STATEMENT OF DR. DAVID BRESSOUD, PAST-PRESIDENT OF THE MATHEMATICAL ASSOCIATION OF AMERICA AND DEWITT WALLACE PROFESSOR OF MATHEMATICS, MACALESTER COLLEGE

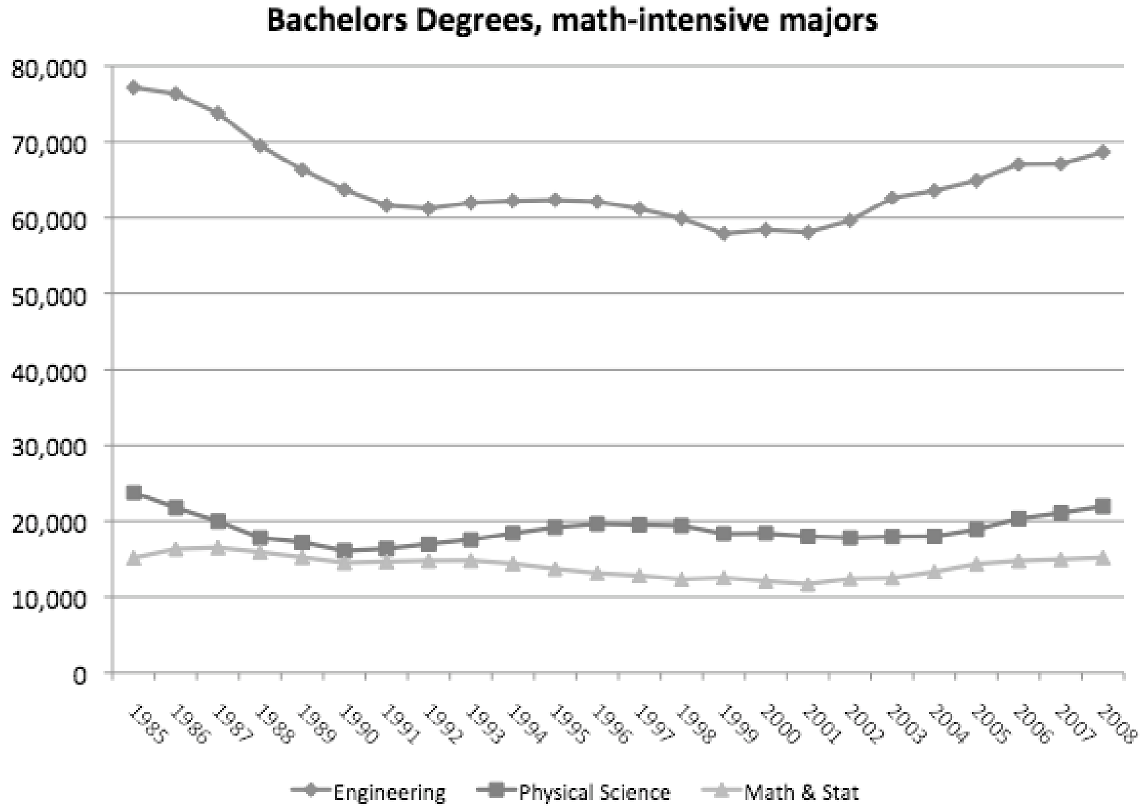
Chairman Wolf, Ranking Member Fattah, and distinguished Members of the Subcommittee, I greatly appreciate this opportunity to participate in today's hearing and to speak to the importance of national funding for science in general, and the advancement of science education in particular. On behalf of the Mathematical Association of America, I can state that the American mathematical community strongly supports the President's overall Fiscal Year 2012 budget request for the National Science Foundation, and urges that, given the need to improve undergraduate STEM education, funding for Education and Human Resources (EHR) should be supported at a similar level.

Much of America's competitive advantage in the world today is the result of its leadership in science and technology. This was made possible by decades of investment in the infrastructure of the scientific enterprise, both public and private. Our system of university, corporate, and foundational research centers is the envy of the world. The rest of the world has learned from our success. Emerging powerhouses such as China and India are investing heavily in their universities and scientific institutes. As they also realize, promoting scientific and technological innovation requires more than funding laboratories and institutes. It requires educating the next generation of scientists and engineers who will populate those centers of excellence.

As immediate Past-President of the Mathematical Association of America, the world's largest professional association providing expository mathematics, professional development for college mathematics faculty, and resources for the teaching and learning of college-level mathematics, I am intimately aware of the critical shortage of students choosing to pursue scientific, mathematical, and technological careers.

As I travel around this country, I find universities in serious financial straits, forced to replace regular faculty with part-time adjunct instructors, to increase class size, and to decrease support services. A quarter century ago, we regularly graduated 75,000 to 80,000 engineers a year. In 2008, we graduated 69,000 engineers. This has happened while our demand for a technologically savvy workforce has grown. Until now, we have been able to bridge the shortfall in the number of engineers and scientists that we need by drawing large numbers of highly talented immigrants to America. It is not clear that we can continue to do that. Both China and India, as well as other large developing countries such as Brazil and Indonesia, are improving their systems of higher education while sweetening the incentives for their graduates to stay home.

Focusing just on the most mathematically-intensive majors of engineering, the physical sciences, and the mathematical sciences (including statistics), the U.S. has seen no net gain in the past 25 years (see graph 1). The numbers dipped in the mid to late 1990s as we reached the trough in the college-age population between the baby boom generation and its echo. The number of young people of college age today is essentially back to what it was in 1980. Yet, our production of scientists and engineers is lower than it was then.



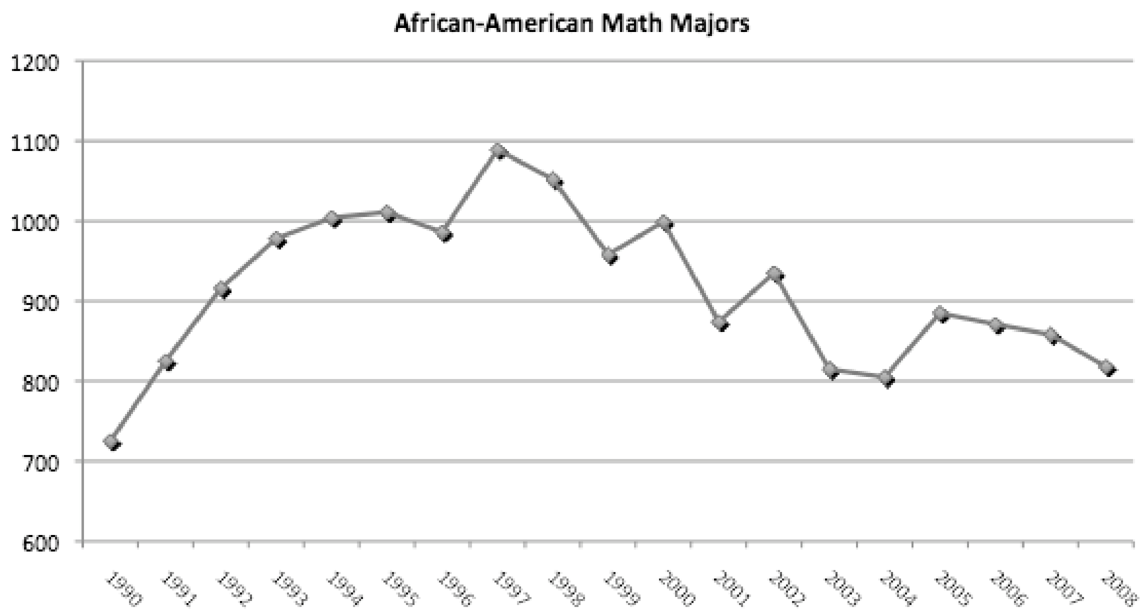
Graph 1: Total number of Bachelors Degrees per year. Source: US Dept of Education, National Center for Education Statistics

What I find particularly alarming is how many talented students aspire to careers in engineering or science, but fail to achieve their dream. This past fall, 210,000 students entered as full-time students in four-year undergraduate programs with the intention of majoring in engineering, a physical science, mathematics or statistics. We can expect that no more than half of them will graduate with one of these degrees.

At the same time, this country is undergoing a demographic change. Our college-age population is increasingly Hispanic and African-American. As recently as 1990, 87% of those graduating from college were White. By 2008, it was less than 75%. If we are to continue even to maintain current numbers of graduates with degrees in science, engineering, and mathematics, we must improve the rates of attraction and retention of students from traditionally underrepresented groups into science and engineering. We are doing a lousy job of this.

During the 1990s and early 2000s, there was real progress in U.S. institutions. Women reached 47% of mathematics majors, 42% of all physical science majors, and, from a very low base, climbed to just over 21% of all engineering majors. Today, despite the fact that they now receive 57% of all Bachelors degrees, women have fallen to 44% of mathematics degrees, 41% of physical science majors, and, most discouragingly, only 18% of engineering degrees.

Furthermore, in 2008, Hispanic students earned 8% of all Bachelors degrees, but only 6% of math degrees and of engineering degrees, and only 5% of physical science degrees. The situation is even more problematic for African-Americans. In 2008, they earned 10% of all Bachelors degrees, but only 6% of degrees in the physical sciences, and 5% of math degrees and of engineering degrees. What is especially discouraging is that in mathematics and engineering, the absolute numbers of African-Americans earning bachelors has been falling (see graph 2). In the case of mathematics, there has been a 25% decrease since the high point of almost 1100 Bachelors degrees in the mathematical sciences earned by African-Americans in 1997.



Graph 2. Number of Bachelors Degrees in Mathematics or Statistics earned by Black, non-Hispanic students. Source: US Dept of Education, NCES

It does not have to be this way. We know what works to support students into and successfully through science and engineering majors. In the Fall of 2009, Dr. Sylvia Bozeman of Spelman College came here to brief Congress on the success of their program, made possible through support from the NSF. By 2007, Spelman, a small liberal arts HBCU for women, was one of the top two producers of African-Americans earning degrees in Mathematics or Statistics. Their Chemistry Department today boasts 46 alumnae who have earned a doctorate degree in chemistry or a related STEM field, as well as hundreds of other chemistry graduates. As Dr. Bozeman said at the time, the key to their success was no more, and no less, than "creating a more welcoming environment, new pathways into science with additional courses of study, and a nurturing environment with exposure to role models and mentors."

This same approach of attention to the additional courses that are needed together with a nurturing environment that includes role models and mentors has worked wonders under the directorship of Dr. Carlos Castillo-Chavez at the Mathematical and Theoretical Biology Institute (MTBI) of Arizona State University. Initially created under the NSF's Research Experiences for Undergraduates (REU) program, MTBI has grown into an extensive program that mentors and supports students from the moment they enter university through post-doctoral programs. In the over eleven years of its existence, it has sent 112 of its alumni from underrepresented minorities on to graduate school, 71 of them on to PhD programs in STEM fields.

These are only two examples of unique NSF programs that provide impetus and seed money for the development of good ideas that are beginning to work to spur the growth of the educated workforce that we need. Distinctive NSF programs such as Integrative Graduate Education and Research Traineeship (IGERT), the Louis Stokes Alliances for Minority Participation (LSAMP), Alliances for Graduate Education and the Professoriate (AGEP), Mentoring through Critical Transition Points (MCTP), and Enhancing the Mathematical Science Workforce for the 21st Century (EMSW21) have invested substantial public resources for the training of American graduate students in the STEM fields and been particularly effective at attracting students from underrepresented groups.

The NSF's Directorate for Education and Human Resources (EHR) also has been a leader in developing and promoting programs that work, and EHR stands virtually alone in supporting innovative approaches to undergraduate science education. This is particularly exemplified by the Transforming Undergraduate Education in Science, Technology, Engineering, and Mathematics (TUES) program of the Division of Undergraduate Education (DUE). With very small sums of money, DUE is able to make a real difference in the quality of science instruction at many of our colleges and universities. The TUES program has encouraged and enabled some of our best scientists to work on the improvement of science education.

EHR's Division of Research on Learning in Formal and Informal Settings (DRL) has made it possible for science museums to actively engage with elementary and middle school students in our schools, building enthusiasm for science. DRL has also supported groups such as Dr. Phillip Sadler's Science Education Department within the Harvard-Smithsonian Center for Astrophysics that is learning what works—and what doesn't—in preparing high school students to succeed in science, engineering, or mathematics.

For these reasons, the Mathematical Association of America strongly supports the President's FY 2012 budget proposal to fund the NSF. We wish to bring to the attention of this Subcommittee that while this represents an increase of 13% over the enacted NSF funding for 2010, actual NSF funding has fallen behind the growth rates that both the current and prior administrations have proposed. Furthermore, EHR, the critical directorate that oversees the efforts of NSF in scientific education, has long been undervalued and underfunded. Even in this otherwise helpful Fiscal Year 2012 budget request, EHR is proposed for a much lower 4.4% increase.

In these tough budget times, there are many worthy programs that must deal with cutbacks. But the maintenance and cultivation of a scientifically capable workforce is critical to our future. To reduce funding for science, and in particular for science education, really would be an act of eating our seed corn.

Thank you again for this opportunity to appear before the Subcommittee.