NIEHS/AACR Task Force on the Advancement of Minorities in Science: Vision for a Model Program

The National Institute of Environmental Health Sciences/National Institutes of Health and the American Association for Cancer Research initiated the “NIEHS/AACR Task Force on the Advancement of Minorities in Science” to address the issues of recruitment, participation, retention, and advancement of historically underrepresented minorities in the biomedical sciences.

The goal of the Task Force was to establish a model program, national in scope and significance, to increase the number of historically underrepresented minorities who earn a doctorate and excel professionally in the biomedical sciences. To this end, the model program will:

- seek to promote systemic change in educational institutions from precollege through graduate school;
- introduce effective models of diversity training for faculty and students from precollege through university;
- promote collaborative learning, leadership skills, and team building in science;
- focus on the professional development of teachers;
- depend on the commitment and collaboration of financial and philosophical partners for its implementation.

This document represents the vision for the model program, developed by an eight-member subcommittee charged with representing and documenting the concerns and opinions of the Task Force as a whole.

Background

In February 1994, a group of leaders from academia, science and engineering, and government convened in Research Triangle Park, North Carolina, to address the complex issue of minority representation in the sciences. The members of the “NIEHS/AACR Task Force on the Advancement of Minorities in Science” were invited to participate by the NIEHS/NIH and the AACR, based on their involvement with successful programs and their commitment to improving the situation regarding underrepresented minority involvement in science.

NIEHS and AACR share a common goal for this project, i.e., to develop a comprehensive model program to improve the recruitment, retention, and advancement of underrepresented minorities in the sciences throughout the United States. This document represents the vision for the model program, developed by an eight-member subcommittee charged with representing and documenting the concerns and opinions of the Task Force as a whole. (See “Appendix” for complete list of Task Force members.)

Bearing on the 21st Century Workforce

In the next century, the pursuit of science to advance public health and environmental health will play a key role in the development of national policy. Scientific solutions to such problems as environmental pollution, famine, alternative energy sources, ozone depletion, climate change, and devastating epidemic diseases will require integration of expertise on a global scale. The next generation of scientific leaders, whether they work in universities, industry, or in public service, will be drawing their information from sources throughout the world and, therefore, need to understand diverse perspectives and cultures.

Even more germane is the fact that the face of the United States workforce is changing. By the turn of the century, most of the new entrants into the workforce will be individuals other than white American males, who in the past have constituted the majority of new workers. Consequently, it is incumbent on the United States to realize that the success of any national science education and training initiative will depend upon its capacity to impact underrepresented minorities, who will constitute an increasing percentage of the national workforce in the future. For many years, concerns regarding minority representation in the sciences were driven by considerations of equity; now these considerations acknowledge the need to utilize all of the nation’s existing human resources. If this nation is to remain scientifically competitive in the 21st century, its science education programs must impact all strata of society, especially those that will make up the majority of the emerging workforce in the next century.

It was estimated that by the end of 1996, African and Hispanic Americans would constitute one-quarter of the college-aged population, and one-third by the year 2010. However, their representation in science and engineering is not comparable and does not begin to approach these numbers.

Of the 4,827 Ph.D. degrees awarded to U.S. citizens in the life sciences in 1993, 2.6% were granted to African Americans, 0.6% to Mexican Americans, 0.8% to mainland Puerto Ricans, and 0.3% to Native Americans. Although the total number of doctorates awarded to U.S. citizens in this country increased by 4.3% between 1978 and 1993, those awarded to African Americans increased by 7.3%, but with a decline of over 24.4% for African American males (1).

This paucity of representation seen at the training level translates directly to the workforce. In 1991, Blacks made up only 2.2% of the total doctoral scientific workforce, Native Americans accounted for 0.2%, and Hispanics 1.8%. In the life sciences, Blacks, Native Americans, and Hispanics made up 1.9, 0.2, and 1.6% of the working doctoral scientists, respectively. Although Blacks comprised about 11% of the total U.S. workforce and 8% of all those in professional specialty occupations in 1992, only 4% of employed engineers and 2.7% of natural scientists were Black (2).

Current Environment

Minority representation on university and college faculties has not changed in 10 years. The “pipeline” of qualified minority candidates has stagnated on all educational levels and across most academic fields. In science, teaching, and research fields, historically underrepresented minorities are relatively nonexistent, given that very few minorities obtain Ph.D. degrees and, of these, fewer still serve as faculty in major research universities or do research in private industry or federal research establishments. As an example, in 1991, a total

1 The abbreviations used are: NIEHS/NIH, National Institute of Environmental Health Sciences/National Institutes of Health, AACR, American Association for Cancer Research.
2 The subcommittee, which met on June 23 and 24, 1994, was composed of Howard Adams, John Alderete, George Campbell, Grace Mary Flickinger, Marian Johnson-Thompson (Chairperson), Israel Tribble, Sandra White, and James Wyche.
3 Throughout this document, the terms “African American” and “Black” are used interchangeably and correspond with the terms used in the specific citations.
4 The report gives the results of data collected in the Survey of Earned Doctorates, sponsored by five federal agencies: NSF, NIH, NEH, United States Department of Education, and United States Department of Agriculture, and conducted by the National Research Council.
5 For the purposes of this document, “historically underrepresented minorities” include Blacks, Hispanics (Mexican Americans, Puerto Ricans, and other Hispanics), and Native Americans (American Indians and Alaska Natives), groupings used by the National Research Council in its “Survey of Earned Doctorates 1991—92.” In addition, the use of the term “historically underrepresented minority” in this report refers to U.S. citizens.
of 61,827 doctoral scientists and engineers were employed by academic institutions in the life science disciplines. Of these, 1310 (2.1%) were Black, 1072 (1.7%) were Hispanic, and 93 (0.1%) were Native American (2).

When they do achieve faculty status, American-born underrepresented minority scientists, as a whole, find themselves alone and isolated throughout their careers, especially in basic science departments at major universities and research institutions. Many find themselves without mentors, who provide guidance and information crucial to their tenure, promotion, and professional advancement. Underrepresented minority scientists become over-extended in departmental and institutional committees, especially those activities involving minority issues. They also are expected to serve in an unofficial capacity as advisors and counselors to minority students across the campus, regardless of discipline. Their research activities and career development and advancement are, therefore, further compromised.

It is not surprising, given the absence of minority scientist role models, that underrepresented minority graduate students find themselves in departments with faculty lacking an understanding of and sensitivity to their culture and relevant societal issues that impact their lives. They are placed in an environment in which the prevailing atmosphere is that things will be done as they were when the faculty themselves were in graduate school. Some individuals express additional concern that today’s underrepresented minority students are often taught by non-citizen faculty who are even more removed from the cultural and societal issues relevant to American minority school-age populations. Others counter that argument, saying that majority students, too, experience similar difficulties in this regard.

In addition, underrepresented minority undergraduate students interested in the biomedical and life sciences are readily placed in pre-med tracks. However, many if not all of the institutions with a large percentage of minority undergraduates have poor placement records of minorities into medical school. Those minority students not accepted by medical schools then find few alternative career opportunities and many do not continue their (higher) education. These same students are rarely directed toward other bioscience career options. Often underrepresented minorities find themselves in a climate unresponsive and insensitive to their particular needs necessary to ensure higher level educational performance.

Finally, it cannot be emphasized enough that data on the numbers of underrepresented minorities in science are often inappropriately and incorrectly documented, tabulated, and interpreted. Such misrepresentation of data leads to misperceptions about the extent of minority underrepresentation. For example, Hispanic-surnamed students and faculty of privileged backgrounds from Central and South American countries are automatically listed as “minorities” under the “Hispanic” category, although these individuals are not the underrepresented minorities defined earlier in this document. Similarly, non-American-born Blacks who are not truly underrepresented are listed as minorities for the purposes of data collection. This minimizes the emphasis and subverts, at all levels, programs that are implemented for recruitment and retention of underrepresented American minority students and faculty.

**Factors Inhibiting Minority Participation in Science**

Although it is obvious from the preceding discussion that American-born minorities are underrepresented in the biomedical sciences, the reasons for this underrepresentation are complex. Economic circumstances and financial barriers pose a particularly heavy burden to minority students, who are more likely to be dependent on their earnings and loans than are whites but are less likely to receive federal awards. As an example, of the U.S. citizens receiving doctorates in the life sciences in 1993, 45.5% of Native Americans and 29.5% of Blacks reported relying primarily on personal financial resources to pay for their graduate education, compared to 27.5% of white students (1).

Poor academic preparation by the current educational system continues to be a major barrier for underrepresented minorities to gain access to and be competitive in higher education. These students often are plagued by high dropout rates from high school, often due to teenage pregnancy, challenging and insensitive learning environments, and ever-increasing societal factors such as crime and drug abuse. The quality of their education is often compromised due to high school teachers who are ill-prepared to teach the subjects crucial to success as undergraduate science majors. In 1991, only 61% of the high school mathematics teachers in this country had been math majors in college. In the same year, only 70% of high school science teachers had been college science majors (2).

Even when students are successful in completing their high school education and enter college, there are numerous factors that impact on their exposure to and learning of science. John Alderete, Professor of Microbiology at the University of Texas in San Antonio, has said, “In most minority institutions, minority students are unlikely to participate in or even be exposed to research. Faculty are often out of touch with modern research, science laboratories are ill-equipped, and little, if any, faculty enrichment occurs.” In his discussion on minorities in majority institutions, he adds that, “Most majority colleges and universities lack verbal or written declarations from the top administration related to taking a proactive stance on issues of advancement for minority students.”

Another inhibitory factor is the degree to which universities accept foreign students, thus supplanting the presence of U.S.-born underrepresented minority students. In 1978, 15.9% of the doctorates awarded in the United States went to non-U.S. citizens. By 1993, that number had increased to 31.6%, i.e., one in three doctorates earned in the U.S. went to non-citizens (1). Many graduate science programs enroll foreign students because they appear better prepared academically than minority or majority American students and require less financial and social support. Often foreign students are accepted based upon higher Graduate Record Examination (GRE) scores, one of several criteria used for admission into graduate programs.

Some observers also speculate that many African Americans choose professions that require fewer years of schooling for degrees, rather than spending 5 or 6 additional (postgraduate) years pursuing doctorates in abstract fields in which they may or may not be able to find gainful employment upon completion of their degree program. This may result from inadequate mentoring for these students and a relatively nonexistent advisory system for minorities desiring information on alternative careers. Due in part to a desire to change their socioeconomic conditions quickly, African American enrollment in schools of law, medicine, and business has risen while that in Ph.D. programs has fallen during the same period of time. In all likelihood, the socioeconomic status of many minorities plays a major role in their career decisions, and as a result, they are pushed in the direction of “doing something practical.”

At the K-12 level, minority students are often inhibited by their educational experience in the present system, which does not expose them to the contributions of their own culture. Other inhibitory factors for minority students in K-12 include institutionalized low expectations, often including those of and by their parents, many of whom have limited academic experiences, are unfamiliar with the language of academe, and are intimidated by the school administration. Furthermore, majority counselors in these schools continue to advise this group of students toward non-academic careers.

At the undergraduate level, the climate at institutions (both minority and non-minority) does not place value on the higher education and
achievement of underrepresented minorities. This is evident in the lack of minority recruitment and retention efforts; in the inappropriate or nonexistent counseling and advising about alternative careers to medicine; and in the unawareness on the part of minority students regarding the necessity of a rigorous academic curriculum.

Minority students tend to perform poorly on standardized tests, for which they are inadequately prepared. These students have not been formally introduced to sufficient “survival skills,” such as knowledge of the graduate school culture and the prerequisite communication and analytical skills critical to success in graduate education.

In graduate schools, there also exists a lack of recruitment of minority students and few or no role models. Graduate institutions are unlikely to express as policy the need for diversity and minority recruitment. These students face discrimination from faculty lacking in cultural sensitivity and in appreciation of diversity. Students feel isolated because of differences in communication and ways of thinking. Two added barriers are the emphasis on standardized tests by graduate admission policies and the insensitivity of foreign-born faculty to underrepresented minority students.

Underrepresented minority faculty experience similar obstacles. Institutions do not express a desire to recruit minority faculty and do not provide mentoring or guidance on tenure and promotion issues. In general, underrepresented minority faculty face a hostile climate that does not respect or even acknowledge the uniqueness of their views and contributions. These feelings are acute among minority faculty at majority institutions where there does not exist a critical mass of minorities to serve as a support system.

Factors Common to Successful Programs

In spite of the lengthy discussion of barriers to minority participation in science, the Task Force acknowledges that several programs designed to address these issues have met with varying degrees of success. Over the past decade or more, there has been a significant growth in mathematics and science programs intended to increase the participation of underrepresented minority students. These programs exist at all levels of education from K-12 through higher education. This program growth has enabled the Task Force to evaluate and discern those elements of success present in effective programs.

Elements of Successful K-12 Programs. Consistent with research findings over time, parental involvement and support continue to be important in enhancing the effectiveness of programs at the K-12 level. This does not suggest that without parental involvement individual and program success cannot be achieved. Early intervention is also important, which precludes youngsters from turning off or discounting the importance of math and science in their educational process. High expectations for learning are also important for success by minority students. These expectations are best expressed through strong program leadership as well as through competent and enthusiastic role models such as teachers and counselors. A strong academic curriculum reinforces the notion that minority students can achieve beyond their own expectations. Classroom programs should be participatory, holistic, and collaborative, and must provide hands-on experiences for students. In addition, programs must be focused in terms of accomplishments and the target population. Innovative teaching strategies must complement the presence of motivated students. Successful programs usually have long-term support and commitment and provide year-round enrichment for participants. Students are exposed to role models and career options in the most successful programs.

Elements of Successful Higher Education Programs. The literature reveals elements that contribute to the effectiveness of minority programs at colleges and universities. A clearly defined policy and a visible and demonstrable institutional commitment are prerequisites for success. Improved student support services must provide academic enhancement and enrichment, yet ensure that the activities and support provided do not stigmatize the students. Program leadership is critical to the success of all activities. This leadership is usually in the form of an individual who is respected across the institution as well as in science at the national level within scientific organizations. The credentials, preparation, and experience of the program leadership should be consistent with those of their colleagues. Programs appear to be even more effective when staff and faculty of color are present and involved. Financial support of the program must be adequate and comparable to other campus programs. Financial aid for students needs to be sufficient and stable. For graduate programs, teaching and research fellowships must be provided. Programs clearly benefit from collaborations and cooperative relationships to broaden their scope and outreach activities. Finally, a crucial element in the success of programs at all levels is the involvement of mentors to whom the students can relate.

Intended Outcomes of the Model Program

The ultimate goal of this model program is to increase the number of historically underrepresented minorities who earn a Ph.D. and excel professionally in the biomedical sciences. The target populations of the program are those groups of U.S. citizens who have been traditionally underrepresented in the sciences (i.e., African Americans, Native Americans, and Hispanic Americans).

To be successful, this program must include strategies at all educational levels aimed at both students and faculty. Strategies will be developed to assure that the proportion of underrepresented minorities earning a Ph.D. in the biomedical sciences reflects, at a minimum, their percentage by age group in the general population.

Program Goals at the K-12 Level. Many underrepresented minority youngsters are lost from the educational pipeline early in their schooling. These students are the victims of poor teaching, inadequate academic facilities, lack of mentors and, often, low expectations by their teachers, parents, and the system. They are not introduced to science in elementary school, and they are not taught science in a way that keeps them interested in it. Special attention must be paid to engaging students at the elementary level if they are to have any hope of ultimately choosing science as a career.

If the number of underrepresented minorities earning the doctorate in the life sciences is to increase, students graduating from high school must enter college as science majors. This necessitates changes in the current science education system to ensure their preparedness for the undergraduate science curriculum. The model program will stress the importance of teaching underrepresented minority students the skills that are critical for success in science. As an example, they must be prepared for and enroll in algebra and calculus, rather than general mathematics courses, and enhance reading, verbal, and analytical skills. They must receive a high quality science education throughout the K-12 experience.

At this level, underrepresented minority students desperately need a strong mentoring program with positive role models. All students have a right to learn in an atmosphere conducive to learning and be taught by teachers who are committed to their education and to their ability to succeed. Students tend to achieve at the levels expected of them. This program will advocate for teachers who have very high expectations that their underrepresented minority students can master the knowledge and skills required for successful college science majors.

Frequently, teachers in elementary schools are not adequately prepared to teach science in an accurate, meaningful, and interesting way.
NFκB in response to cytokine stimulation (16). In the present study, from NFκB. This mutant form of κB (κB) does not release

MATERIALS AND METHODS whether they are effective in blocking X-ray-induced CAM expression. We observed that nonspecific inhibition and dominant negative complete medium was added, followed by centrifugation at 2000 rpm for 5

cells were harvested with 0.1% collagenase and 0.01% EDTA and were endothelial cell cultures was verified by staining for factor Vifi. Confluent microvascular (17) were maintained in endotheial basal medium MCDB131 subcultured at a ratio of 1:3. HUVECs were used at third passage; this reduced

body (goat antimouse IgGl) for 20 mm at 4°C.The fluorescein-labeled cells (Life Technologies) supplemented with 15% fetal bovine serum, 10 ng/ml endothelial cells in each experimental group for unlabeled cells, nonspecific which does not bind to endothelial cells. Nonspecific binding was evaluated with the use of FITC-conjugated secondary events versus log fluorescence and analyzed in comparison with the autofluo

dilution of stock solution in H2O gave a 4 m@i concentration. Diluted MG132 dissolved in DMSO to a stock solution of 60 mss. The PSI stock solution was subcultural medium to give a 5 mtvi concentration. PSI-i (Calbiochem) was

solution in the amount of 1 ml was added to 1 ml of medium to give a 40-@xM solution, and a 1:10 solution was added to 1 ml of medium to give a 20 fLM

TLCK (Sigma) was dissolved in acidified H2O to produce a amount of 1 pAwas added to 1 ml of cell culture medium to give a 20 fLM stock solution of 100 mM. Stock solution was diluted 1:5 to give a 20 mrsi

labeled with antibodies to E-selectin or ICAM-l and with FITC-conjugated fluorescence of unlabeled cells as well as the fluorescence of baseline or anti

antibody-labeled cells, and anti-CAM-antibody-labeled cells. fluorescence software. Forward- and side-scatter fluorescence data identified 10,000 viable

dissolved in DMSO to a stock solution of 60 mss. The PSI stock solution was

solution was added to 1 ml of medium to give a 40-@xM solution. One nmi stock

reporter gene [pE-sel(—587+ 35)GH]. The reporter gene encodes human

hybrid reporter construct (20) as described previously. The E-selectin promot

mutagenesis as described previously (19). The human growth hormone reporter gene (pOGH) to yield an E-selectin-GH

porter construct consists of the 1.2-kb segment of the human JCAMpromoter

reporter gene expression.

transfection, endothelial cells were X-irradiated with 5 or 10 Gy. Transcrip

gies). Human growth hormone (hGH) was released into the medium, and aliquots of the medium were quantified by hGH ELISA (Life Technolo

interleukin 1. Because the number of minority students attending community colleges is large and increasing, the model program will also be committed to improving the quality of science education and support services at these institutions. These students must be well prepared to continue in science through the Ph.D. degree. Numerous problems have plagued two-year and community colleges, including tracking mechanisms that channel students out of the more challenging science and math courses; inadequate counseling services to help students plan and prepare for higher education; a limited number of positive role models; reliance on adjunct faculty, which interferes with the commitment and continuity of teaching and mentoring; and inadequate attention to and counseling of underrepresented high school graduates in need of remedial education in science, math, and communication skills.

Faculty at two-year and community colleges are often the victims of large classes and heavy teaching loads, which diminish the quality of education they are able to provide. It is essential that science faculty at this level be committed to a high quality and relevant science preparation for their students, many of whom are underrepresented minorities who, because of financial or family constraints, choose to begin their collegiate careers here.

The Task Force acknowledges the importance of a high quality science faculty and advising system at this level. Students who encounter poor quality in these areas are unlikely to make a successful transition to a four-year institution and beyond. This model program will target two-year and community college faculty and administrators to ensure that they assess the effectiveness of their programs by analyzing attrition data and monitoring the progress of their graduates who enter four-year colleges.

Program Goals at the Undergraduate Level. Underrepresented minority students at four-year institutions must be encouraged and provided whatever nurturing and positive experiences necessary for them to continue as science majors. Often students become victims of poor advising and low expectations, and many do not even begin taking core science courses until their junior year. They are encouraged to major in non-science and mathematics programs because of the inappropriate and inaccurate perceptions of faculty regarding minority students’ ability to handle the sciences.

Therefore, underrepresented minority students must be provided with strong support and encouragement. Study groups must be available for students to develop good study habits and to seek assistance from instructors and tutors. High quality mentoring is needed, and counseling is essential to direct these students into highly academic courses that prepare them for post-baccalaureate studies in the biomedical and life sciences.

Minority students must be given information regarding the Ph.D. degree prior to entering undergraduate school and be advised early in their program to pursue a strong curriculum in science. Students must also be advised that a M.S. degree is not a prerequisite for a Ph.D. degree.

At the undergraduate level, as at all levels, faculty must be prepared to teach science well. The Task Force recognizes that a solid educational background of teachers does not, by itself, ensure a quality education for all students. A genuine concern for students’ welfare and ability to learn science is equally important. For these reasons, this model program will pay appropriate attention to the preparation, quality, sensitivity, and commitment of faculty. A desired outcome of this broad-based program will be an increase in the number of underrepresented minority faculty to serve as mentors and role models at all educational levels.

To achieve the model program’s goals, collaboration among faculty at all educational levels must be encouraged. Effective dialogue between teachers at all levels will ensure the continuity of students’ science education as they progress from K-12 through graduate school. The dialogue will help teachers understand what will be expected of their students at the next educational level so that they can best prepare them for the next step in their science education.

Program Goals at the Graduate Level. As stated earlier, the ultimate goal of this model program is for the percentage of underrepresented minorities earning the Ph.D. in the biomedical sciences to roughly equal their percentage, by age group, in the general population. Large numbers of underrepresented minority students who major in science go to medical school, but comparatively few become physician-scientists or academicians (3). In light of this, the model program will also seek to increase the number of minority physicians who opt for careers in academic and research medicine, as well as to increase the number of minority Ph.D.s in the biomedical sciences.

To achieve this goal, students must be prepared for the rigors of graduate programs in science. More than academic preparation is required to ensure the retention of those students who are in the academic pipeline, however. Student success in graduate programs depends also on an institutional and departmental climate that fosters academic achievement. Such a climate must encompass both student-faculty and student-student interactions. Successful graduate students have caring and effective faculty mentors who continuously assist students through their graduate programs. The student-student interactions must be such that they foster an atmosphere of mutual respect and support.

Underrepresented minority students in graduate programs should be in an atmosphere of genuine diversity. Such an atmosphere goes far beyond the mere introduction of diverse individuals into a program. It is one that fosters and promotes diversity of intellectual discourse. The atmosphere needs to be one of inclusiveness, in which diversity is viewed as desirable.

Mentoring is a key role played by faculty serving doctoral candi
dates. Successful doctoral students usually have mentors who guide and promote their education and professional development and open doors of opportunity for them. Underrepresented minority graduate students appear to have little opportunity to benefit from this type of mentoring experience. This contributes to the alienation so often felt by graduate students in institutions where the climate appears hostile to minorities. Minorities, therefore, must overcome obstacles not faced by other students.

Graduate faculty must understand and accept their responsibility to mentor all students. A sensitivity to the rights and needs of a culturally diverse group is prerequisite for successful mentorship. The model
program, in aiming to increase the number of minority Ph.D.s in science, must address the quality of commitment on the part of graduate faculty to the cultivation of genuine diversity and to fostering an institutional climate that embraces such diversity. Finally, institutions of higher education must be held accountable for having clearly defined policies regarding their goals toward establishing diversity. Administrators can most readily effect changes in faculty attitudes by tying faculty awards to the attainment of such goals.

Resources

The model program will forge collaborations among a variety of currently available resources at local, state, and national levels. The collaborations will be with agencies and funding sources with compatible goals to those of NIEHS and AACR. The collaborations will, hopefully, result in the creation of a new quasi-public entity to serve the interest and goals of the program. Particular attention will be paid to those organizations most directly responsible for the accomplishment of the model program’s goals, i.e., doctoral-granting institutions and those agencies and corporations that make up the nation’s research infrastructure. In addition, the model program will require close collaboration with teachers and other leaders in the K-12 educational system. Win-win strategies will be constructed whenever possible to produce satisfying results for all involved. Research universities will be held accountable both as financial partners and in advancing the goals of the program. Their financial commitment to this project will ensure their involvement and vested interest in accomplishing the model program’s goals.

Program Strategies

Overall Strategies. In the overall implementation of the model program, it will be necessary to collaborate with effective existing programs with experience in accomplishing objectives similar to ones delineated in this document. The model program will seek to promote systemic change in educational institutions from precollege through graduate school, rather than promoting external intervention programs. Student success will depend on the program’s introduction of an egalitarian model of cognitive development and the elimination of tracking, magnet programs, and other exclusionary methods. The program will insist on high expectations, including an advanced math and science curriculum for all students, and promote a constructive model for educational development.

In institutions, the model program will introduce effective models of diversity training for faculty and students from precollege through graduate school. The goal of this type of training will be for faculty and students to become aware of differences and skilled in cross-cultural and cross-gender communication and conflict resolution.

The program will promote collaborative learning, leadership skills, and team building in science. It will advocate effective career advising, mentoring, and parental involvement. It will include a mechanism by which students are exposed to a meaningful range of career options in the sciences.

Pipeline Strategies (Precollege). At the precollege level, the model program will seek to develop a program focused on a small number of critical intervention points or grade ranges, such as preschool, fifth through seventh grade, and twelfth grade. It will begin by selecting small manageable numbers of urban centers or school districts through a request for application or other competitive funding mechanism. The proposals must show evidence of strong partnerships within school districts, universities, community-based organizations, and corporations, all with resources and appropriate expertise. A priority of the model program will be to include organizations with a proven track record in establishing education coalitions. Teachers will need to be represented in all aspects of this initiative.

The model program will also focus at the precollege level on the professional development of teachers. Two areas of development will be included in the program: (a) teachers must be dedicated to the notion that all children can learn; and (b) training and re-training of teachers in math and science must take place.

Pipeline Strategies (University). At the undergraduate and graduate levels, the model program will focus on fundamental institutional change to create a nurturing, egalitarian climate for all students rather than creating marginalized special programs for minorities in contrast to the special programs for nonminorities. The overall climate encouraged by the model program will be one that develops the intellectual potential and capability of every student. The current strategy of selecting out the “brightest” students will not be promoted.

Students come to the university with widely varying social and academic experiences. A provision will be made in the model program for those students with potential but without strong academic backgrounds. The Task Force feels strongly that this must occur without the stigma of remedial courses or subtle tracking mechanisms.

As in the precollege strategies, the model program will introduce an effective model of diversity training for university faculty and students. The program will promote effective career advising and mentoring, including peer mentoring by more advanced students. The Task Force also feels the provision of external mentors for students will be a beneficial aspect of the program.

The program will support research experiences for minority undergraduate students during the academic year and through summer internships. Meetings, conferences, and seminars will be planned to bring together minority students involved in the same program at different universities. Finally, the Task Force stresses the importance of the program providing adequate financial support for students who need it. This financial support, however, will be structured so as not to supplant the normal university financial aid package to which the students might be entitled. Funding from the model program will be intended to replace loans, for example, which require repayment, but not to replace grants and other aid that place no financial obligations on the student after graduation.

Implementation of the Model Program

Although NIEHS will be the lead agency in this project, several steps need to be taken before the model program can be implemented. It is obvious that the scope of the program is broader than NIEHS and AACR can address alone, both in terms of funding considerations and in the quantity of tasks to be accomplished. Therefore, a contingent of collaborators must be identified. The Task Force envisions each collaborator identifying a segment of the program as a whole to sponsor, fund, and/or implement.

Once collaborators and financial commitments have been secured, a detailed and specific implementation document will be developed. The document will specify the model program’s mechanism for information dissemination, a realistic schedule for the accomplishment of tasks, and a comprehensive evaluation plan.

Although wide partnering will be required to accomplish the broad-based vision of the model program set forth in this document, the Task Force anticipates that in the interim, portions of the model will be addressed by individual agencies, possibly in collaboration with one or two partners sharing similar goals. Each segment that is addressed individually will build toward the full accomplishment of the goals of the model program. Any such interim projects will be described fully in the implementation document.

As an example, the NIEHS is already moving ahead with science
education initiatives at the K-12 level. The program currently funded by NIEHS is general in nature, but two of the awards focus on underrepresented minority populations, one of which is producing bilingual science education materials for Spanish and English-speaking students. Programs like these represent good blueprints for how portions of the model program (in this case, K-12 education) can be tackled individually while corresponding with the overall vision of the model program.

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Appendix
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