# Math Sciences 2025

The first decade of the current century witnessed a rapid increase in the pace of mathematical discovery. The proof of the Poincaré Conjecture, the development of the Schramm-Loewner process describing conformally invariant scaling limits, and the Green-Tao proof of arbitrarily long arithmetic progressions in the primes are vivid examples that quickly spring to mind. Simultaneously there has been a significant shortening of the time scale over which new discoveries have impact on science, technology, and society. For example, a 2006 *BusinessWeek* cover story describes how algorithms derived from recent research in combinatorics and number theory are driving electronic commerce, Internet search, and cybersecurity. A particularly dramatic illustration is the speed with which the theorems of Donoho, Candès, and Tao on compressed sensing enabled development of new imaging equipment that significantly outperforms existing standards. Just three years after publication of their ideas in 2004, compressed sensing was named by *Technology Review* as one of the top ten emerging technologies of 2007. We are truly in a golden age for the mathematical sciences, and the prospects for the future are very exciting. (This paragraph is based on an excellent summary of the decade that was provided in 2008 by Peter March and colleagues to the Board on Mathematical Sciences and Their Applications (BMSA) of the National Academies.)

It is healthy for disciplines to step back occasionally and evaluate how well they're operating and where they're headed. Such an evaluation—sponsored by the National Science Foundation's Division on Mathematical Sciences (DMS) and carried out by a BMSA committee—is currently under way. This study is called "The Mathematical Sciences in 2025" to suggest that we are looking over the horizon to infer what our discipline and community might look like in 2025 and what we need to attend to now to prepare.

Previous such studies include the landmark 1984 "David Report", which documented serious federal underfunding of the mathematical sciences, and the 1998 "Odom Report", which again highlighted the great potential contributions of the mathematical sciences and the funding shortfalls that were limiting our ability to seize those opportunities.

But those reports did more than focus on federal funding. At their heart, both gave the discipline a chance to examine itself and reflect on its progress and health. They sparked healthy discussions within the community. And, perhaps most importantly, they provided evidence that federal funding agencies could use in arguing for greater support of the mathematical sciences. Such evidence is valuable in Washington. It demonstrates that the field is thoughtful about its future, is a responsible steward of federal funds, and has clear ideas about its future growth.

When Tony Chan was appointed as NSF Assistant Director of Mathematics and Physical Sciences in 2006, he observed that the other fields in his portfolio carried out such self-evaluations with regularity and that they were powerful tools in arguing for resources within the NSF and for building support within Congress. He and Peter March, then DMS director, approached the BMSA to commission a study. BMSA members developed careful plans and a funding proposal, and the study committee held its first meeting in September 2010.

DMS and BMSA agreed that, for maximum credibility, the study should be chaired by a nonmathematician, following the model of the David and Odom reports. As longtime president of Caltech, Tom Everhart is familiar with the mathematical sciences and their roles within science, engineering, and education, but he is not perceived as an advocate for one field over another. The rest of the committee was assembled to span core and applied mathematics and statistics, along with fields with which the mathematical sciences interface: e.g., financial engineering, computer simulation, machine learning, theoretical physics, and theoretical computer science. The result is a strong committee that can see both the inner workings of our community and also the setting in which it has influence.

The official charge for this study reads as follows:

*The study will produce a forward-looking assessment of the current state of the mathematical sciences and of emerging trends that will affect the discipline and its stakeholders as they look ahead to the quarter-century mark. Specifically, the study will assess:*

• *The vitality of research in the mathematical sciences, looking at such aspects as the unity and coherence of research, significance of recent developments, rate of progress at the frontiers, and emerging trends.*

• *The impact of research and training in the mathematical sciences on science and engineering, on industry and technology, on innovation and economic competitiveness, on national security, and other areas of national interest.*

• *The study will make recommendations to [DMS] on how to adjust its portfolio of activities to improve the vitality and impact of the discipline.*

We intend this study to develop a strategic view that is useful to the NSF and other federal agencies; to chairs, deans, and academic administrators; to the mathematics and statistics communities; to the science and engineering community more broadly; and to the leadership of business, industry, government laboratories, and federal mission agencies. If you have insights you'd like to pass on to the committee, please visit `http://www.nas.edu/mathsci2025`, where you can upload a pdf or Word document or directly enter shorter input. The last date for submissions is August 31, 2011. This site also contains more detail about the study committee and its meetings to date.

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