AMERICAN MATHEMATICAL SOCIETY

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FUNDING IN THE MATHEMATICAL SCIENCES

Dear Dr. Atwell, Members of the Panel, Colleagues,

I wish to thank the National Science and Technology Council and the Lawrence Berkeley National Laboratory for this opportunity to discuss funding in the mathematical sciences.

Mathematics plays an enabling role in the research and discovery of many other disciplines, as well as underpinning much of our modern day technological innovation. One can see the benefits of mathematical research everywhere; for example, in secure internet communication, deciphering DNA, forecasting weather, fingerprint storage technology, blood flow and heart research, brain research, financial investment models, tracking products, routing traffic, and designing aircraft. Much of the current federal funding increase for mathematics has been directed towards interdisciplinary collaborations. We feel that these collaborations strengthen the mathematical disciplines by emphasizing the versatility of mathematics in modern day discovery and innovation. We embrace the dissoluton of barriers among the sciences this entails, and welcome the recognition that true progress in technology relevant to today's needs requires ideas and techniques from often very diverse points of view.

At the same time, we must reflect that the fundamental mathematical ideas involved in each of the innovations cited above came out of inquiries in a quite different context, often that simply of mathematical discovery. Research of this kind, not just in mathematics, but in all disciplines - sometimes called "small science" - is essential to breakthroughs relevant to our modern world, although at the time of discovery the relevance is not even suspected.

Looking back over the mathematical discoveries of the twentieth century, one can find many more examples of theoretical mathematics research and discovery that now play expanding roles in modern day technology. This research, at the time, was not driven by a desire to create new technology but by the desire to understand and develop areas of mathematics. To illustrate, much of the theoretical machinery developed during the latter part of the twentieth century to solve the three hundred year old Fermat's Theorem is now finding its way into the construction of codes for secure communication. The mathematicians developing this theory were not thinking secure communication codes, they were trying to solve a famous mathematical problem. Fourier series, developed over one hundred years ago as a way to represent functions, has a modern-day equivalent, wavelets, that has been instrumental in image restoration, including military applications.

What then, is the right model for funding in the mathematical sciences? We propose that it be based on balance: a balance which recognizes the importance of timely response to emerging technologies, the necessity of collaboration across disciplines, and the essentiality of basic investigation. We are concerned that this balance not be eroded. The success rate in the Division of Mathematical Sciences at the National Science Foundation this year is near 30%. For FY 2003 DMS is funding fewer mathematicians than in recent past years. These facts compare starkly with the corresponding data in other disciplines. The limiting factor is not the quality of the science, but the level of available funds.

Mathematics is a "small science" in the sense that the discipline, for the most part, does not require large facilities or laboratories; but mathematics collaborates with the "big science" disciplines. Small science is the riskiest research investment, but often with the highest potential in all of science. Mathematics is a human capital discipline. It requires a continuous flow of people, working on important mathematics, for the benefit of the field itself, as well as for collaborating with other disciplines and enabling technology. Federal support, broadly across the mathematical areas, is critical for the discipline to remain healthy, to grow, and to be a contributor to innovation twenty to thirty years from now.

We need support for all of mathematics, not just for the mathematics that we currently see as useful to applications. Over time, neglect of basic inquiry will lead to a dearth of fresh ideas, as yet untapped, but suddenly readily available for application. One never knows when mathematics that might be labeled theoretical today, will be an enabler of a new technology tomorrow. We urge, while you are re-thinking the way in which science is funded, that you take into consideration the special characteristics of the discipline of mathematics and its need for human capital.

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