7. Issues Internal To NSF

"As we strive to improve opportunities in science, engineering, and technology for all citizens, we face challenges of inclusion and challenges of opportunity that are in many ways more complex and more subtle, and therefore more difficult to address... That is why we need a new strategy, a new direction, for human resource development in science and engineering."

Rita Colwell, Director,
National Science Foundation

As the federal agency charged with advancing science and engineering across the United States, it is incumbent upon NSF to provide equal opportunities both internally through staffing and administrative practices and externally in its grants programs and review criteria. One of NSF's primary goals is to foster the entire nation's scientific activity and discovery by expanding the preparation of and thus the science career choices available to all citizens, not just a select few. CEOSE believes that the regular presence of members of underrepresented groups as program directors, Advisory Committee members, and review panelists will not only help educate society as a whole, but also enable NSF to identify best practices that are appropriate to a diverse community. Similarly, the ways in which NSF designs programs and awards grants are critical to this mission. Diversity within all programs and in all practices is essential to broadening the participation of underrepresented groups.

In this chapter, we examine the demographics of senior NSF staff, Advisory Committees, and review panels in order to gauge whether directorates and divisions are actively seeking to include members of underrepresented groups. We also examine the number of awards compared to the number of proposals submitted at the directorate and divisional levels. While the proposal success rate is not the only measure of NSF progress in this area, it is certainly one measure of the direct impact of NSF support on the communities served. Finally, we review current practices to embed diversity and broaden participation in all NSF programs and discuss the effects of these efforts in terms of outputs and outcomes, as defined by the Government Performance and Results Act (GPRA) (see sidebar to right).

7.1 Staffing for Diversity at NSF

The diversity among professional staff makes a broad statement about NSF's attention to diversity. Indeed, objectives of NSF's fiscal year 2000-2005 Strategic Plan include increasing the quality, number, and percentage

Government Performance and Results Act (GPRA): History and Terminology

In 1993, Congress determined that waste and inefficiency in Federal programs was hampering government performance. In response, Congress passed the Government Performance and Results Act (GPRA), which holds Federal agencies accountable for meeting agency-defined goals. The legislation mandates a variety of measures, to streamline the workings of the Federal Government and improve public satisfaction with Federal programs.

As a result of GPRA, agencies such as NSF are required to submit a strategic plan to the Office of Management and Budget, and Congress, every three years. The strategic plan addresses agency missions and goals for a given fiscal year and five years into the future. The agencies are required to submit annual performance plans that outline the year's goals and determine if those goals are realized. If necessary, actions for meeting or modifying the original goals will be addressed.

The following terms are often used to describe GPRA goals:

Performance Goal: A measurable objective, such as increasing minority participation in SMET fields.

Input: The resources available to an agency for implementing a program. Inputs can include employees, funding, equipment, facilities, etc.

Output: The goods or services produced by a program. The mentorship that is provided to minority SMET undergraduates as part of the NSF Division of Human Resource Development, *Historically Black Colleges and Universities Undergraduate Program* would be considered an output.

Outcome: Program results; how well a program performed in relation to its stated performance goals.

Impact: The direct or indirect effects of a program. Agencies often measure impact by comparing program results to a hypothesized outcome resulting from the program's absence. For example, if SMET baccalaureates awarded to minorities increase over the several years that the *Historically Black Colleges and Universities Undergraduate Program* is active, it can be asked if there would be an increase without the program?

References:
Government Performance and Results Act of 1993{57}; Primer on GPRA Performance Management, Office of Management and Budget, Revised Feb. 25, 1995 (Web Document){58}; and GPRA Strategic Plan FY 2001-2006, National Science Foundation, September 30, 2000 {59}.

Table 7-1: Total Number of Staff and Percentage of Women, Underrepresented Minorities, and Persons with Disabilities Among NSF Staff with Decision-Making Responsibilities, 1999

NSF Directorate	Total Staff	Percentage of Women	Percentage of Underrepresented Minorities	Percentage of Persons with Disabilities
BIO – Directorate for Biological Sciences	59	49%	7%	2%
CISE – Directorate for Computer and Information Science and Engineering	39	21%	3%	NA*
EHR – Directorate for Education and Human Resources	91	53%	27%	1%
ENG – Directorate for Engineering	66	24%	8%	NA*
GEO – Directorate for Geosciences	64	30%	2%	NA*
MPS – Directorate for Mathematical & Physical Sciences	84	18%	12%	NA*
SBE – Directorate for Social, Behavioral and Economic Sciences	92	49%	8%	1%
OD – Office of the Director	49	35%	8%	2%
Total	547	36%	10%	<1%

Source: National Science Foundation, Internal Data {64}.
* Numbers are not available (NA)

of U.S. degree recipients from underrepresented groups and expanding their participation in NSF research and education programs {13}. The Foundation's recruiting strategies include efforts to attract applicants from groups underrepresented in science and engineering, such as participation in job fairs targeted to underrepresented groups, targeting vacancy announcements to institutions and publications primarily serving underrepresented groups, and direct networking {12}. This section discusses diversity among all decision-making staff at NSF for FY 1999.

Women

In some disciplines in the Biological Sciences (BIO) and Social, Behavioral and Economic Sciences (SBE) directorates, the participation of female researchers has grown considerably in the last two decades. As shown in Table 7-1 {64}, for BIO, SBE, and Education and Human Resources (EHR), the proportion of women in decision-making staff positions (i.e., assistant director, program director, program officer, or senior executive) is about half (49% for BIO and SBE, and 53% for EHR). For other directorates, the number of women is closer to one-fifth (18% in Mathematical and Physical Sciences [MPS], 21% in Computer and Information Science and Engineering [CISE]) and 24% in Engineering [ENG]. Not surprisingly, the ranking of the directorates with respect to female representation in decision-making positions generally reflects similar statistics for female representation within the doctoral population discussed in Chapter 6.

Overall, women hold approximately 36% of the decision-making staff positions at NSF (i.e., assistant director, program director, program officer, or senior executive). This compares favorably with the percentage of women in the U.S. doctorally-trained SMET population (24% in 1999).

Minority Groups

As indicated in Table 7-1, the percentage of underrepresented minorities in decision-making staff positions (i.e., assistant director, division director, or program director) is considerably lower than that of women. They range from a high of 27% in EHR to lows of 2% and 3% for Geosciences (GEO) and CISE, respectively. Overall, the percentage of underrepresented minorities among decision-making staff at NSF in 1999 was 10%. The corresponding percentage for underrepresented minorities in the doctorally-trained SMET population in 1999 was 5%.

Persons with Disabilities

Little data are available for staffing with respect to persons with disabilities. Table 7-1 shows figures of 1-2% for several directorates. However, it should be cautioned that disability data are based on self-reports of

Table 7-2: FY 2000 Advisory Committee Demographics, by Directorate

NSF Directorate	Number of Advisory Committee Members	Percentage of Women	Percentage of Underrepresented Minorities
BIO – Directorate for Biological Sciences	15	40%	13%
CISE – Directorate for Computer and Information Science and Engineering	14	14%	7%
EHR – Directorate for Education and Human Resources	17	41%	41%
ENG – Directorate for Engineering	33	21%	21%
GEO – Directorate for Geosciences	31	35%	0%
MPS – Directorate for Mathematical & Physical Sciences	17	18%	12%
SBE – Directorate for Social, Behavioral and Economic Sciences	29	48%	17%
OD – Office of the Director	48	44%	13%
National Science Board	41	34%	10%
Total	245	35%	14%

Source: National Science Foundation, Internal Data.

severe disabilities, as defined by the U.S. Office of Personnel Management, and therefore may underreport these figures in actuality.

7.2 Reviewers And Advisors

Much of NSF's work is performed by scientists and engineers who act as reviewers for and advisors to NSF. Unfortunately, the available demographic information about these individuals is quite limited, either because NSF has not made a concerted effort at tracking the information and/or because requested information has not been provided.

The only reliable demographic information about panelists that is available is their gender. Among the 95% of panelists reporting this information in FY 1999, 26% were women.

Only 3 divisions within NSF reported having any Special Emphasis/Advisory Panel members with disabilities: 2 of 84 members of Civil and Mechanical Structures panels, 1 of 276 members of Design, Manufacturing, and Industrial Innovation panels, and 2 of 31 members of Human Resource Development (HRD) panels. However, these low figures may constitute a significant underestimation of the actual disability rate, because of the reporting problems discussed above.

Each year Directorate Advisory Committees—composed of experts in academia, industry, and government—review Committee of Visitors 5 (COV) reports, external evaluations, and directorate annual reports with the combined purposes of providing advice for strategic planning and systemic programming and judging program and directorate effectiveness. Across NSF directorates in FY 2000, 35% of Advisory Committee members were women (See Table 7-2). {64} Their representation in individual directorates ranged from 14% for CISE to 48% for SBE. With regard to race/ethnicity, 14% of all Advisory Committee members were underrepresented minorities, with a range in individual directorates from 0% for GEO up to to 41% for EHR. Fewer than 1% of all individuals on NSF Advisory Boards reported having a severe disability.

7.3 Current Program and Review Practices with Respect to Diversity

NSF's practices to ensure diverse representation in its programs have changed in the past few years. New review criteria, data collection systems, and programs have enabled the Foundation to address more directly issues of equal opportunity in science and engineering. In this section, we discuss these changes as they relate to diversity.

Merit Review Criteria

NSF's merit-based review process (see sidebar on page 40) includes evaluation of proposed grants on "broadening opportunities and enabling the participation of all citizens – women and men, underrepresented minorities, and persons with disabilities…."

In FY 1999, 95% of funds were allocated to projects

A Diverse, Globally Oriented Workforce

Since FY 1999, NSF's first full year of implementation for GPRA, the agency has shown progress towards meeting its goals. One of the desired GPRA Strategic Outcomes is "A diverse, globally-oriented workforce of scientists and engineers." Committee of Visitors and Advisory Committee reports have rated NSF as generally successful in meeting these goals, although they emphasize that additional progress will be necessary.

In 1999, progress was demonstrated in the awarding of Graduate Research Fellowships to 900 graduate students, of whom 49% were women and 8% minorities. In addition, in that same year Collaborative Teacher Preparation programs enrolled nearly 74,000 undergraduates and post-baccalaureate students, 58% of whom were women and 30% from underrepresented minority groups.

For FY 2000, the Division of Human Resource Development's Annual Report highlights additional successes for underrepresented minorities. The Alliances for Graduate Education and the Professorate (AGEP) program reports increases in the participation of underrepresented groups at the doctoral level. For example, the University of California at Irvine reported an increase of over 50% in first-year Ph.D. minority graduate enrollment in SMET fields. The University of Michigan enrolled 21 AGEP Fellows in SMET fields during the 1998-1999 academic year, representing a 34% increase in minorities entering these doctoral programs. Furthermore, the university saw a 50% increase in minority Ph.D. graduates in SMET fields from 1998 to 1999.

The NSF FY 2001 GPRA Performance Plan (February 2000) declares a new performance goal: to increase the total number of hires to SMET positions from underrepresented groups over 1997 (in FY 1997, there was a baseline of 54 hires, 22% female and 19% from underrepresented groups). These strategies include a focus on encouraging new applicants and proposals among women and minorities, attending to diversity as one of the elements of merit review criteria, developing and increasing funding for specialized programs to promote diversity, and embedding diversity in all NSF programs. The plan also stipulates that trend data will be kept on the actual numbers of new hires as well as the aggregate numbers of underrepresented groups.

Source: FY 1999 National Science Foundation GPRA Performance Report {60};, 2001 National Science Foundation GPRA Performance Plan (February 2000){61}; ,and FY 2000 National Science Foundation Division of Human Resource Development's Annual Report {62}.

subjected to merit review, compared to 89% in FY 1997 and 90 percent in FY 1998. In addition in FY 1999, 33 of 36 Committees of Visitors (COV) reports and 3 of 8 Advisory Committee (AC) reports rated NSF as successful in achieving a GPRA goal of using established merit review criteria. While these ratings are encouraging, they generally do not provide separate information about how well reviewers are doing on the specific element of integrating diversity into NSF Programs, Projects, and Activities. In the future, CEOSE encourages NSF's COVs and Advisory Committees to provide specific ratings of how well reviewers do in using the specific merit review element of integrating diversity into NSF Programs, Projects, and Activities in order that progress in this area can be directly tracked.

An example of the importance of the COV reports as a catalyst for change is provided by the Directorate for Engineering. Staff are addressing COV concerns that both principal investigators and reviewers pay too little attention to Criterion 2 when developing and reviewing proposals. The directorate has asked reviewers to consider more closely the embedding of diversity into NSF programs, projects, and activities.

Greater understanding and application of the diversity and other merit-review requirements are expected as program announcements make these requirements more explicit and as more guidance is provided to reviewers in using the criteria to evaluate proposals.

FastLane

FastLane is a proposal submission and data collection system designed to make NSF a paperless environment. The online system comprises a collection of modules intended to help all directorates streamline interactions with the research community. The relevant GPRA performance goal for FY 1999 was that 25% of full proposal submissions would be received and processed electronically: in fact, nearly twice as many (44%) were submitted electronically. The FY 2001 performance goal for FastLane is that 95% of full proposals will be received electronically.{59} While FastLane has the capability to collect data regarding women, minorities, and persons with disabilities, priorities have been placed on expanding its overall use, and these data have not been monitored to date. As FastLane matures, CEOSE encourages NSF to institute procedures that will permit

Table 7-3: NSF Funding Success Rates for Women and Minorities, FY1998 to FY2000

		Funding Success Rates		
Directorate	Year	All PIs	Female PIs	Minority PI
BIO	2000	29%	33%	32%
	1999	29%	29%	37%
	1998	29%	28%	36%
CISE	2000	31%	36%	30%
	1999	33%	34%	35%
	1998	35%	33%	26%
HER	2000	35%	35%	37%
	1999	29%	32%	25%
	1998	34%	44%	31%
ENG	2000	25%	32%	22%
	1999	27%	27%	26%
	1998	25%	30%	21%
GEO	2000	39%	41%	35%
	1999	38%	35%	24%
	1998	37%	32%	28%
MPS	2000	39%	39%	42%
	1999	37%	37%	33%
	1998	35%	33%	30%
SBE	2000	38%	33%	32%
	1999	30%	30%	29%
	1998	41%	37%	35%

Source: National Science Foundation, Internal Data {64}.

collecting more accurate data about the application rate, success rate, and grant size of groups based on gender, race/ethnicity, and disability status.

Transitions from Focused Programs to Embedded Diversity

Perhaps NSF's most dramatic shift with respect to providing equal opportunity in science and engineering has been a shift from providing programs specifically targeted to women, minorities, or persons with disabilities to embedding diversity in all of its programs.

In 1980, legislation charged NSF with addressing issues of equal opportunity, reflecting the underrepresentation of women, minorities, and persons with disabilities in the sciences. This was pursued largely through developing programs explicitly for women, minorities, or persons with disabilities. Recently, however, NSF has taken steps to ensure that all its programs serve underrepresented groups. New announcements of opportunities and proposal solicitations include statements asking proposers to take steps to improve the participation of underrepresented groups in their activities.

Much of the activity to embed diversity has taken place in the Divisions of Human Resource Development (HRD) and Division of Undergraduate Education (DUE) in EHR. Strategies for increasing the participation of women include research on pre-college and undergraduate barriers and enablers, demonstration projects at the pre-college and undergraduate levels, and direct support of graduate students and faculty. For minorities, these divisions are focusing on institutional capacity building in research and education, alliances of undergraduate and graduate institutions in partnership with industry and national laboratories, and direct support of students and faculty. Finally, with respect to persons with disabilities, HRD is conducting research on pre-college and undergraduate barriers and enablers, demonstration projects at the pre-college and undergraduate levels, direct support of facilitation aids, and research on assistive technologies. DUE also supports a few demonstration projects.

7.4 Proposals and Awards

In view of NSF's FY 2001 GPRA goal to increase the involvement of women, underrepresented minorities, and persons with disabilities, the distribution of research grants for FY 1998, 1999, and 2000 is a relevant indicator of expanding opportunities for underrepresented groups. (Involvement refers to persons named as principal investigators (PIs) or co-PIs on the proposal, but it should be noted that their gender and race/ethnicity do not necessarily represent the populations being served. In some cases, project PIs may distribute funding to other researchers or may lead projects in areas designated as underserved or with concentrations of underrepresented minorities.)

In FY 1998, 5,785 competitive research grants were awarded. Of these, 990 (17%) were awarded to women and 210 (4%) were awarded to underrepresented minorities (researchers who are both women and underrepresented minorities are duplicated in these figures). In FY 1999, 6,015 competitive research grants were awarded, with 1,030 (17%) awarded to women and 239 (4%) to underrepresented minorities. In FY 2000, 6,505 grants were awarded; of these, 1,173 (18%) were awarded to women and 286 (4%) to minorities.

Funding rates of proposals are also an important indicator of opportunities for women and underrepresented minorities. For FY 1999 the overall funding rate was 32%, and during the recent 3-year period, the funding rates for minorities and for women

have not changed dramatically. The FY 1999 Report on the NSF Merit Review System also found that:

- The funding rates for proposals from minority PIs were below the NSF average in FY 1999, and have been for 7 of the past 8 years. The number of proposals received yearly from minority PIs has decreased by 5% since FY 1992.
- Since FY 1992, the funding rates for proposals received from female PIs and male PIs have been similar. The number of proposals received from female PIs increased by 19% during that 7 year period.

The following observations can be made regarding funding success rates within NSF directorates during the period FY 1998 to FY 2000 that are contained in Table 7-3 {64}:

- In FY 2000, women PIs had success rates that were equal to or higher than those of their male colleagues in all directorates except SBE. This stands in marked contrast to FY 1998, when five of the seven directorates reported women having lower success rates than men.
- In FY 2000, the minority success rate was higher than the total success rate in 3 of the 7 directorates in comparison with FY 1998, when only 1 of the directorates (BIO) reported minority members with above average success rates.
- The overall finding rate in 2000 ranged from 25% to 39% across directorates, with an even narrower range among women (32% to 41%) and a slightly larger range among minorities (22% to 42%).

New NSF GPRA performance goals for FY 2001 include:

NSF will begin to implement the mechanisms and approaches put forth in FY 2000 for increasing the number of women and underrepresented minorities in the proposal application pool.

NSF will begin to implement the approaches identified in FY 2000 for retaining women and underrepresented minorities in the proposal applicant pool.

- These strategies include a focus on obtaining new proposals from women and minorities, attending to diversity as one of the elements of merit review criteria, developing and increasing funding for specialized programs to promote diversity, and embedding diversity into all NSF programs.

- The FY 1999 performance goal for the use of merit review was that at least 90% of NSF funds be allocated to projects that are reviewed by external peers and selected through a merit-based competitive process.

Source: FY 1999 National Science Foundation GPRA Performance Report{60};, 2001 National Science Foundation GPRA Performance Plan (February 2000){61}; ,and FY 2000 National Science Foundation Division of Human Resource Development's Annual Report {62}.

NSF Grant Proposal Process

"We must embrace the concept of preparing our citizens to take advantage of opportunities. If we allow anyone to be left behind, we create a formula for our nation to be left behind. We are talking here about opportunities not only for individuals – we are talking also about ways to create expanded opportunities for the United States to participate, prosper and contribute."

Joseph Bordogna, Deputy Director,
National Science Foundation

The current grant proposal guidelines provide the following instructions to potential grantees and reviewers:

Proposals received by the NSF Proposal Processing Unit are assigned to the appropriate NSF program for acknowledgment and, if they meet NSF requirements, for review. All proposals are carefully reviewed by a scientist, engineer, or educator serving as an NSF Program Officer, and usually by 3 to 10 other persons outside NSF who are experts in the particular fields represented by the proposal. Proposers are invited to suggest names of persons they believe are especially well qualified to review the proposal or persons they would prefer not review the proposal. These suggestions may serve as one source in the reviewer selection process at the Program Officer's discretion. Program Officers may obtain comments from assembled review panels or from site visits before recommending final action on proposals. Senior NSF staff further review recommendations for awards.

Review Criteria

The National Science Board approved revised criteria for evaluating proposals at its meeting on March 28, 1997 (NSB 97-72). The criteria are designed to be useful and relevant across NSF's many different programs, however, NSF will employ special criteria as required to highlight the specific objectives of certain programs and activities.

The merit review criteria are listed below. Following each criterion are potential considerations that the reviewer may employ in the evaluation. These are suggestions and not all will apply to any given proposal. Each reviewer will be asked to address only those that are relevant to the proposal and for which he or she is qualified to make judgments.

Criterion 1: What is the intellectual merit of the proposed activity?

How important is the proposed activity to advancing knowledge and understanding within its own field or across different fields? How well qualified is the proposer (individual or team) to conduct the project? (If appropriate, the reviewer will comment on the quality of prior work.) To what extent does the proposed activity suggest and explore creative and original concepts? How well conceived and organized is the proposed activity? Is there sufficient access to resources?

Criterion 2: What are the broader impacts of the proposed activity?

How well does the activity advance discovery and understanding while promoting teaching, training, and learning? How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)? To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships? Will the results be disseminated broadly to enhance scientific and technological understanding? What may be the benefits of the proposed activity to society?

PIs should address the following elements in their proposal to provide reviewers with the information necessary to respond fully to the above-described NSF merit review criteria. NSF staff will give these elements careful consideration in making funding decisions.

Integration of Research and Education

One of the principal strategies in support of NSF's goals is to foster integration of research and education through the programs, projects and activities it supports at academic and research institutions. These institutions provide abundant opportunities where individuals may concurrently assume responsibilities as researchers, educators, and students, and where all can engage in joint efforts that infuse education with the excitement of discovery and enrich research through the diversity of learning perspectives.

Integrating Diversity into NSF Programs, Projects, and Activities

Broadening opportunities and enabling the participation of all citizens -- women and men, underrepresented minorities, and persons with disabilities -- are essential to the health and vitality of science and engineering. NSF is committed to this principle of diversity and deems it central to the programs, projects, and activities it considers and supports.

Reference: NSF Grant Proposal Guide (NSF 00-2) {63}.