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**Before the Research and Science Education Subcommittee**

**House Science and Technology Committee**

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Chairman Baird, Ranking Member Ehlers, thank you for the opportunity to testify before the Research and Science Education Subcommittee today. You have raised a number of important issues in your invitation letter and I commend you both for taking an active role in promoting a discussion of these questions.

The first issue you raise is in regard to NSF's efforts to nurture young investigators. Encouraging new investigators to become effective contributors to the science and engineering workforce is a critical goal for the National Science Foundation. Supporting young investigators is something that NSF takes seriously and it is an issue that we are addressing in a variety of ways.

Attracting new researchers is a key part of our Learning investment priority, articulated in the NSF's new strategic plan. The Strategic Plan also calls for expanding efforts to broaden participation in all NSF activities and programs. This year NSF is developing a plan to target such opportunities. Assessing the impact of NSF efforts to nurture young investigators, especially at the interfaces between K-12 and university education, 2-year and 4-year colleges, and technical and other higher education settings will be an important part of the broadening participation plan.

An ongoing program at NSF that supports young investigators is our signature Faculty Early Career Development (CAREER) Program. This is an NSF-wide activity that offers our most prestigious awards in support of the early career-development of young investigators. Successful applicants must effectively integrate research and education within the context of their organization's mission. The longer awards provided through CAREER offer new Principal Investigators (PIs) stability as they build their academic careers. NSF provides 400 CAREER awards annually, each for a duration of 5 years, to some of the best and brightest graduate students in the country.

Moreover, each year from among these outstanding CAREER awardees, NSF selects nominees for the Presidential Early Career Awards for Scientists and Engineers (PECASE). This Presidential Award is the highest honor bestowed by the U.S. government on scientists and engineers who are beginning their careers. It is awarded

both for excellence in research and for demonstrated leadership and service in their community.

NSF also engages in a variety of outreach efforts intended to assist and nurture young investigators. Our NSF Days program serves to assist investigators in understanding the process of submitting proposals to NSF through workshops that provide an introduction to and overview of NSF, its mission, priorities, budget, and its proposal and merit review process. In the five years that we've had the current configuration of NSF Days we have sponsored 40 workshops that have attracted nearly 6,000 participants. Additional outreach efforts typically pair NSF program officers with researchers whose proposals have been declined in an effort to improve proposals for subsequent re-submission. This is helpful for young investigators as it is the exception rather than the rule that a proposal is accepted by NSF the first time it is submitted. These activities serve to improve the funding rates of young investigators.

The effectiveness of these efforts is shown by the fact that we've maintained the funding rates of young investigators. The current NSF success rate is 21% for research grants—a decline from the 30% success rate of the late 1990s—however, the percentage of awards made to new investigators as a share of the NSF portfolio has remained stable at 27% in 1997 and 28% in 2006. Also, the length of time between the year of an investigator's last degree and the year of an investigator's first research grant from NSF in 1997 and 2006 has remained stable. In 1997, 73% of new Principal Investigators receiving their first NSF award were within 7 years of their last degree and in 2007 the comparable figure was 74%.

Still, we continually strive for improvement, and we believe that the variety of programs in place to foster young investigators will continue to increase the pool of successful young investigators involved in the U.S. science and engineering enterprise.

A second item raised in your invitation letter concerned the appropriate balance between interdisciplinary and disciplinary research. The current scientific era is characterized by interdisciplinary research with much of the promise of future work occurring at the interstices between traditional scientific disciplines.

Support for interdisciplinary research is a priority for the National Science Foundation and presents a tremendous opportunity for innovation. And yet the nature of scientific research is changing so rapidly that much of what is today considered disciplinary research would previously have been considered interdisciplinary in nature.

The issue of a balanced portfolio is a pivotal one for NSF. We must continue to push the frontiers through interdisciplinary, transformative research and foster advancements within the scientific and engineering disciplines that serve as a platform for such advancement. We must also balance between individual and small group research grants, infrastructure awards, center awards, and other types of grants and agreements. Approximately 40 percent of awards go to proposals with two or more PIs, a figure that has more than doubled in the past 20 years. The NSF portfolio is balanced through

negotiations between NSF and the National Science Board, through feedback with our many stakeholders – including Congress, the National Academies, OSTP, other research agencies, the research communities -- and through the merit review process itself.

NSF's Centers and Priority Areas, as outlined in our budget, serve as catalysts for generating interdisciplinary proposals. These efforts are effective strategic means to cultivate interdisciplinary areas of research. By growing these new avenues of research the participating disciplines are transformed and re-defined.

We have made a deliberate effort to communicate to various scientific communities our interest in supporting interdisciplinary research. Upcoming solicitations are strategically mentioned at all town hall meetings, conferences, workshops, and symposia and we regularly inform the community of interdisciplinary opportunities through Dear Colleague letters.

The use of co-reviews addresses one of the greater challenges that interdisciplinary research proposals present, which is that these proposals frequently require a greater range of expertise among the reviewers than disciplinary proposals. The flexibility of NSF's merit review process allows the program officers to use multiple approaches to meet this challenge for both solicited and unsolicited interdisciplinary proposals. The program officers will often work collaboratively, sharing their expertise to identify the right reviewers and to assess the reviewers' input. In some cases, mail reviews can be used to provide deeper expertise on various aspects of the proposal. Panel reviews are often used to integrate reviews from different disciplinary perspectives, and provide a broader interdisciplinary overview.

Recognizing which proposals are interdisciplinary poses little difficulty, especially when they are submitted in response to a specific solicitation. As for the unsolicited interdisciplinary research proposals, FastLane gives PIs an opportunity to select multiple programs as potential units to consider the proposal. Program officers take note when multiple programs are listed, and will evaluate if the interdisciplinary nature of the proposal is such that co-reviews by more than one program are warranted. Even if the PI does not choose multiple programs for review, program officers can recognize interdisciplinary proposals, and will bring these proposals to the attention of their colleagues in the appropriate programs. Co-reviews can be arranged between the relevant program officers on a case-by-case basis or on a larger scale if appropriate. For example, in the last few years program officers in BIO and MPS have recognized the increasing interdisciplinary nature of the research being proposed by new investigators and have coordinated the co-review of CAREER proposals that lie at the interface of the biological and physical sciences.

In 2004, the National Science Board initiated a Task Force on Transformative Research. A planning document generated by this task force is currently under review. A key concern of this effort is stimulating interdisciplinary, transformative research while maintaining the balance with disciplinary research. One aspect of the NSF internal task group on the Impact of Proposals and Award Management Mechanisms (IPAMM) study

is taking a closer look at transformative research. Ultimately, this issue can only be addressed through continuous feedback between NSF and the scientific community, and it is an issue that is central to our role as stewards of the U.S. scientific and engineering enterprise.

Let me move on to the matter of how NSF focuses attention to research issues of national importance. NSF is committed to fostering the fundamental research that delivers new knowledge to meet national needs and to improve the quality of life for all Americans. To meet the challenges of concern to our nation, NSF research activities are determined in accordance with guidance from several sources. These include reports from the National Academy of Sciences, R&D guidance as presented by the OSTP/OMB priorities memo, Presidential priorities such as the American Competitiveness Initiative, congressional interests, and the research community. NSF research priorities are evaluated on a continuous basis through such activities as Advisory Committees, Committees of Visitors, scientific conferences, strategic plans, etc. The priorities that emerge reflect the current needs of the Nation and are updated and represented annually in the Budget Requests to Congress.

Through funding collaborative grants and cooperative agreements, NSF can foster partnerships with academia and industry, potentially expediting the transition of basic research to "products." Several NSF programs are directly related to encouraging industry and university partnerships such as Small Business Innovative Research/Small Business Technology Transfer Research; Partnerships for Innovation and many of our Centers programs (e.g. Engineering Research Centers; Industry/University Cooperative Research Centers; Science and Technology Centers; Materials Research Science and Engineering Centers; and Nanoscale Science and Engineering Centers). NSF's most effective partnership with industry is accomplished through training undergraduate and graduate students who in turn enter the private sector with advanced skills in science and engineering fields.

NSF's Broader Impacts criterion requires each proposal to address the question "What are the broader impacts of the proposed activity?" This is an excellent way of determining whether proposals meet the mission of NSF, and therefore meets the needs of the nation. Considerations embedded in this criterion reflect the need to promote teaching and training among all citizens.

Mr. Chairman, the issues you have raised in this hearing are of profound importance, not only to NSF, but to the nation. They are not easy matters, nor do they lend themselves to simplistic or formulaic solutions. I commend you for making these matters the topic of your first hearing as chairman and I look forward to responding to any questions the members of the committee may have.