NSF Mathematical Sciences Initiative

The National Science Foundation (NSF) is planning a new Mathematical Sciences Initiative (MSI). Plans call for increased funding over the next five years to support fundamental mathematical sciences research, connections of the mathematical sciences to other areas of science and engineering, and improvements in mathematical sciences education.

The MSI is needed because advances in fundamental mathematical sciences, which embrace mathematics and statistics, are closely intertwined with the discovery process in science, engineering, and technology. The mathematical sciences are accelerating progress across the spectrum of science and engineering, even in traditionally descriptive sciences.

Why is the MSI needed now? One reason is the "mathematization" of science. Science is becoming more mathematical and statistical—not only the physical and information sciences, but also the biological, geophysical, environmental, social, behavioral, and economic sciences. There is a vital need for mathematicians and statisticians to collaborate with engineers and scientists to explore the frontiers of discovery, where science and mathematics meet and interact. Another reason is that the technical work force, as well as society at large, needs more mathematical and statistical skills today than ever before. Technology-based industries fuel the growth of the U.S. economy, which, in turn, relies on large numbers of college graduates well versed in mathematics, science, and engineering. In our increasingly complex world, the need for broad mathematical and statistical literacy becomes ever more acute.

The MSI has three main components: advancing fundamental mathematics; advancing interdisciplinary collaborations among the mathematical sciences, other areas of science, and engineering; and advancing mathematical skills and mathematical literacy.

1. The first component of the initiative calls for increased support for fundamental mathematical research. The mathematical sciences have consistently renewed themselves through synthesis of preceding work and infusion of new ideas, some of which originate through the application of mathematics in other disciplines. This process of rejuvenation and evolution is indispensable for discovery at the frontiers of the mathematical sciences.

2. Many technological advances—from Doppler radar to magnetic resonance imaging to public key cryptography to the Internet—are rooted in fundamental mathematics and statistics. The concepts and structures developed by fundamental mathematics and statistics often provide just the right framework for the formulation and study of seemingly unrelated applications. Therefore, the second component of the MSI focuses on connections between the mathematical sciences and other sciences and engineering. Mathematics and statistics provide a vocabulary that grows richer as the boundaries between the disciplines become more diffuse. We must nurture and train researchers who are capable of participating in multidisciplinary collaborations. Mathematics and statistics have enabled extraordinary advances across the board, yielding new analytical, statistical, computational, and experimental tools to tackle a broad range of scientific and technological challenges previously considered intractable. With this unprecedented expansion of our capacity to discover and its potential for application to societal needs comes a demand for new mathematical and statistical techniques.

3. The third component of the initiative advances mathematical sciences skills in a broad sense. Public literacy in mathematics and statistics and appreciation of their roles in modern life are critical for societal progress. Education, research, and national work force needs are inextricably linked: we must attract the best talent from today's youth into undergraduate, graduate, and postdoctoral programs in the mathematical sciences and train them for a broad array of careers in academia, industry, and government. It is important that U.S. students sense the excitement and see the opportunities for careers based on the mathematical sciences. The involvement of the research community in this mathematical sciences education agenda is indispensable. Providing all young citizens with the mathematical skills to enjoy productive and fruitful employment is a national priority.

The NSF has adopted a five-year investment plan for the MSI, starting in fiscal year 2002 (which begins October 1, 2001). Right now, specific plans for the initiative are taking shape. Members of the mathematical sciences community are urged to contribute their thoughts and ideas as the initiative moves forward. As plans develop information will be posted on the Web site of the NSF's Division of Mathematical Sciences, `http://www.nsf.gov/mps/dms/`.

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