other areas of mathematics; only the names, dates, mathematical issues, and particular contacts with the tangible world are different.

The Division of Mathematical Sciences wishes to foster the participation of more mathematical scientists, from every area of mathematics and statistics, in such important interdisciplinary work. In support of this goal, the MSII activity provides funding to catalyze the involvement of mathematical scientists in research areas where the mathematical sciences are not yet playing large roles.

The MSII activity will emphasize scientific research areas of high national priority that would benefit from innovative developments in mathematics and statistics. As pointed out in references [1] and [2], modern communication, transportation, science, engineering, technology, medicine, manufacturing, security, and finance all depend on the mathematical sciences. Success in meeting crucial challenges currently facing the nation in these areas will rest on advances in mathematical sciences research. The increasingly

important challenges of deriving knowledge from huge amounts of data, whether numerical or experimental, of simulating complex phenomena accurately, and of dealing with uncertainty effectively are some of the areas where the mathematical sciences will play a central role. Other promising areas where mathematical scientists could play larger roles include research on the power grid, the brain, and optics and photonics. Collaborative research projects involving mathematical scientists have the potential to transform the nation's ability to respond to these and many other challenges.

Areas of national high-priority scientific research in fiscal year 2014 identified by the U.S. Office of Science and Technology Policy (reference [3]) include:

- **Advanced Manufacturing**
- **Clean Energy**
- **Global Climate Change**
- **Research and Development for Informed Policy-Making and Management**
- **Information Technology Research and Development**
- **Nanotechnology**
- **Biological Innovation**

The MSII activity will support research projects in these and other areas of national priority that are managed by NSF programs outside of DMS and that involve mathematical scientists in the research. Proposals submitted to these programs outside of DMS are eligible for support through the MSII activity. (Proposals submitted to DMS are not eligible for MSII funding.)

National Science Foundation programs addressing these areas of national priority in which mathematical scientists are not yet playing large roles are listed on the MSII web page:

http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505044&org=DMS

To apply for MSII support, after submitting a proposal to a non-DMS program for a research project that involves mathematical scientists, or a supplement request to include new mathematical scientists in a research project supported by a non-DMS award, the Principal Investigator must send an e-mail message specifying the name(s) and affiliation(s) of the mathematical scientist(s) and the NSF proposal ID to [DMScofunding@nsf.gov]. Transmission of this e-mail message will constitute a request that DMS consider the proposal or supplement request for MSII funding.

MSII funding recommendations will be based on the intellectual merit and broader impacts of the proposed research, with particular emphasis on:

- likely impact of the involvement of mathematical scientists in the project;
- the extent to which the mathematical sciences play an essential role in the proposed research project;
- novelty of the proposed collaboration or research topic; and
- potential for impact of the research project in furthering mathematical sciences research.

Mathematical scientists are encouraged to consider establishing new research collaborations with researchers in other NSF-supported disciplines and to make collaborators aware of the possibility of MSII support for the activity.

Michael Vogelius

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References:

[1] ***Fueling Innovation & Discovery***, National Academies Press, 2012 [http://www.nap.edu/catalog.php?record_id=13373]

[2] ***The Mathematical Sciences in 2025***, National Academies Press, 2013 [http://www.nap.edu/catalog.php?record_id=15269]

[3] U.S. Office of Science and Technology Policy memorandum M-12-15, "**Science and Technology Priorities for the FY 2014 Budget**" [<http://www.whitehouse.gov/sites/default/files/m-12-15.pdf>]