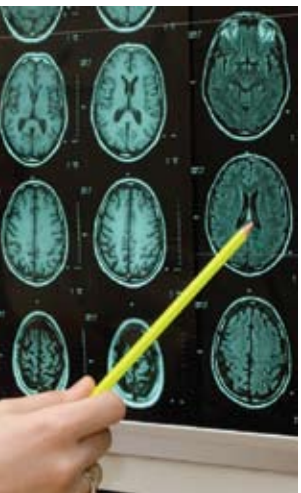
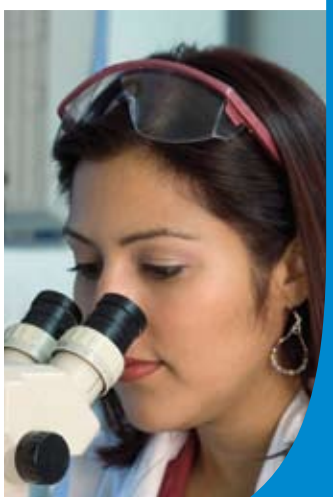




INVESTING IN THE FUTURE

2008

National Advisory Mental Health Council Workgroup on Research Training

Contents

I. Introduction

A. Mission of the NIMH

The mission of the NIMH is to transform the understanding and treatment of mental illnesses through basic and clinical research, paving the way for prevention, recovery and cure.

Four strategic objectives were defined in the recently released NIMH Strategic Plan (http://www.nimh.nih.gov/about/strategic-planning-reports/):

- Promote discovery in the brain and behavioral sciences to fuel research on the causes of mental disorders
- Chart mental illness trajectories to determine when, where, and how to intervene
- Develop new and better interventions that incorporate the diverse needs and circumstances of people with mental illnesses
- Strengthen the public health impact of NIMH-supported research

These objectives will guide the Institute's priorities in the next five years.

The Strategic Plan acknowledged that the Institute's success in the long term relies upon its ability to support and train future generations of researchers. These researchers must be able to use emerging technologies, approaches, and methods as the broad field of mental health research advances and evolves. In addition, it was noted that the Institute's research training efforts should stimulate creativity and innovation among the supported trainees while ensuring that they are appropriately trained and mentored.

In considering the Strategic Plan at its September 2007 meeting, the National Advisory Mental Health Council (NAMHC) decided that critical thinking about research training and career development would be best addressed by obtaining input from a workgroup. That decision led to the formation of the Workgroup on Research Training that was charged with providing recommendations to the NAMHC.

B. Workgroup Charge

This Council Workgroup was asked to advise the NAMHC on NIMH's investment in research training and to provide strategic recommendations about how NIMH could better achieve its goals of recruiting, training, and retaining a workforce capable of integrating novel technologies and approaches across multiple levels of analysis in its NIMH-relevant research. The Workgroup was charged with answering the following questions:

- Recognizing that resources to support research training are limited, what portion of the budget should be dedicated to research training, and how many individuals should NIMH support as trainees to ensure that the Institute has an adequate cohort of new R01 investigators? To what extent should research training be supported collaboratively with other Institutes, through the Neuroscience Blueprint, or other cooperative efforts? What "best practices" for institutional training programs could be adopted both to increase the return on investment and to anticipate workforce needs in the next one to two decades? With the goal of recruiting an outstanding workforce by the year 2020 that can integrate novel technologies and approaches across multiple levels of analysis, what innovative strategies might NIMH use to stimulate interest in mental health-related research careers among individuals who have not yet chosen a research career path?

- How can NIMH most effectively increase the diversity of its research workforce? With limited resources, where should NIMH place emphasis in its efforts to diversify its research workforce? Are particular funding

mechanisms most appropriate/effective for increasing workforce diversity? Are new research training programs needed to optimally increase the diversity of the NIMH research workforce? How can NIMH partner with other Institutes, other federal agencies, and with the private sector/foundations to diversify the research workforce?

- How can NIMH most effectively stimulate the recruitment, training, and retention of MD/PhD scientists as NIMH researchers? Are there unique issues that the Institute must address with this cohort of future investigators, e.g. a leakier pipeline or significant retention issues? How can NIMH partner with other Institutes, other federal agencies, and with the private sector/foundations in this endeavor?

C. Research Training and Career Development Programs Supported

NIMH supports a wide array of research training, career development, and related programs that extend across a researcher's career (see Figure 1). The Institute's efforts primarily support individuals during the years of pre- and postdoctoral training and during the transition to research independence. Appendix 4 provides a brief summary of each program and a link to the current funding opportunity announcement for each program.

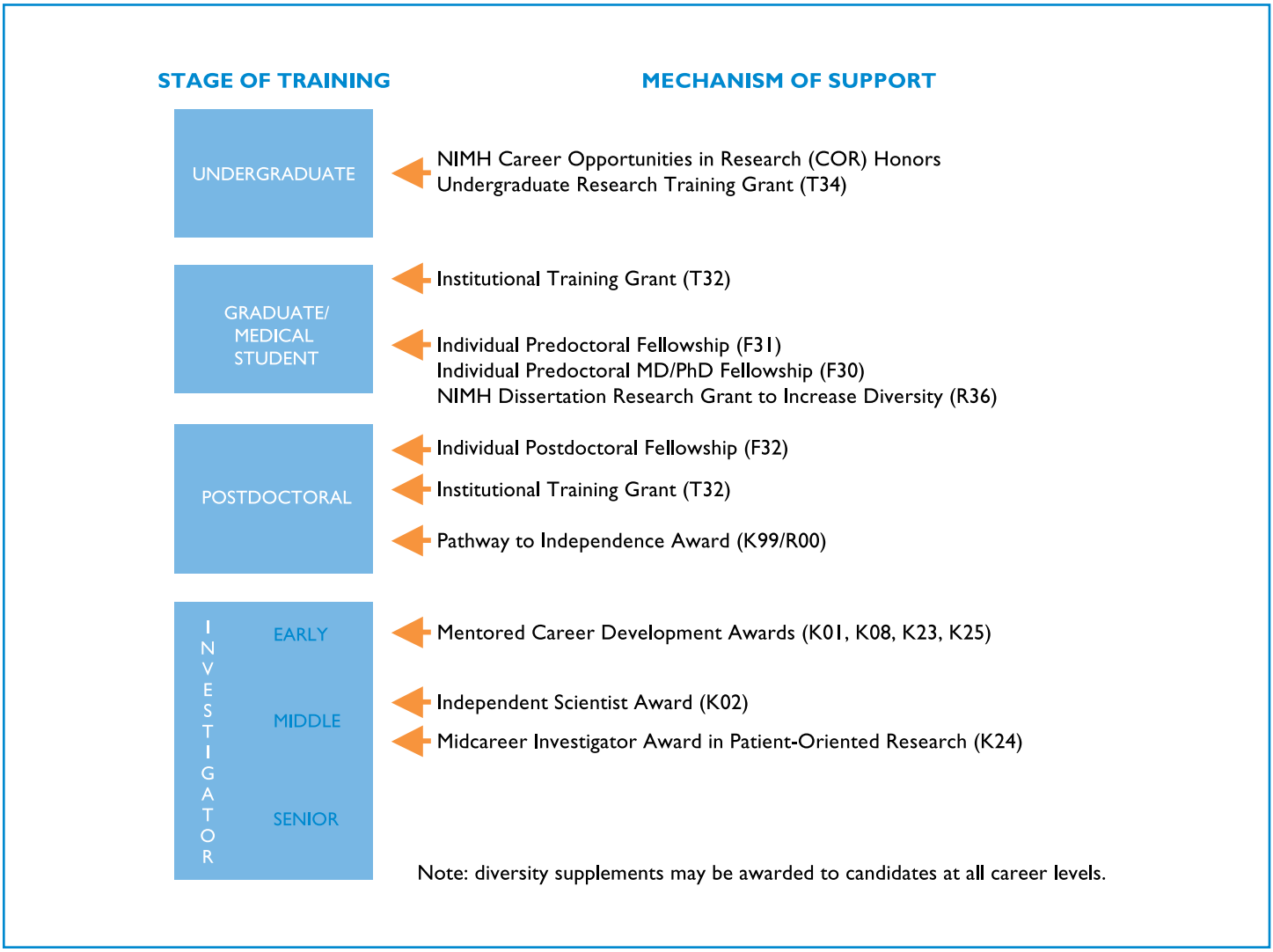
D. Workgroup Process

An array of information was made available to the Workgroup members for their review and discussion. Descriptive information about the various NIMH-supported research training, career development, and other related programs was provided so that Workgroup members were knowledgeable about the costs of these programs and the numbers of individuals supported. Related NIH Roadmap (http://nihroadmap.nih.gov) and Neuroscience Blueprint (http://neuroscienceblueprint.nih.gov) initiatives, various publications, and past reports were made available through a web-based forum that facilitated the rapid dissemination of information. In addition, some outcome data for NIMH-supported institutional training and diversity supplement programs were presented. Program directors for a sample of institutional training programs were asked to respond to a brief set of questions concerning institutional training efforts, and their responses were provided to the Workgroup members. At the first face-to-face meeting, there were two invited presentations: Dr. William R. Galey, Jr. [Director of Graduate and Medical Programs, Howard Hughes Medical Institute (HHMI)] discussed various medically oriented research education initiatives of the HHMI, and Dr. Olaf S. Andersen (Thomas H. Meikle, Jr., Professor of Medical Education in the Department of Physiology and Biophysics at the Weill Medical College of Cornell University and Director of the Tri-Institutional Medical Scientist Training Program) discussed outcome studies of MD/PhD program graduates. At the third face-to-face meeting, the Workgroup members had a roundtable discussion with six MD/PhDs at various career stages from MD/PhD student through residency and beyond. The purpose of this discussion was to provide the Workgroup members with candid input so that they could better understand the challenges and issues this cohort of trainees faces early in their career. Additionally, Dr. James Leckman (Neison Harris Professor of Child Psychiatry, Psychiatry, Psychology and Pediatrics at Yale University) described the psychiatry residency training program he has developed. In total, the Workgroup held three web-assisted conference calls and three face-to-face meetings between February 2008 and May 2008.

E. Overview of the Report

This report seeks to provide recommendations that will enable the NIMH to develop a future research workforce that is equipped with the cutting-edge knowledge, skills, and perspectives that will facilitate their contributions to the research mission of the NIMH. Section II summarizes desirable characteristics of the future NIMH research workforce and then goes on to consider three other important issues, the diversity of the workforce with particular emphasis on racial and ethnic diversity, individuals holding the MD/PhD degree, and international students and postdoctoral scholars. Section III presents data that both contextualizes and

Figure 1. Diagram Illustrating Programs Supported by the NIMH



enumerates current support for research training and career development by the NIMH. In addition, outcome data for selected cohorts of NIMH-supported individuals are provided. Section IV outlines recommendations for future directions for NIMH-supported research training programs and initiatives. Section IV also outlines recommendations for program assessment and dissemination to the extramural research community. Section V provides a final summary.

The Workgroup submits these recommendations in the hope that developing an even stronger scientific workforce will increase the rate of innovative discoveries that will lead to improvements in the lives of those affected by mental illness and ultimately cures for these illnesses.

II. Who? Characteristics of the Future NIMH Research Workforce

Who will make the breakthroughs in the next generation of scientists? Who will NIMH need to solve the pressing research questions related to mental illnesses? The workforce must be capable of integrating novel technologies and approaches across multiple levels of analysis in order to make rapid scientific advances that address the NIMH mission.

As noted in the Introduction, the mission of the NIMH is broad. Hence the research questions of interest to the Institute are diverse, spanning human genetics, fundamental neuroscience, behavioral science, clinical and translational research, and services and interventions research. An equally broad spectrum of scientific skills will be needed to advance the mission. This breadth of research interests dictates that the NIMH develop a research workforce that, in aggregate, has training that encompasses the future needs of the Institute. Although a wide variety of methodological skill sets will be appropriate for NIMH-supported researchers, six features transcend the specific methodologies and technical skills of the desired workforce: three involving the "phenotype" of the investigator and three recognizing the changing culture of science.

A. Research Phenotypes of the Workforce (the three "T's" for tomorrow's most successful scientists)

The Workgroup believes that a rich variety of research phenotypes will be needed to address the Institute's research priorities and that these phenotypes are likely to change over time as research advances. As a result, we recommend that the NIMH continue to support a broad array of contemporary training programs across the breadth of the Institute. The Institute should, however, be mindful of the rapidly changing research landscape so that the composition of its training portfolio moves with scientific advances. Regardless of the specific scientific domains, it is likely that the future research workforce will need individuals who can successfully navigate the changing cultural and technical face of science relevant to the NIMH mission with ease.

1. Trans-Disciplinary Scientists

Science is increasingly multidisciplinary and "interdisciplinary." For the purposes of this report, we will use the term "interdisciplinary" and the following definition of interdisciplinary research: "a mode of research by teams or individuals that integrates information, data, techniques, tools, perspectives, concepts, and/or theories from two or more disciplines or bodies of specialized knowledge to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single discipline or area of research practice" (National Research Council, 2005c).

The increasing interdisciplinarity of the science underlying the NIMH mission demands that NIMH's future workforce be trained with the values of interdisciplinary research in mind, e.g. flexibility; openness to and respect for different perspectives, scientific cultures, and languages; and willingness to conduct research and collaborate across traditional scientific silos/boundaries (see, e.g., National Research Council, 2005c; Nash, 2008).

The increasing interdisciplinarity of research pertinent to the NIMH mission leads to two other conclusions. First, it suggests that the NIMH needs nimble scientists who can adapt quickly as the technologies and knowledge base relevant to the NIMH mission change. Second, this interdisciplinarity suggests that basic scientists from many research areas and clinician-scientists from multiple specialties have the potential to make significant contributions to the Institute's mission. As a result, it may well be more important that a physician-scientist conduct innovative research that helps the NIMH move its research agenda forward than the physician-scientist be trained in a particular clinical specialty. Similarly, NIMH

may benefit from cell biologists working on fundamental aspects of transcriptional control or molecular biologists investigating genetic variation as well as looking to its historical base of behavioral or system-level scientists.

2. Team Players in a Collaborative Scientific Enterprise

Team science, i.e. science based on collaborations, is increasingly common (see, e.g., Miller, 2008) and may reflect the increasing complexity of the research questions posed and the need for diverse kinds of expertise to address the research question at hand. In fact, the increase in interdisciplinary research and team science may be closely linked. Regardless, members of the future NIMH research workforce need to be comfortable working as members of teams. Institutional training programs should provide the breadth of experience and the skills necessary to work in broad, collaborative research teams.

Collaborative research by teams of scientists may speed the translation of fundamental discoveries into new treatments and interventions for mental disorders. The CNTRICs (Cognitive Neuroscience Treatment Research to Improve Cognition in Schizophrenia; e.g. Carter et al. 2008) initiative is a recent example of a collaborative approach taken by the NIMH to encourage collaborations among basic, clinical and translational researchers.

3. Translators

In 2005, the NIMH recognized the need for institutional training programs to provide trainees with the opportunities that would enable them to conduct interdisciplinary research and to contribute to team science (see http://grants1.nih.gov/grants/guide/notice-files/not-mh-05-001.html). It was noted that such training programs should provide the breadth of experience and the skills necessary to work in broad, collaborative research teams. Moreover, these programs should provide translational education and research opportunities for trainees in order to facilitate their ability to integrate and translate findings along the basic-clinical dimension and/or the clinical-services dimension. These translational educational/research opportunities would be expected to have multiple benefits: 1) to help trainees contextualize their research within the mission of the NIMH and to be able to articulate its relationship to the Institute's mission; 2) to increase trainees' comfort level collaborating across disciplinary boundaries and working with individuals who speak different scientific languages; and 3) to foster the training of individuals who will be facile translators from bench to bedside to the community. The Workgroup recognized that there are varied ways to achieve these interrelated goals, and that institutions should capitalize on their strengths and unique attributes in this pursuit. As noted below, individuals with formal MD/PhD training may be particularly poised to contribute to the Institute's mission because of their unique training that includes both clinical and research skill sets. In addition, with the tools now available for "reverse translation," we recognize the value of bringing outstanding PhDs into the clinical arena. One notable effort is the HHMI Med into Grad initiative (http://www.hhmi.org/grants/institutions/medintograd.html) highlighted in Text Box 1.

Text Box 1. HHMI's Med into Grad Initiative

The HHMI developed the Med into Grad Initiative in 2005 in order to stimulate graduate programs to integrate clinical medicine into PhD education and change the way graduate students are trained to conduct biomedical research. The thinking was that such integrated programs would increase the number of PhD-trained scientists who can help translate basic science discoveries to the clinic. The HHMI made 13 awards (http://www.hhmi.org/grants/office/graduate/gradstudent/medintograd_opportunities.html) to academic institutions across the country. These programs take advantage of institutional strengths and resources and provide innovative programmatic activities for the participating graduate students, e.g. dual clinical-PhD mentorship, participation in clinical rounds, and clinical rotations. In some cases, students receive a master's degree or a certificate in addition to their PhD degree.

B. The Changing Culture of Science

As a workgroup, we recognized that one of the greatest challenges of training is acknowledging that our students and fellows will need skills and perspectives that we, as mentors, have never used. The information technology revolution and the genomic revolution are recent examples of the changing culture of science. But there are other, broader changes, some that can be identified and others that will emerge, that should be considered as NIMH crafts new programs for training the most successful scientists of the future.

1. A Culture of Sharing Information and Resources

As the culture of science shifts to a more collaborative one, there has also been a shift to more open access to scientific tools, resources, and data. Notable examples include the Biomedical Informatics Research Network (BIRN; http://www.nbirn.net/index_ie6.shtm) that enables a collaborative scientific culture through common tools and data repositories. The NIH has encouraged public access to resources, tools, and data (http://grants.nih.gov/grants/sharing.htm) as well as publications (http://publicaccess.nih.gov/index.htm). Taken together, these three examples underscore the cultural changes that are occurring in science. It will be important for the Institute to encourage recognition and awareness of these changes and to implement ongoing program assessment so that NIMH-supported training programs adapt to the changing culture of science and transmit these cultural values to their trainees.

2. Discovery-Based Science

While traditional training has stressed hypothesis testing, some of the most important research today is discovery-based science. Whether it is exploring patterns of gene expression or screening for small molecules, discovery science looks for new candidates upon which to build a hypothesis. Until recently, most genomic research on mental disorders has focused on fewer than 20 of the 20,000 genes in the human genome. Over the next few years NIMH researchers will need to identify the roster of candidates that are most important for pathophysiology. Therefore, the future workforce needs to be exposed to both discovery-driven and hypothesis-driven approaches and to understand the strengths and limitations of each approach.

3. Quantitative Skills

Technological advances have enabled scientists to expand the spectrum of analyses at both the microscopic and macroscopic levels. Datasets in areas such as genomics, array electrophysiology, and imaging have grown exponentially in size. Research conducted by teams of scientists has also contributed to the increasing size of datasets as investigators seek to integrate information across scientific domains. Interdisciplinary studies combining neuroimaging and cognitive performance, the connectome, and genome-wide association studies (GWAS) that assess genetic associations with targeted phenotypes are just a few examples. Even the very nature of scientific approaches has evolved from the more qualitative to the more quantitative, with information theory being integrated into neuroscience research. Understanding the quantitative nature of experimental observations requires the future workforce to be well versed in quantitative reasoning. In agreement with a recommendation of the 2005 National Research Council report (2005a), it will be important for the NIMH to invest in training programs that incorporate didactics in quantitative methods appropriate for their scientific domains.

C. Other Considerations

Because different individuals bring different perspectives and experiences to research questions, it is important that the NIMH train a workforce that is heterogeneous, e.g. with respect to gender, race/ethnicity, research focus, and those with or without clinical training/responsibilities. In this way, a broad range of perspectives is brought to and helps shape the research that advances the Institute's mission. Based on the charge given to the Workgroup (see Section I), bringing individuals from diverse backgrounds and individuals with dual degrees (MD/PhD) into the future NIMH workforce were considered priorities for in-depth discussion.

1. Individuals from Diverse Backgrounds

For many years NIH has encouraged the recruitment and retention of underrepresented minorities into the biomedical and behavioral workforce. The institutional training grant program (T32), through the required recruitment and retention plan, and the research supplement program have been two major vehicles for this effort at all NIH Institutes. The Institutes also have long supported a research supplement program for individuals with disabilities. The National Institute of General Medical Sciences (NIGMS), through its Division of Minority Opportunities in Research, administers a number of research and research training programs aimed at increasing the diversity of the research workforce (http://www.nigms.nih.gov/Minority/). In addition to the above-mentioned NIH-wide programs, the NIMH has uniquely contributed to increasing the diversity of the biomedical workforce through its Career Opportunities in Research (COR) institutional training (T34) program for undergraduate students that began in 1979.

In 2004, the NIH broadened its efforts and identified three groups in need of special recruitment and retention efforts in order to diversify the biomedical, behavioral, and clinical workforce (see PHS 398, revised 11/2007; (http://grants.nih.gov/grants/funding/phs398/phs398.html).

1. Individuals from racial and ethnic groups that have been shown by the National Science Foundation to be underrepresented in health-related sciences on a national basis (see data at http://www.nsf.gov/statistics/showpub.cfm?TopID=2&SubID=27) and the National Science Foundation report Women, Minorities, and Persons with Disabilities in Science and Engineering, 2007, p. 262). The following racial and ethnic groups have been shown to be underrepresented in biomedical research: African Americans, Hispanic Americans, Native Americans, Alaska Natives, Hawaiian Natives, and natives of the U.S. Pacific Islands. In addition, it is recognized that under-representation can vary from setting to setting and individuals from racial or ethnic groups that can be convincingly demonstrated to be underrepresented by the grantee institution should be included in the recruitment and retention plan.

2. Individuals with disabilities, who are defined as those with a physical or mental impairment that substantially limits one or more major life activities.

3. Individuals from disadvantaged backgrounds who are defined as:

    a. Individuals who come from a family with an annual income below established low-income thresholds. These thresholds are based on family size, published by the U.S. Bureau of the Census; adjusted annually for changes in the Consumer Price Index; and adjusted by the Secretary of Health and Human Services for use in all health professions programs. The Secretary periodically publishes these income levels at http://aspe.hhs.gov/poverty/index.shtml. For individuals from low-income backgrounds, the institution must be able to demonstrate that such candidates (a) have qualified for federal disadvantaged assistance; or (b) have received any of the following student loans: Health Professional Student Loans, Loans for Disadvantaged Student Program; or (c) have received scholarships from the U.S. Department of Health and Human Services under the Scholarship for Individuals with Exceptional Financial Need.

    b. Individuals who come from a social, cultural, or educational environment such as that found in certain rural or inner-city environments that have demonstrably and recently directly inhibited the individual from obtaining the knowledge, skills, and abilities necessary to develop and participate in a research career. Note, however, that the NIH has suggested that this group would be most applicable to high school and perhaps undergraduate candidates for support, but would be more difficult to justify for individuals beyond that level of achievement (e.g., pre- and postdoctoral candidates).

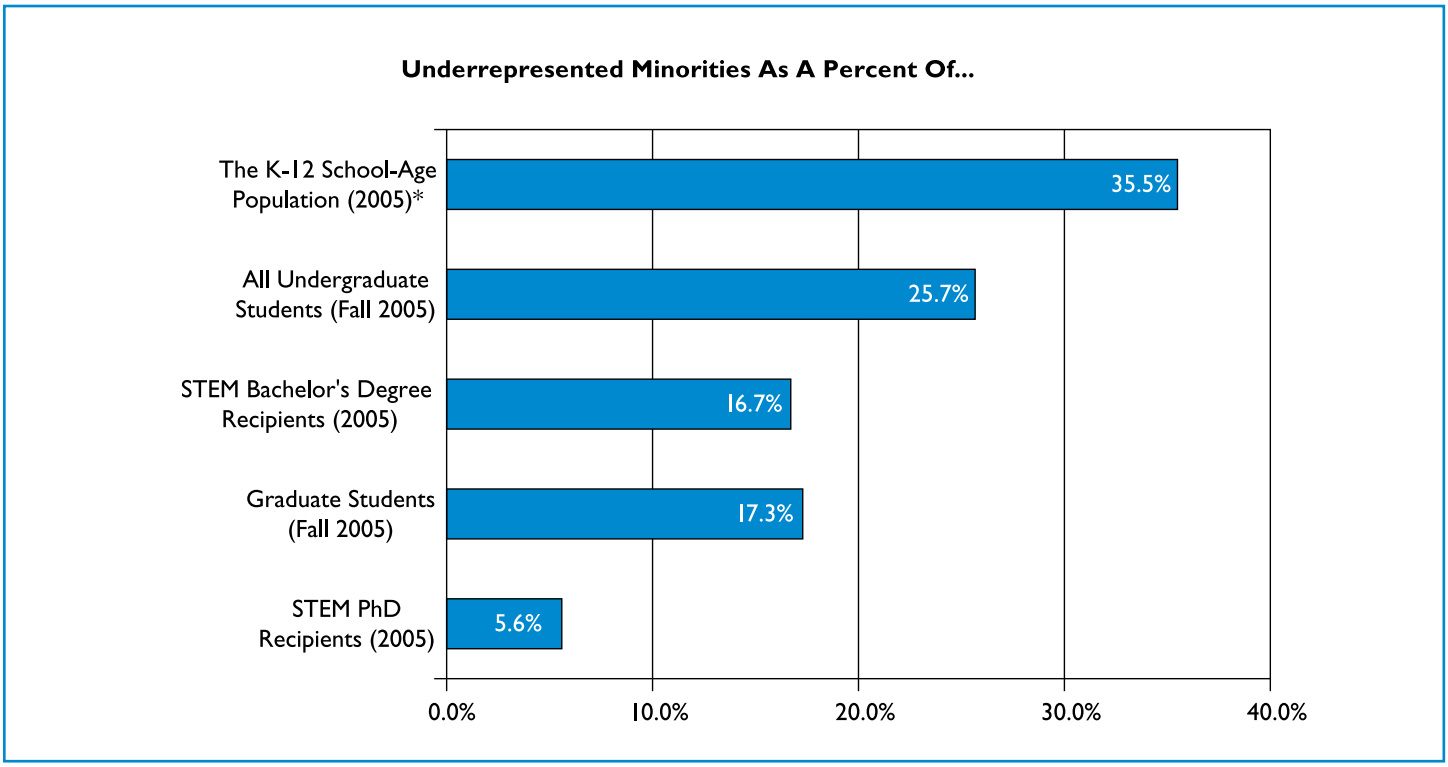
a. The Diversity of the Workforce: Issues Remaining

Because limited descriptive data are available on educational levels for individuals from the three groups identified by the NIH to be underrepresented in the workforce, this section considers the available data on individuals from underrepresented racial and ethnic groups. While it is estimated that 35% of the K-12 school-age population are from underrepresented racial and ethnic groups, a decreasing percentage of these individuals progress up the educational ladder (see Figure 2; Chubin, 2007). Less than 6% of doctorate recipients in science, technology, engineering and mathematics (STEM) are members of underrepresented racial and ethnic groups.

Recent data on doctorate recipients in specific disciplines are in agreement with the characterization of STEM doctorates generally (see Hoffer et al., 2006). Table 1 provides a breakdown by racial and ethnic groups for U.S. citizens receiving their doctorate in neuroscience, human and animal genetics, clinical psychology, or social work in 2005. In all four disciplines shown, 75-80% of the doctorates were awarded to white U.S. citizens. Only nine African-Americans (1.9% of total) and 26 Hispanics (5.4% of total) received doctorates in neuroscience in 2005. In social work, the numbers were higher with 21.5% of doctorates being awarded to individuals from underrepresented racial and ethnic groups.

These data underscore general observations about the small numbers of individuals from underrepresented racial and ethnic groups who enter the STEM workforce and indicate that these observations are consistent across several disciplines from which the NIMH is likely to draw its workforce in the next several decades. Thus the pipeline of underrepresented individuals who complete doctorates is far from full.

Figure 2. Underrepresented Racial and Ethnic Groups across the Educational Ladder[1]



[1] Chubin (2007).

* The K-12 group includes non-U.S. citizens because information for this group is not available by citizenship.

Table 1. Doctorate Recipients (2005) in Four Selected Disciplines[1]

	Neuroscience	% of Total Neuroscience	Genetics, human & animal	% of Total Genetics	Psychology, clinical	% of Total Clinical Psych	Social Work	% of Total Social Work
Total Doctorate Recipients*	689		287		1,158		325	
Non-U.S. Citizens	191	**27.7**	71	**24.7**	60	**5.2**	29	**8.9**
U.S. Citizens	480	**69.7**	206	**71.8**	1,035	**89.4**	270	**83.1**
Total U.S. Citizens	480		206		1,035		270	
American Indian/ Alaska Native	0	**0.0**	0	**0.0**	7	**0.7**	4	**1.5**
Asian	53	**11.0**	20	**9.7**	46	**4.4**	2	**0.7**
Black	9	**1.9**	7	**3.4**	55	**5.3**	35	**13.0**
White	372	**77.5**	167	**81.1**	809	**78.2**	201	**74.4**
Hispanic	26	**5.4**	5	**2.4**	70	**6.8**	19	**7.0**
Other/ Unknown Race	20	**4.2**	7	**3.4**	48	**4.6**	9	**3.3**

[1] Source: Survey of Earned Doctorates Summary Report 2005, Appendix Table A-2 (Hoffer et al., 2006).

* Notes: includes individuals who did not report their citizenship at the time of the doctorate. As a result, the sum of non-U.S. citizens and U.S. citizens is less than the total doctorate recipients for each discipline. Hispanic combines Puerto Rican, Mexican & Other Hispanic categories used in the Survey of Earned Doctorates. Persons reporting Hispanic ethnicity, whether singly or in combination with another race/ethnicity, are included in the respondent-selected Hispanic ethnicity category. Other/unknown race includes Native Hawaiians and other Pacific Islanders, respondents choosing multiple races (excluding those selecting Hispanic ethnicity), and respondents with unknown race/ethnicity.

b. The NIMH and Training Individuals from Diverse Groups

The NIMH has a longstanding commitment to recruit and retain in its research workforce the brightest and the best from the diverse fabric of U.S. society. Individuals from diverse racial and ethnic groups may be ideally poised to address the significant mental health disparities that exist in the U.S. Since its creation in 1946, the NIMH has supported a variety of funding mechanisms to facilitate the career development of individuals from underrepresented groups. That commitment is currently exemplified by the estimated commitment of $17 million in

fiscal year 2007 (FY 2007) to research training of individuals from diverse groups (see Section III for details about programs, funding, and outcomes). Recommendations developed by the Workgroup to enhance NIMH's efforts to increase the diversity of its workforce are found in Section IV.

2. MD/PhD Investigators

Much has been written about the critical role that physician-scientists play in biomedical research (see, e.g., Ley and Rosenberg, 2005). In the last two decades of the twentieth century, concern that the pipeline of physician-scientists was disappearing led to development of the NIH Loan Repayment Program (to decrease indebtedness of medical school graduates; http://www.lrp.nih.gov) and other efforts by the federal government and foundations (e.g., Burroughs Wellcome Fund and Howard Hughes Medical Institute) to increase the number of physician-scientists entering the research workforce. The Workgroup acknowledged the complexity of the problem and focused their attention primarily on a subset of the physician-scientists, those with dual degrees (MD/PhD).

It is widely believed that MD/PhD investigators bring a unique perspective to their research programs because of the blend of clinical and research perspectives honed through graduate and medical education, residency and fellowship. In addition, MD/PhD investigators may be well-trained for translational research careers. According to Ley and Rosenberg (2005), less than 600 individuals matriculated into an MD/PhD program in 2005, about 4% of the total medical student population. Unlike the relative gender parity that exists among matriculants into MD degree programs, the proportion of female students in MD/PhD degree programs has been low (Bradford et al., 1996; Andrews, 2002). Andrews (2002) asserts that this disparity reflects four concerns of young women: 1) work-life balance issues; 2) concern that they must be better than male counterparts to be seen as equal; 3) little encouragement given to women to become physician-scientists; and 4) the absence of strong role models. Despite these issues, the number of female MD/PhD students appears to be increasing (see below).

Dr. Lawrence Brass (Associate Dean, Combined Degree and Physician Scholars Programs and Department of Medicine, University of Pennsylvania) recently compiled outcomes data on behalf of the AAMC/GREAT Section on MD/PhD Training and the National Association of MD/PhD Programs. He found that 37% of the MD/PhD trainees are women at the 24 institutions he recently surveyed (Brass, September 1, 2008 personal communication to N. L Desmond). More than 80% of the MD/PhD program alumni sampled who have completed training and are in academia are conducting research (Brass, August 28, 2008 personal communication to N. L Desmond). Since 1965, roughly 5-6% of the MD/PhD program alumni sampled chose psychiatry as their residency while roughly 8% chose neurology (Brass, August 28, 2008 personal communication to N. L Desmond). Given that historically a significant percentage of MD/PhDs chose residency programs unrelated to the mission of the NIMH, the number of MD/PhD investigators entering the NIMH research workforce is small. As detailed in Section III, less than 10% of the NIMH-funded principal investigators in FY 2007 hold MD/PhD degrees and nearly 11% of the mentored career development awardees hold the MD/PhD degree.

The Workgroup acknowledged the unique skill set that MD/PhDs can bring to research related to the Institute's mission and made specific recommendations designed to build a strong pipeline for these individuals (see Section IV).

3. International Students and Postdoctoral Scholars

Over the last 40 years, the number of scientists and engineers who are not U.S. citizens has increased in the U.S. population. A recent report from the National Research Council (2005c) notes that, in 1966, 78% of science and engineering doctorates were U.S. citizens and, in 2000, 61% were U.S. citizens. This changing landscape is reflected in specific scientific disciplines relevant to the NIMH as well. In 2005, 28% of the doctorate recipients in neuroscience and 25% in human and animal genetics were non-U.S. citizens (Hoffer et al., 2006; Appendix Table A-2; see Table 1). Additionally significant numbers

of postdoctoral scholars do not hold U.S. citizenship. A 2006 National Science Foundation survey estimates that 60% of science and engineering postdoctoral scholars are temporary residents compared with 37% in 1982 (National Science Foundation, 2008, Table 50). A comparable percentage of neuroscience postdoctoral scholars are estimated to be foreign-born (2005 ANDP survey: http://www.andp.org/newsite/surveys/reports/2005/Survey05Report.pdf). Taken together, these data indicate that non-U.S. citizen scientists are a significant component of the current research workforce. The NIMH must factor this cohort into its planning as the Institute considers how to develop an outstanding workforce that can accomplish its mission.

A recent National Research Council report on policy implications of international graduate students and postdoctoral scholars in the United States (2005d) reported two findings that are pertinent to the Workgroup's charge. They found that international students and scholars have made significant contributions to U.S. science and engineering and that these individuals are integral to the scientific enterprise in our country. The Bridges to Independence report (National Research Council, 2005b) recommended that the citizenship requirement for National Research Service Awards (NRSAs) and related postdoctoral training awards should be changed, or that alternative and equivalent mechanisms of support should be available to individuals who do not meet the citizenship criterion for NRSA support. The NIH Roadmap (RFA-RM-04-015) and (RFA RM-06-006) and Neuroscience Blueprint (RFA-DA-06-011) and (RFA-DA-06-010) issued one-time Requests for Applications (RFA) for interdisciplinary institutional training programs that would support both U.S. citizens and non-U.S. citizens in the same training program. These RFAs used a special mechanism, the T90/R90 (http://grants.nih.gov/grants/funding/t90.htm), that has not been broadly implemented across the NIH to date. It should be noted that non-U.S. citizens are eligible to apply for the Pathway to Independence Award (K99/R00) program (http://grants.nih.gov/grants/guide/pa-files/PA-07-297.html), a relatively new program for postdoctoral scholars who have not yet received more than five years of postdoctoral training at the time of application. However, there are presently no NIMH-supported institutional research training funding opportunities at the predoctoral or early postdoctoral level for which non-U.S. citizens may compete. The Workgroup agreed that the NIMH should make some investment in the training of this component of the future workforce (see Section IV).

III. How Many? Ensuring an Adequate Research Workforce

In addition to considering who is needed in the NIMH research workforce and the desirable skill sets, the Workgroup was asked to consider how many individuals the Institute should train through targeted research training and career development programs in the future. NIMH supports 90–100 new R01 principal investigators (PIs) each year. A training pipeline with 1000 investigators delivered into the R01 applicant pool each year would mean that 90% could not be supported by the NIMH. On the other hand, a pipeline that yielded only 50-60 new investigators each year would be insufficient. Assuming a success rate of at least 20% (which approximates the current overall success rate for NIMH grant applications), the NIMH would need about 500 trainees joining the applicant pool each year. For 500 to be completing their training, how many should be at each stage of the pipeline? Consideration of this question was grounded in information about both the dollars expended and number of individuals supported in the institutional and individual research training programs supported by the NIMH. These data are summarized below.

As we reviewed the various programs and mechanisms, the Workgroup discussed the importance of looking at outcomes. While there are many measures of success, the Workgroup was cognizant of measuring outcomes relevant to the Institute's mission. We did not have an optimal measure of quantifying impact on the mission, but we agreed that subsequent NIMH funding was a rough surrogate for an outcome relevant to the NIMH mission[1]. The Workgroup recognized that using subsequent NIH or NIMH funding as an outcome measure would overlook scientists making breakthrough discoveries in industry and, of course, graduates who become teachers for the next generation. These individuals would be both successful and essential but would not be identified as a "success" with this outcome measure. Nevertheless, the rigor afforded by NIH/NIMH funding records and the unambiguous relevance to the mission provide a useful measure for estimating the outcomes of the many training efforts supported by the NIMH.

[1] Because the NIMH shares some research interests with some other Institutes at the NIH, subsequent funding by another Institute may, in some cases, be an outcome relevant to the NIMH mission.

A. Fiscal Context[2]

It may be useful to place NIMH's support for research training and career development within the context of what other NIH Institutes and Centers do. In fiscal year 2004, the NIMH was

Table 2. Total Positions (Competing and Noncompeting) Starting With Year 1 of the Seven-Year Plan[1]

	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008*
Mentored K	379	376	361	336	317*
K99			1	9	17*
Career K	107	99	83	79	67*
F	312	290	268	246	246*
T	1111	1074	977	827	773*
Total	1909	1839	1689	1497	1420*
% of Budget	10.4	10.2	9.7	8.9	8.7

* FY 2008 values are projections. Abbreviations: FY, fiscal year; Mentored K, mentored career development awards (K01, K08, K22, K23, K25); Career K, independent career development awards (K02, K24, K05); F, individual fellowships (F30, F31, F32); T, institutional training grants (T32, T34). Note that the K99 program began in FY 2006. % of Budget, % of total non-AIDS budget.

[1] Data Source: NIMH Budget Office, September 2008

[2] Unless otherwise noted, all budget-related information reflects only the non-AIDS portion of the NIMH budget.

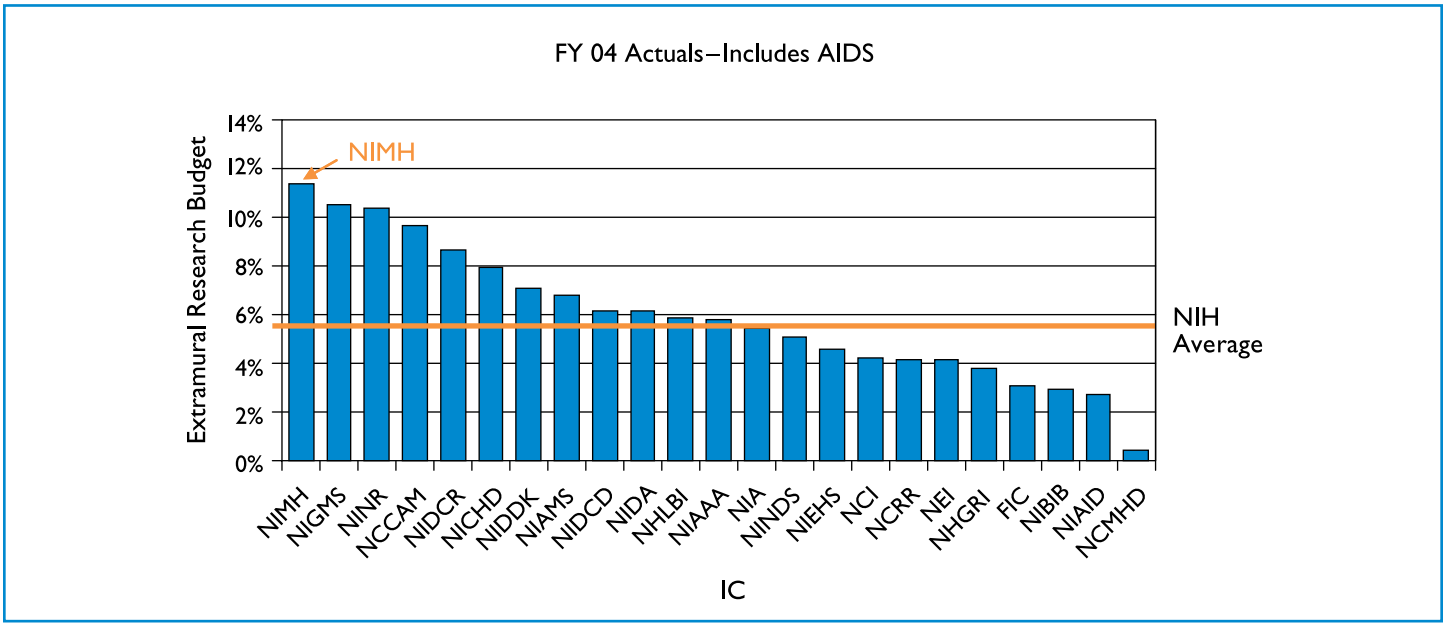
the leader among all Institutes and Centers in the percentage of extramural research budget spent on research training and career development (F, K and T) awards (see Figure 3). While the NIH-wide average was 5.8% of the extramural research budget, NIMH spent 11.4% of its extramural research budget (non-AIDS + AIDS) on support for research training and career development in fiscal year 2004.

B. NIMH's Seven-Year Plan: Balancing the Pipeline and the Payline

In 2003 the NIMH carefully examined projections for its support of research training and career development and conducted a very preliminary outcomes assessment for some of these programs. At that time, more than 10% of the total NIMH budget (non-AIDS) supported research training and career development programs[3] (T, F, and K), and sustaining this effort was not feasible in the budget climate after the NIH doubling. Based upon fiscal projections and preliminary outcomes assessment, the Institute formulated a seven-year plan that was designed to 1) maintain support for the research pipeline support where outcomes are better (individual fellowships); 2) reduce support where growth could not be sustained (Ks); and 3) maintain support for a diverse workforce. This plan led to a decrease in the number of competing (new) positions awarded from FY 2003 to FY 2007 and projected for the current fiscal year (FY 2008) (see Table 2). As a result, NIMH's support for research training and career development programs declined from 10.4% of total non-AIDS budget in FY 2004 to 8.9% in FY 2007.

Figure 4 depicts research training and career development support (T, F and K) as a percentage of each IC's extramural research budget for FY 2007. Despite NIMH's planned decrease, the Institute's support for research training and career development in FY 2007 [10.24% of the extramural research (AIDS + non-AIDS) budget] still exceeds the overall NIH average of 6.01% of the extramural research budget. It is also informative to compare NIMH's

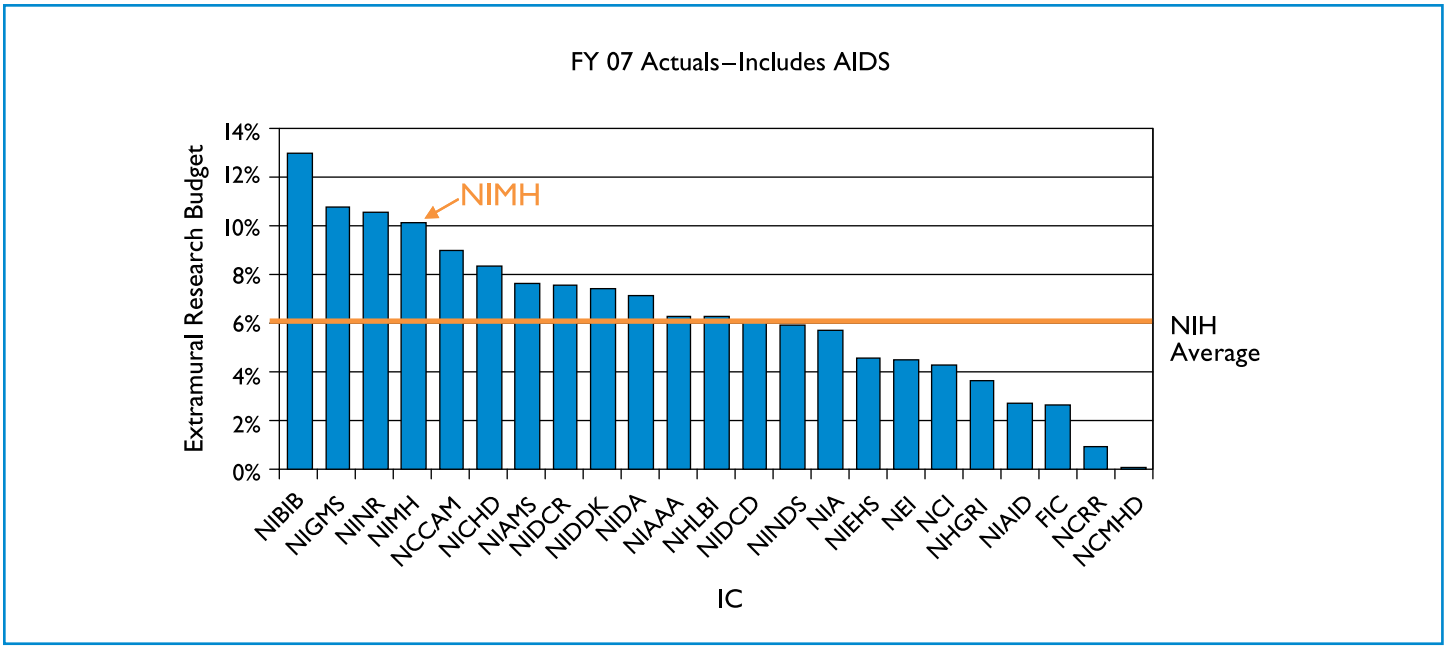
Figure 3. NIH Context: FY 2004 Research Training and Career Funds (Fs, Ts, & Ks) as a Percent of IC Extramural Research Budget (including AIDS)[1]



[1] Data Source: NIMH Budget Office, September 2008

[3] Appendix 4 describes each of the research training, career development, and related programs NIMH currently supports.

Figure 4. NIH Context: FY 2007 Research Training and Career Funds (Fs, Ts, & Ks) as a Percent of IC Extramural Research Budget (including AIDS)[1]



[1] Data Source: NIMH Budget Office, September 2008

support for research training and career development with that of three Institutes that share some research interests with the NIMH: *Eunice Kennedy Shriver* National Institute of Child Health and Human Development (NICHD) averaged 8.47%, National Institute on Drug Abuse (NIDA) 7.21%, and National Institute of Neurological Disorders and Stroke (NINDS) 6.00%.

While there were significant decreases in the number of positions supported across this belt-tightening period from FY 2004 to present, the success rates for FY 2007 awards are not markedly worse than for FY 2004 awards (see Table 3). The success rate is defined as the number of funded applications divided by the number of unique applications submitted in a given fiscal year. Importantly FY 2007 success rates for the various research training and career development award programs exceed that for research project grants (RPG). It should be noted that the Institute exercised the practice of pruning the number of trainee positions awarded to institutional training (T) programs to allow a larger number of meritorious programs to be funded during this constrained period. Without this practice, the FY 2007 success rate would likely have been lower for institutional training programs.

Drilling down into the FY 2007 support for research training and career development, Table 4 shows the number of positions and total dollars spent by program category. A total of 1497 (competing and noncompeting) positions were awarded. As a percentage of dollars awarded, the majority of funds support career development (~49% of dollars) and institutional training (~33% of dollars) positions. More individuals are supported on institutional training awards than on mentored career development awards because, on a per person basis, each individual career development award is more expensive than a position on an institutional training award. Of the $64.7 million awarded to individual career development awards, most (82%) supports mentored career development awards (K01, K08, K22, K23, K25).

C. National Research Service Award (NRSA) Programs

The NIMH supports both individual and institutional National Research Service Award (NRSA) training programs. The individual NRSA programs include the program for individual MD/PhD fellows (F30), two programs for individual predoctoral

Table 3. NIMH Application Success Rates[1]

	FY 2004	FY 2007
Mentored K	36.4%	31.5%
K99		24.2%
F	29.1%	27.4%
T	54.7%	49.2%
RPG	24.2%	22.1%

[1] Data are success rates for total NIMH (AIDS + non-AIDS). Abbreviations: FY, fiscal year; Mentored K, mentored career development awards (K01, K08, K22, K23, K25); F, individual fellowships (F30, F31,F32); T, institutional training grants (T32, T34); RPG, research project grant (e.g., R01, R03, R21). Note that the K99 program began in FY 2006.

Data Source: http://report.nih.gov/award/success.cfm.

Table 4. FY 2007 Support (non-AIDS) for Training & Career Development[1]

	N	$ (M)	% of Total non-AIDS Budget
Mentored K	336	53.3	4.4
K99	9	0.7	0.06
Career K	79	10.7	0.9
F	246	8.8	0.7
T	827	36.0	2.9
Total	1497	109.5*	8.9*

[1] Mentored K, mentored career development awards (K01, K08, K22, K23, & K25). Career K, independent career development awards (K02, K24, & K05). F: individual fellowships (F30, F31, & F32). T, institutional training grants (T32 & T34). M, million.

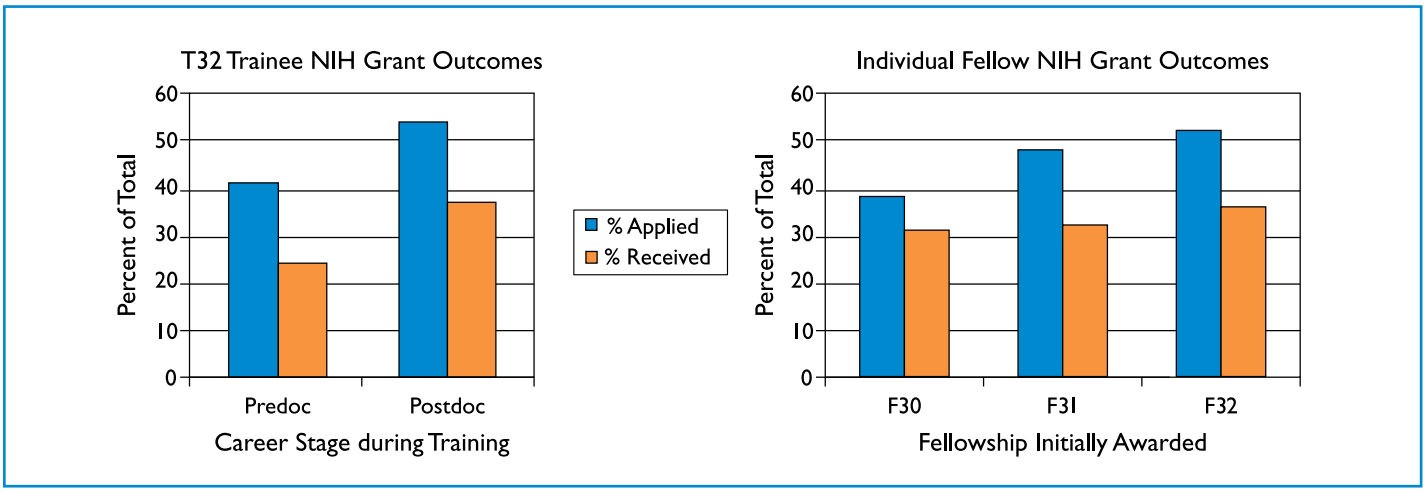
* Subject to rounding error. Data Source: NIMH Budget Office, January 2008

fellows (F31), and the program for individual postdoctoral fellows (F32). The NIMH supported a total of 246 individual fellowships in FY 2007. Of this total, 14 were F30s, 175 were F31s, and 57 were F32s. Thus, 77% of the individual fellowships were at the predoctoral level and 23% were at the postdoctoral level. The institutional NRSA training programs include programs supporting only undergraduate students (T34s) as well as programs for predoctoral and/or postdoctoral trainees (T32s). Support for predoctoral training programs includes participation in the Jointly Sponsored Predoctoral T32 Program in the Neurosciences (http://grants.nih.gov/training/joint_predoc/jointpredoc.htm). Many, but not all, of the remaining predoctoral training programs support advanced graduate students who are conducting dissertation research in a focused area relevant to the mission of the NIMH. Postdoctoral institutional training programs aid the training of individuals with the PhD, MD, or MD/PhD degree. In FY 2007, NIMH awarded a total of 159 institutional training grants (T32 and T34) and supported a total of 827 full-time training positions (FTTPs) on these grants at a total cost of $36 million. Of these FTTPs, 11.5% (95) were undergraduate, 43.8% (362) were predoctoral, 0.7% (6) were short-term summer positions typically for medical students, and 44.0% (364) were postdoctoral positions. It is also important to remember that many predoctoral and postdoctoral trainees are supported on R01 grants and not by formal training mechanisms. Indeed, NIH estimates that 80% of postdoctoral scholars are supported via R01, rather than T32 or F32, funding. Unfortunately, neither NIH nor NIMH has outcome data or training data for those trainees supported via R01 funding.

1. Outcome Data: University-Based T32s and Individual Fellowships

Early in 2008, the NIMH obtained outcome data for individuals supported on individual fellowships and on institutional training grants. T32 pre- and postdoctoral trainees and F31 and F32 fellows supported in FY 1999 and F30 fellows supported in FY 1997 and FY 1998 were sampled. F30 fellows were sampled from an earlier fiscal year than F31 fellows to take into consideration the required medical education component of their MD/PhD degree. The following outcomes were

Figure 5. NRSA Outcomes: Subsequent NIH Awards[1]



[1] Training Year: FY 1999 for 487 T32 predoctoral trainees, 430 T32 postdoctoral trainees, 190 F31 fellows, and 100 F32 fellows; FY 1997 and FY 1998 for 55 F30 fellows.

Data Source: NIH IMPAC II database, January 2008; analysis by NIMH OSPPC.

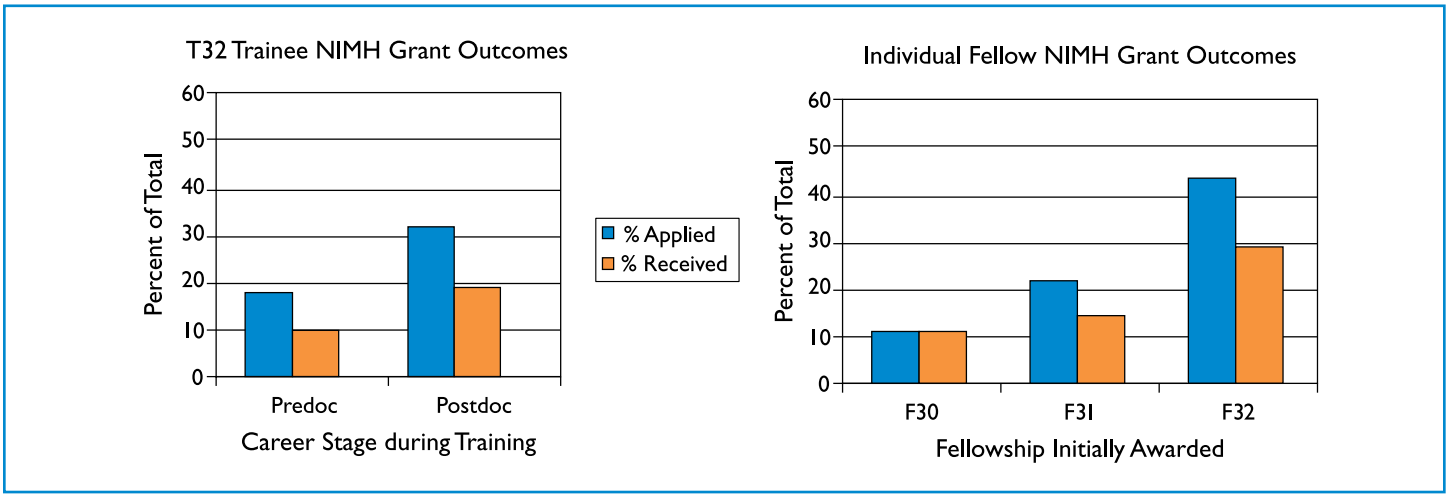
quantified: 1) the percentage of supported individuals who a) ever applied for or b) ever received individual funding from the NIH (Figure 5) subsequent to their training support; and 2) the percentage of supported individuals who subsequently a) ever applied for or b) ever received individual funding from the NIMH (Figure 6) subsequent to their training support. In all cases, the period assessed was from the specified year of training until January 2008.[4] The data show that 40-50% of predoctoral students supported applied for subsequent funding from the NIH; predoctoral students supported by an F31 were somewhat more likely to apply for individual funding than were those supported on a T32 (see Figure 5). This difference persisted when the percentages of predoctoral students receiving subsequent funding from the NIH were compared: 32% of F31 fellows vs. 24% of predoctoral T32 trainees. NIH outcome data for postdoctoral scholars supported on F32s and T32s were very similar with just above 50% of the supported scholars applying for subsequent NIH support and about 37% of the supported scholars receiving subsequent funding. Similar trends were observed when NIMH-specific outcomes were examined (see Figure 6). It thus appears that individuals who are more advanced in their research training are more likely to compete for and receive subsequent support. At least at the predoctoral level, fellowship recipients appear more likely to receive subsequent awards than trainees on institutional training grants (see Pion, 2001). This last observation was confirmed in an independent sample of NIMH trainees who were supported during an earlier fiscal year.

2. Diversity-Focused NRSA Programs

Among the institutional and individual NRSA programs are NRSA programs targeted to enhance the diversity of the research workforce. These programs include the NIMH Career Opportunities in Research (COR) Honors Undergraduate Research Training Program (T34), the Institutional Research Training Programs: Increasing Diversity (T32), and the Individual Predoctoral Fellowships (F31) to Promote Diversity in Health-Related Research. All of these programs are intended to promote diversity in NIMH-related research by supporting research training at the undergraduate (T34), predoctoral (T32 and F31), and postdoctoral (T32) levels. The longstanding NIMH T34 and diversity-focused T32 initiatives were initiated in 1979; the NIH initiated the diversity F31 program in 1995.

[4] Unless otherwise noted, the NIH outcome data include applications and awards from all Institutes including the NIMH.

Figure 6. NRSA Outcomes: Subsequent NIMH Awards[1]



[1] Training Year: FY 1999 for 487 T32 predoctoral trainees, 430 T32 postdoctoral trainees, 190 F31 fellows, and 100 F32 fellows; FY 1997 and FY 1998 for 55 F30 fellows.

Data Source: NIH IMPAC II database, January 2008; analysis by NIMH OSPPC.

a. COR Program (T34)

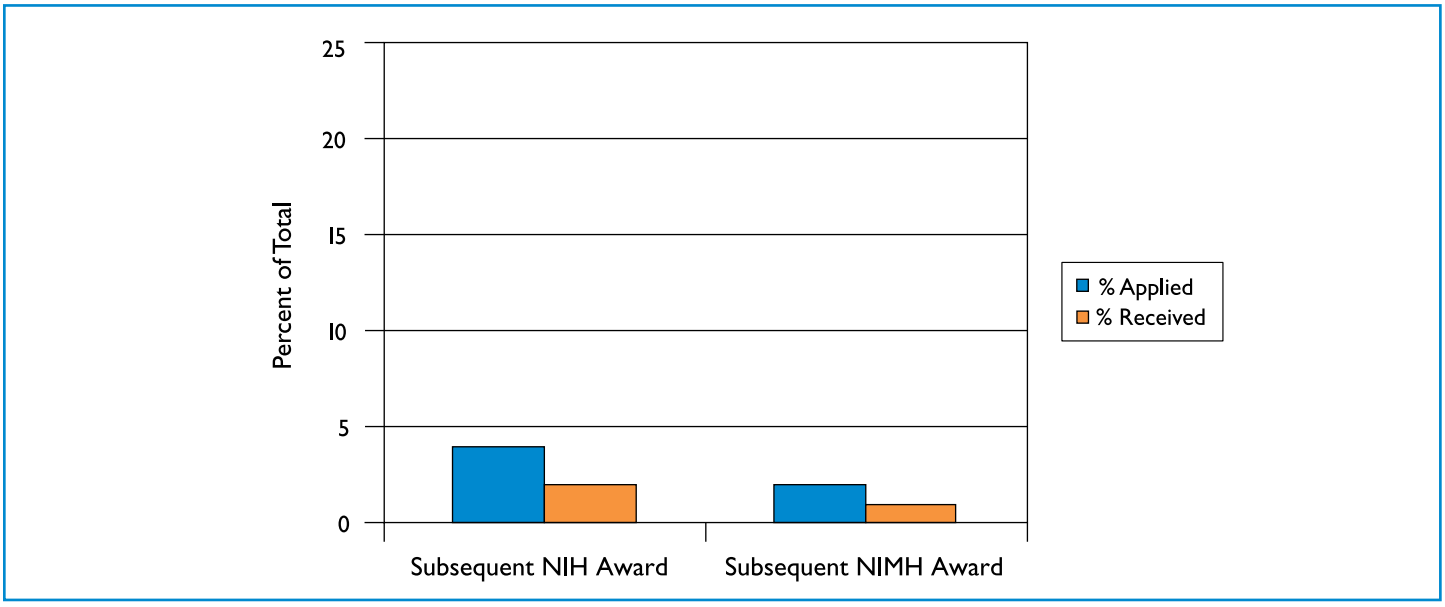
The NIMH COR program supports research training for undergraduate students from diverse backgrounds in biomedical, behavioral and clinical research areas relevant to the NIMH mission. Specific program objectives include: 1) a program of didactics and mentored research experiences for trainees during their junior and senior years of undergraduate education; and 2) enhanced undergraduate research training curricula relevant to the NIMH mission. Trainees receive mentoring at their home institution and also at the annual NIMH COR meeting. Allowable costs for T34 programs include standard NRSA categories of trainee stipends, tuition and fees, and trainee-related expenses, as well as trainee travel. In FY 2007, the NIMH spent $2.7 million to support 95 undergraduate trainees in 34 T34 programs.

Outcomes. Early in 2008, the NIMH examined outcomes for T34 trainees who were supported during FY 1996 and FY 1997. This cohort graduated from college in 1996-1998 and thus could reasonably be expected to have completed graduate school and begun postdoctoral training by 2008, ten or more years after their college graduation. In assessing outcomes, the NIMH asked what proportion of these trainees ever applied for or received any individual funding from the NIH or the NIMH. It was expected that this cohort of T34 trainees may have applied for and received an individual training mechanism (e.g., F31, R36 or F32), a mentored career development award (e.g., K01) or perhaps a research grant between FY 1996 and FY 2008. The data (Figure 7) show that less than 5% of the T34 trainees supported during FY 1996 and FY 1997 had ever applied for or received any subsequent NIH award from the time they were supported until January 2008. A smaller percentage of those supported had ever applied for or received any subsequent NIMH award.

b. Diversity-Focused Institutional Training (T32) Program

The diversity-focused T32 program offers an additional vehicle (in addition to NIMH-supported, university-based T32 programs) to support research training of individuals from diverse groups at the pre- and postdoctoral levels. The NIMH currently supports both national and regional diversity-focused T32 programs. The national programs support pre- and postdoctoral trainees who are enrolled at and receive mentored research training at academic institutions throughout the U.S. These individuals apply to the national organization (American Psychological Association, American

Figure 7. T34 Trainee Outcomes: Subsequent NIH and NIMH Awards[1]



[1] Training Year FY 1996 (86 trainees) and FY 1997 (97 trainees).

Data Source: NIH IMPAC II database, January 2008; analysis by NIMH OSPPC.

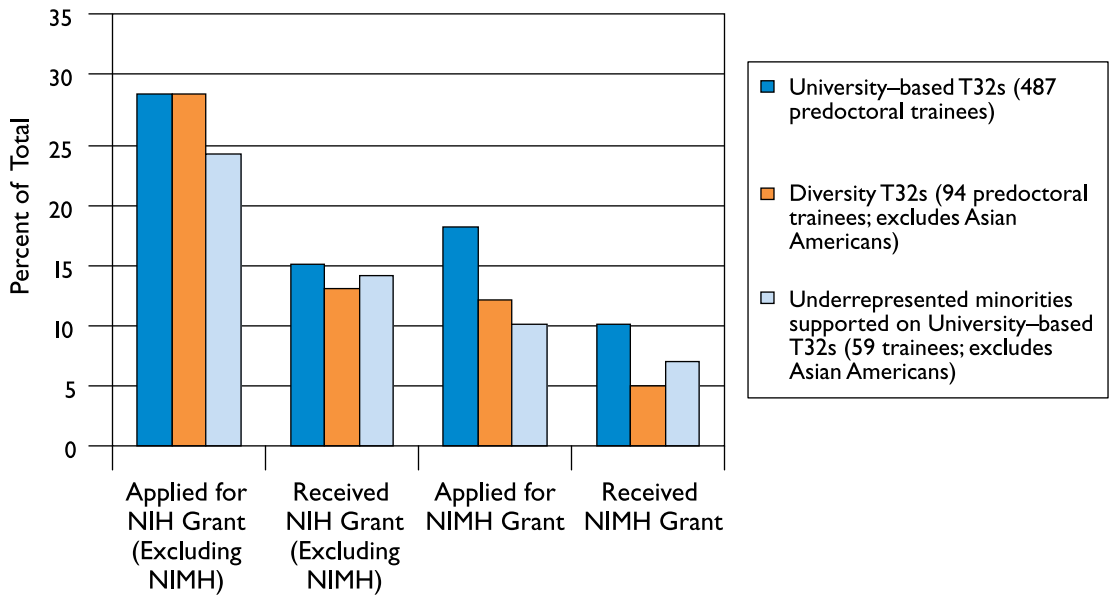
Sociological Association, Council on Social Work Education, or American Psychiatric Association) for support. The national organization selects and appoints the trainees to their diversity-focused T32 program. The appointed trainees obtain mentored training at their home institution. The regional T32 programs are networks of at least three academic institutions that work together to provide research training experiences for trainees who are enrolled at one of the participating institutions. Many of these programs provide networking and mentoring opportunities beyond the trainees' home institutions.

In FY 2007, NIMH supported six diversity-focused T32 programs with a total budget of $2.54 million and 78 full-time training positions. Of that total, $1.7 million supported national programs and $840,522 supported regional programs. Two other Institutes, NINDS and NIDA, provided some co-funding for this programmatic effort. In addition to the usual NRSA-allowable costs (stipends, tuition, fees and health insurance, trainee travel, and trainee-related expenses), the diversity-focused T32 program allows applicants to request additional funds in the trainee-related expense category up to 30% of the total direct costs in any year. These additional funds may support partial administrative assistance for program management and other costs necessary for implementation of the program (e.g., travel for advisory committee members and additional travel for trainees to attend specialized workshops). Because of these additional allowable expenses, diversity-focused T32 programs are more expensive on a per trainee basis than university-based T32 programs.

Outcomes. Early in 2008, the NIMH examined outcomes for three groups of predoctoral trainees who were supported during FY 1999: 1) those supported on diversity-focused T32s who are, by definition, all underrepresented minorities[5]; 2) underrepresented minorities supported on university-based T32s; and 3) all university-based T32 predoctoral trainees. Data were limited to predoctoral trainees because the number of postdoctoral trainees supported in FY 1999 on diversity-focused T32 programs was very small. The predoctoral cohort

[5] In FY 1999, only underrepresented minorities were eligible to apply to these T32 programs.

Figure 8. Predoctoral T32 Trainee Outcomes[1]



[1] Data Source: NIH IMPAC II database, January 2008; analysis by NIMH OSPPC.

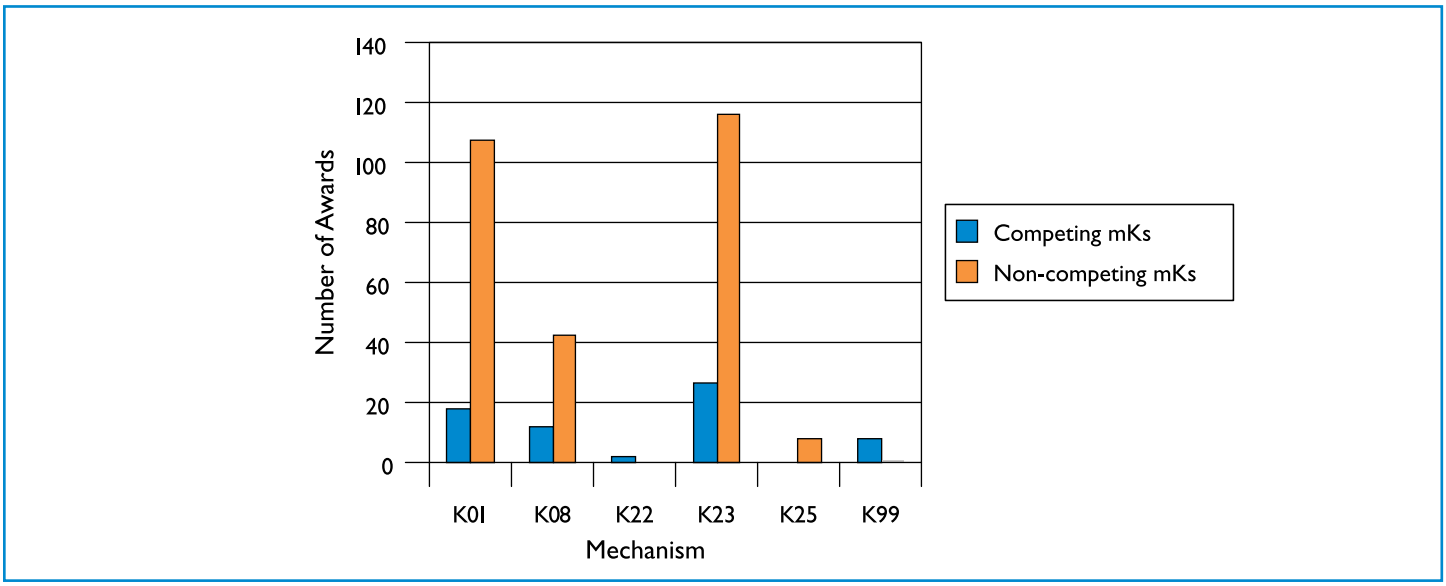
could reasonably be expected to have completed graduate school and perhaps postdoctoral training by 2008. Again, the outcomes assessed were the proportion of trainees who ever applied for or received any individual funding from the NIH or the NIMH.[6] Given the amount of time elapsed since their support as trainees, it was expected that T32 trainees may have applied for and received an individual training award (e.g., F31, R36 or F32), a mentored career development award, or perhaps a research grant. The data (Figure 8) show that 24-29% of all university-based T32 predoctoral trainees and diversity-focused T32 predoctoral trainees supported during FY 1999 applied for an NIH award subsequent to their T32 support, while 13-15% of trainees supported during FY 1999 received any subsequent NIH award. Similar to the overall trends for individuals supported on T32s and Fs described in Section III.C.1, a smaller percentage of underrepresented minorities supported on either a university-based T32 or a diversity-focused T32 program ever applied for or received any subsequent NIMH award (applied for, 10-12% compared to 18% of all university-based T32 predoctoral trainees; received, 5-7% compared to 10% of all university-based T32 predoctoral trainees). Surprising to the Workgroup was that the additional training and mentoring opportunities provided by the diversity-focused T32 programs did not provide any detectable added value with respect to this measured outcome.

c. Predoctoral Fellowship Program to Promote Diversity (F31)

The NIMH supports the NIH-wide, individual predoctoral fellowship program (F31) to promote diversity in health-related research. Eligibility is limited to individuals from diverse groups. In FY 2007, 17 predoctoral fellows were supported at a total cost of $525,000. As was noted in the 2001 NAMHC report on racial/ethnic diversity in mental health research careers, it is not clear if the relatively small number of awards made in response to this funding opportunity announcement is due to applicants applying to the F31 program that does not limit eligibility to individuals from diverse groups (PA-

[6] Note that, in this case, applications to or funding from the NIMH is not included in the NIH outcome measure.

Figure 9. FY 2007 Mentored K (mK) Awards[1]



[1] Data Source: NIMH Budget Office, September 2008

07-002), applicants not knowing about the F31 program to promote diversity, or applicants not wishing to be identified as receiving an award limited to individuals from diverse groups.

D. Mentored Career Development Award (Mentored K) Programs[7]

In FY 2007, the NIMH supported a total of 336 mentored K and 9 K99 awards. Figure 9 illustrates the mentored K awards by individual program. Most mentored K awardees are supported either by K01 or K23 awards. The largest percentage of new mentored K awards in FY 2007 was for K23 awards for mentored research training in patient-oriented research. If we examine mentored K investigators by terminal degree (Figure 10) four observations may be made: 1) the vast majority of K01 awards are made to PhD investigators; 2) K08 awards are relatively evenly divided among PhD (clinically trained), MD, and MD/PhD investigators; 3) K23 awards are relatively evenly divided between PhD (clinically trained) and MD investigators; and 4) MD/PhD investigators are most frequently awarded K08 awards.

In January 2008, outcomes for mentored K awardees supported in FY 1999 were examined. The outcomes assessed were the proportion of these individuals who ever (between FY 1999 and January 2008) applied for or received a subsequent award from the NIH or the NIMH (see Figure 11). Because the K23 program was relatively new in FY 1999, most of the individuals had K01 and K08 awards. More than 80% of the awardees ever applied for a subsequent NIH award and about 70% of the awardees received a subsequent NIH award. The percentages are lower for subsequent NIMH awards, especially for K01 awardees, ranging from 60% to 100% of awardees applying for subsequent NIMH awards and from 40 to 60% of awardees receiving subsequent NIMH awards. These outcomes support the inference drawn from the outcomes of predoctoral and postdoctoral NRSA trainees, viz. individuals more advanced in their research training are more likely to compete for and receive subsequent NIH awards.

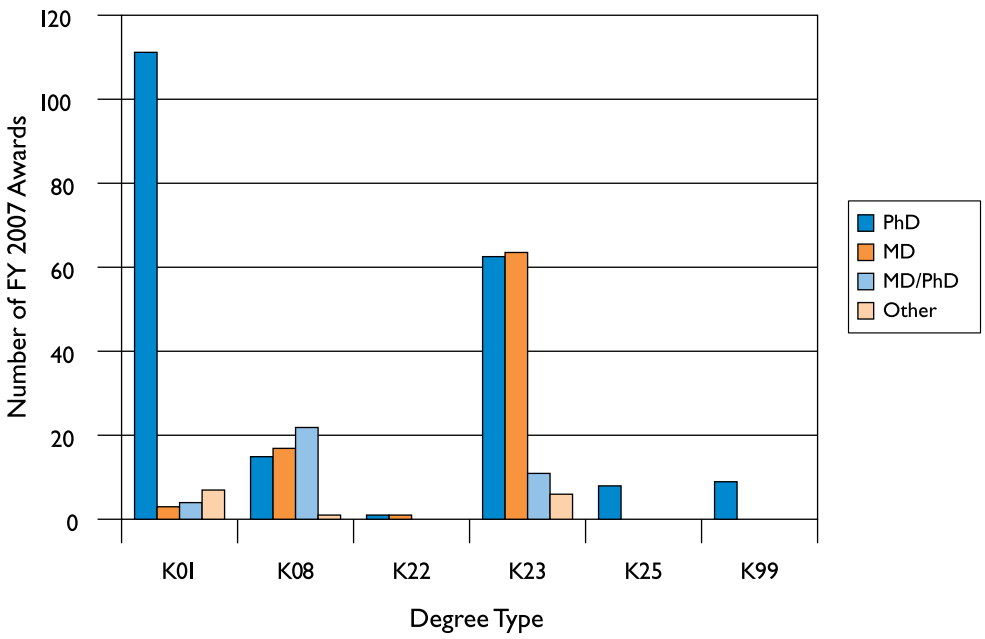
E. Other Training-Related Programs[8]

The NIMH supports three other programs that contribute to its research training mission.

[7] Refer to Appendix 4 for brief descriptions of the various mentored career development award programs the NIMH supports.

[8] Refer to Appendix 4 for brief descriptions of the training-related programs that the NIMH supports.

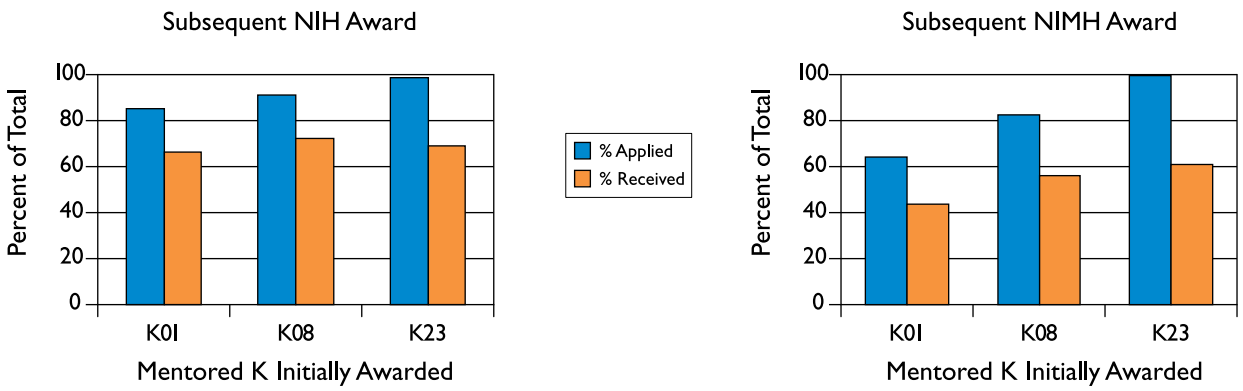
Figure 10. Total Mentored K Awards by PI Terminal Degree in FY 2007[1]



[1] Data Source: NIMH Budget Office, January 2008

The NIMH Research Education Program (R25) provides the opportunity for creative educational opportunities for individuals from the graduate to investigator career level. In FY 2007, the NIMH supported 46 research education programs totaling $8.28 million. Figure 12 helps describe these programs. Because of fiscal constraints, support for new programs focused on undergraduate research education efforts was discontinued with publication of PAR-05-153 in 2005. A significant number (30%) of the current R25 programs focus on research education opportunities during residency and are generally designed to prepare psychiatry residents for future careers as physician-scientists. One example is the "Research

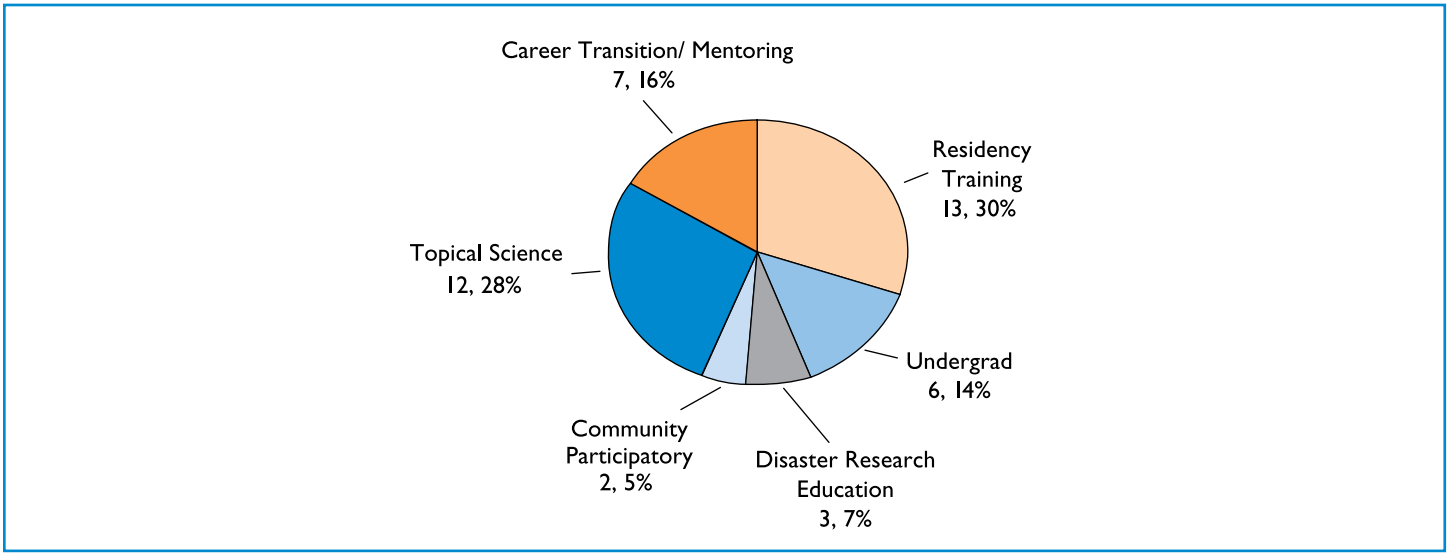
Figure 11. Outcome Data for Mentored K Awardees[1]



[1] Training Year FY 1999 for 49 K01s, 75 K08s, and 10 K23s.

Data Source: NIH IMPAC II database, January 2008; analysis by NIMH OSPPC

Figure 12. NIMH (non-AIDS) Research Education Programs (FY 2007)[1]



[1] Three research education grants that the NIMH administers on behalf of the NIH Neuroscience Blueprint are not included in this chart.

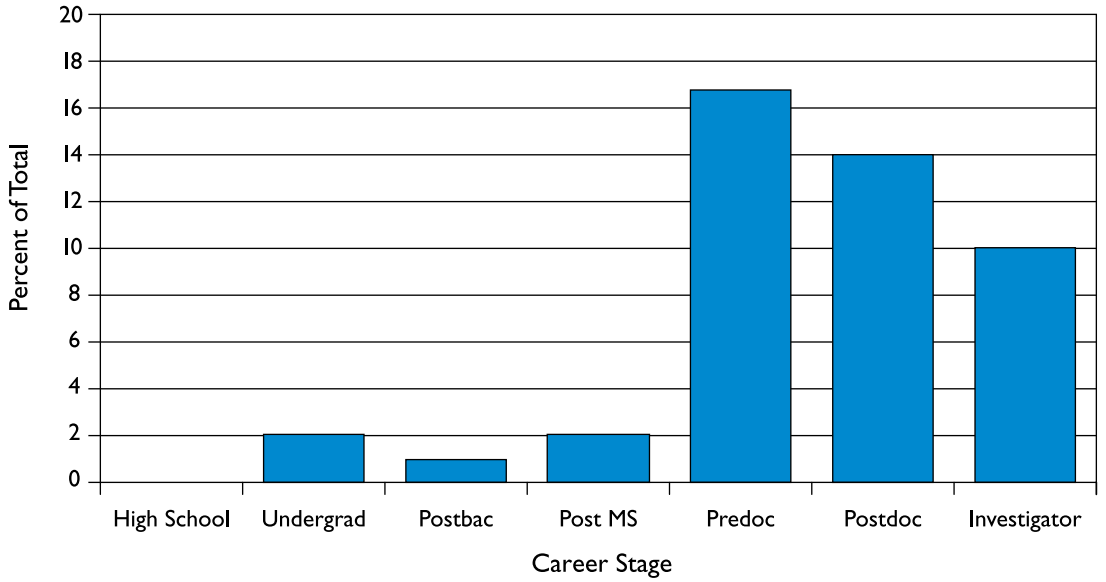
Data Source: NIH IMPAC II database, January 2008.

Education Program for Future Physician-Scientists in Child Psychiatry" that is led by Dr. James Leckman at Yale University with support from the NIMH and the Klingenstein Third Generation Foundation. This program provides research education and training opportunities for both medical students and medical residents interested in pursuing interdisciplinary research careers in the area of child and adolescent mental health. Cutting-edge scientific short courses comprise 25% of the supported research education programs. Such courses offer opportunities for individuals to gain expertise in specific skill sets in an intensive, focused program, e.g. the annual ERP boot camp led by Steve Luck at University of California-Davis Center for Mind and Brain for individuals interested in learning the fundamentals of event-related potential (ERP) research (http://erpinfo.org/boot-camp). Finally, the NIMH invests in research education programs that emphasize mentoring. One example is the "Summer Program in Neuroscience, Ethics and Survival (SPINES)" at the Marine Biological Laboratory that Drs. Joe Martinez and James Townsel direct (http://www.mbl.edu/education/courses/special_topics/spines.html). This month-long program, targeted to individuals from underrepresented groups, includes mentoring, discussion of neuroscience research in seminar and lecture format, ethics using case studies, and professional development activities including public speaking and grantsmanship. Another example (see Text Box 2) is the "Advanced Research Institute in Geriatric Psychiatry" organized by Dr. Martha Bruce (http://www.cornellpsychiatry.org/research/ari.html). This program targets a vulnerable stage in the career pipeline, the transition from junior investigator to R01-funded investigator. Through focused mentoring of selected junior candidates, this program intends to reduce attrition from the pipeline and thereby increase the number of independent investigators in geriatric psychiatry.

NIMH offers a two-year dissertation research award (R36) program to increase the diversity of the workforce. Because this is not an NRSA program, applicants remain eligible after exhausting their NRSA eligibility as a predoctoral fellow. In FY 2007, NIMH made two R36 awards. These data identify an under-utilized program for individuals from diverse groups. It is not clear if the small numbers of applications and awards reflect minimal need for such a program, a lack of awareness of the existence of the program among potential applicants, or potential applicants not wishing to be identified as receiving an award limited to individuals from diverse groups.

Like the other Institutes, the NIMH supports the research supplement program to promote diversity in health-related re-

Figure 13. Individuals Supported by Diversity Supplements in FY 2007 by Career Stage[1]



[1] Data Source: NIMH Budget Office, January 2008.

search. The NIMH made 46 diversity supplement awards in FY 2007 totaling $4.15 million. Figure 13 shows the distribution of these awards as a function of career stage. The modal award was made to a predoctoral candidate.

Early in 2008, NIMH examined outcomes for diversity supplement recipients at the pre- and postdoctoral level who were supported during fiscal years 2000-2002. [Asian-Americans were not included in this analysis because this group has not been shown

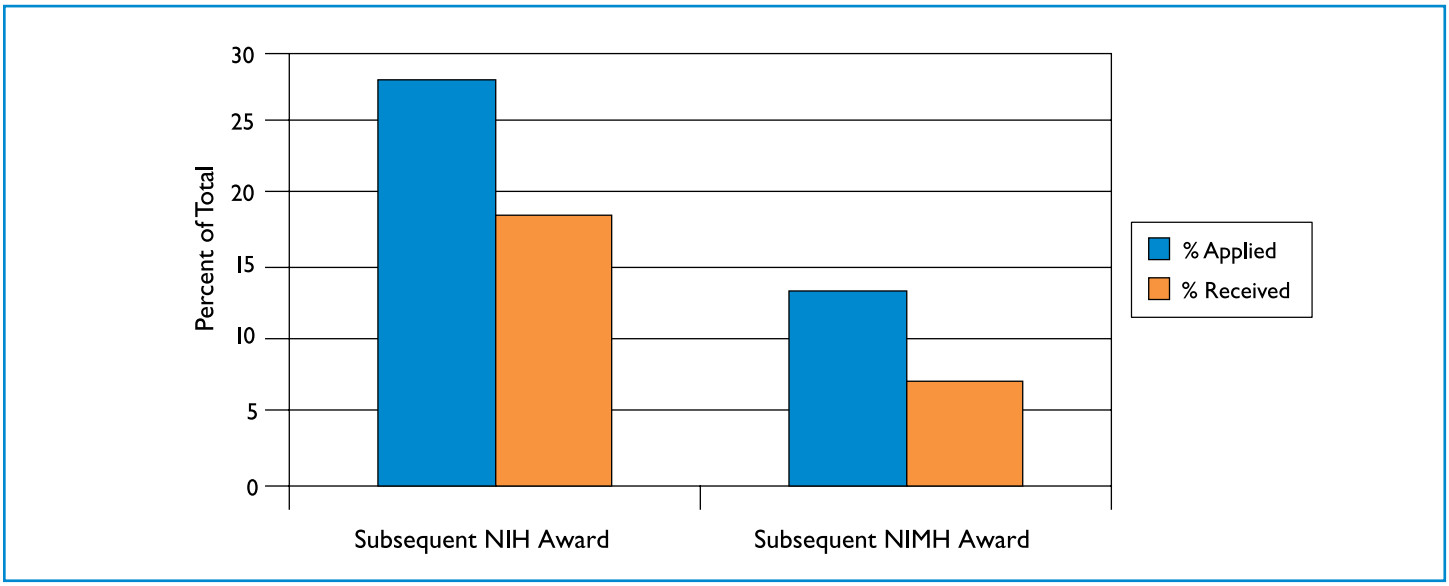
Text Box 2. Advanced Research Institute in Geriatric Mental Health (ARI)

Led by Dr. Martha Bruce (Weill Medical College of Cornell University), this innovative, NIMH-funded research education program is designed to increase the number of investigators conducting translational, intervention, and services research focused on geriatric mental health. The program pairs mentored K awardees and other junior investigators who have comparable research experience with established investigators who serve as mentors and consultants. This program has three goals: 1) increase the likelihood of obtaining NIH independent R01-level funding; 2) decrease the lag time between early career development support and independent R01-level funding; and 3) enhance the knowledge and skills in mentoring and other responsibilities of academic leadership. The specific components of the program include: a) sustained mentoring of trainees by senior program faculty; b) structured opportunities for individualized mentoring and consultation including an intensive, annual 3-day retreat attended by trainees, mentors, research methodologists, and NIMH program staff, small group, web-based work-in-progress seminars, and targeted consultation on substantive and methodological issues from senior experts; and c) enhancing participants' knowledge and skills in mentoring and other responsibilities of academic leadership. The ARI also interfaces with other early stage research education programs focused on geriatric mental health and thus provides continuity across different stages of the trainees' research careers. The unique web-based technology utilized by the ARI allows for ongoing research education as well as ongoing mentorship, consultation, and interaction amongst peers.

to be underrepresented in biomedical research.] As before, the outcomes assessed were the proportion of these individuals who ever (between FY 2000 and January 2008) applied for or received a subsequent individual award from the NIH or the NIMH (see Figure 14). The data show that 28% of all supplement recipients applied for and 18% of all supplement recipients received any subsequent NIH award. A smaller percentage of the supplement recipients (14%) applied for and received (7%) any subsequent NIMH award. It was noted that the NIMH recently modified its management of the diversity supplement program to strongly encourage recipients to apply for individual funding during the period of supplement support. It is, however, still premature to assess the impact of this change in program management on program outcomes.

MD degree are not eligible to apply for individual fellowships while individuals seeking the MD/PhD degree are eligible to apply for the F30 or the F31 award. In FY 2006, 6.7% of F30 and F31 awards were made to individuals seeking the MD/PhD degree (18 individuals). One individual postdoctoral (F32) award (1.4% of F32 awards) was made to an individual with the MD/PhD degree and none with the MD degree in FY 2006. Of the postdoctoral T32 trainees supported in FY 2006, 21% held the MD or MD/PhD degree (52 MDs and 22 MD/PhDs). The number of medically trained individuals who receive support from the NIMH increases at the mentored career development level. In FY 2007, 24.7% of the mentored career development awards were made to MDs and 10.8% to MD/PhDs. These percentages are similar to the NIMH pool of research project grant (RPG) investigators in FY 2007: 22.5% of NIMH-funded principal investigators held the MD degree and 8.8% held the MD/PhD degree. These data suggest that the NIMH currently tends to invest more funds to support medically trained investigators later, rather than earlier, in their training.

Figure 14. Outcome Data for Pre- and Postdoctoral Diversity Supplement Recipients: Subsequent NIH and NIMH Awards[1]



[1] Training Years: FY 2000-2002 for 73 pre- and postdoctoral recipients. As noted in the text, Asian-Americans are not included in this analysis.

Data Source: NIMH Office for Special Populations and NIH IMPAC II database, January 2008; analysis by NIMH OSPPC.

F. MDs and MD/PhDs in NIMH-Supported Training

The most recent data available on MDs and MD/PhDs participating in NIMH-supported training programs are summarized below. At the graduate level, individuals seeking only the

IV. What Works? Best Practices and Evidence-Based Principles for Research Training

The charge for this NAMHC Workgroup was broad, and included, in part, the following questions. What research education/training programs are needed to produce the types of investigators who will be well poised to address NIMH's research mission in the future? What steps should be taken to improve the recruitment, training, and retention of specific trainee populations (e.g., MD/PhDs and those from diverse groups)? Given the limited NIMH research training budget, what modifications to existing programs or development of new programs should the Institute consider to maximize its research training yield? From discussions of future workforce needs (Section II) and current programs (Section III), a number of cross-cutting themes emerged to inform answers to these questions. First, targeted and flexible funding vehicles would constitute an important strategy for attracting, training, and retaining trainees who are currently underrepresented in the NIMH research workforce and provide a means to accelerate the research career progression of the most promising junior investigators. Second, to increase state-of-the-art training in areas relevant to the NIMH mission, it is critical that research training experiences be conducted in research intensive environments. Third, to maximize training experiences in interdisciplinary research, it is important that research training programs be housed in, and managed by, research intensive institutions rather than by professional scientific organizations that represent a single discipline. Fourth, enhanced and direct efforts must be made to establish continuity among the various research education, training, and career development programs so that gains made in recruitment and training at one stage of the research career path are carried forward.

As stated earlier in this report and as reflected in NIMH's Strategic Plan, a broad array of well-trained basic, clinical, and services researchers is needed to address the public health mission of the Institute. The remainder of this section provides a series of specific recommendations intended to enhance existing NIMH research training efforts and investments, and to develop new initiatives that address current and anticipated areas of need. The relatively narrow focus of these recommendations reflects the charge given to the Workgroup. However, we wish to acknowledge the critical contributions of, and the need for investment in 21st century training for, PhDs who are likely to continue to comprise the vast majority of the future NIMH workforce. In order to minimize unintended consequences, it will also be important for the NIMH to weigh carefully changes in the mix of programs supported as the Institute considers implementation of our recommendations.

A. Maintain NIMH Budget for Research Training and Career Development

The Workgroup was of the opinion that the magnitude (percent of Institute budget) of the NIMH's current investment in research training and career development was appropriate and should not be reduced further. As a result, the Workgroup recommended that the NIMH maintain its current total investment in research training and career development. However, the Workgroup recognized that implementing the recommendations presented below may necessitate adjustments in the relative mix of programs that the NIMH is able to support in the future. Care should be exercised to ensure that outstanding training programs that contribute to the current priorities of the NIMH are not unintentionally harmed in implementing our recommendations.

B. Build a Strong Pipeline

Building and maintaining a strong pipeline of trainees who are focused on mental health-relevant research careers are critical if the NIMH is to accomplish its research mission. While the Workgroup acknowledged the importance of maintaining a strong pipeline of individuals with varied research

phenotypes who can contribute to the broad research mission of the NIMH, the Workgroup identified three important populations, individuals from diverse backgrounds, physician-scientists, and international scholars, where it is recommended that the NIMH make targeted efforts.

Recommendation B-1. Revise approach to undergraduate research training for individuals from diverse groups

Despite the significant funds NIMH has expended over several decades, the pipeline of individuals from diverse backgrounds striving toward and becoming NIMH-funded investigators continues to be less than would be expected or desired (see Section III above; National Advisory Mental Health Council Workgroup on Racial/Ethnic Diversity in Research Training and Health Disparities Research, 2001). This pattern is most striking in genetics and neuroscience, two research areas in which NIMH expects sustained need for skilled researchers in the future.

The college level is one stage in the research career pipeline where targeted efforts need to be made to increase the pool of trainees from diverse backgrounds who pursue research careers in neuroscience. NIMH's T34 program has supported training at several minority-serving institutions since 1979. The NIGMS, the only other NIH Institute with a substantial commitment to pre-baccalaureate education, supports institutional training for future biomedical scientists at all NIH Institutes. The NIMH T34 program, developed when NIMH was not heavily biomedical, is the only program from a disease-specific Institute that targets undergraduate research training. Although the Workgroup clearly saw the importance of increasing the pool of trainees at this early stage, we also recognized that it is unrealistic for the NIMH to accomplish this job alone. There was general agreement that undergraduate students are not yet prepared to commit to an NIMH career path at this early stage of their career. Therefore, any future initiative targeting undergraduate students from diverse backgrounds should be carried out in cooperation with either the NIGMS, which has this responsibility at the NIH, or through the NIH Blueprint for Neuroscience Research, a cooperative effort among the 16 NIH Institutes, Centers and Offices that support neuroscience research. If appropriate, the cooperation of other federal agencies (e.g., the National Science Foundation) and/or philanthropies (e.g., HHMI) should be enlisted in developing an effective undergraduate research training program.

Specifically, the Workgroup recommends that the NIMH replace its existing T34 undergraduate training program with a diversity-focused, trans-NIH undergraduate research training program in the neurosciences that operates through the NIH Blueprint for Neuroscience Research (http://neuroscience-blueprint.nih.gov/). While not an inclusive list, components of this program would likely include a systematic mentoring program; cutting-edge and rigorous curriculum enhancement/development; hands-on research experiences; and programmatic activities to extend the trainees' knowledge (e.g., seminars, and exposure to clinical populations and questions related to human health and disease) and to help prepare them for graduate school.

To maximize the probability that supported trainees will successfully transition to predoctoral research training programs, this undergraduate research training program should be linked to both the recommended match-making system (see Recommendation E-1), to facilitate early communication and interaction between these undergraduate trainees and appropriate predoctoral institutional research training (T32) program directors from across the country, and the national mentoring network (see Recommendation C-1) to provide additional mentoring opportunities for undergraduate trainees.

Recommendation B-2. Recruit and retain outstanding physician-scientists

It is widely believed that there is a shortage of rigorously trained physician-scientists conducting mental health-related research. A number of reports (e.g., Abrams et al., 2003) have described various institutional, regulatory, and personal obstacles that impede the recruitment, training, and retention

of physician-scientists in the research workforce. While Workgroup members recognized the need for increasing scientific literacy during medical training, attention was focused on efforts that would increase the likelihood that the most talented physician-scientists would choose a mental health-related research career. Two potential initiatives were recommended by the Workgroup to address this concern.

Initiative 1: Stimulate the interest of early-stage, research-oriented medical students who have not yet finalized their research field. The goal of this initiative is to pique interest early and build upon it to foster a commitment to a research career. The Workgroup suggested that the NIMH consider the following elements in such an initiative: a) didactic experiences to convey current advances in the science of mental disorders (e.g., structured curriculum, brain-interest groups, annual retreats); b) short-term mentored research experiences at the students' home institutions, the NIMH Intramural Research Program, or as part of other short-term, summer research programs; and c) ongoing mentoring by and networking with peers,

Text Box 3. Perspectives of MD/PhDs

The Workgroup members held a roundtable discussion with six MD/PhDs at various career stages (from graduate school through residency and beyond). The purpose of this discussion was to help the Workgroup members better understand the challenges and issues faced by individuals during their training. The Workgroup members found the discussion informative. The following quotations provide a flavor of the discussion.

Concerning MD/PhD education: "I don't remember any presentations during my medical school classes of, you know, scientific stories that were turned into treatment advances in mental health. And that is something we could really use..."
"...for those individuals being exposed to psychiatry there is the sense that the research isn't integrated with that [psychiatry], there is the sense that we're still back at chlorpromazine in 1952, and obviously there is more than that...but I don't think that is getting communicated around the programs."

Concerning the transition from the MD/PhD to residency: "So once the PhD is completed there's the remaining years of medical school, and then starting residency, you are pretty much looking at a 4-5 year absence from research...There is the added challenge of going to a residency program that is different from where I did the MST [Medical Scientist Training] program, so in other words starting up a new line of research."

Concerning residency: "...encourage residency programs to value people with that identity [as a researcher], and how to keep that identity from the very beginning of their residency training."

Concerning the role of mentorship in MD/PhD training: "The thing I have noticed that has allowed people to succeed in MD/PhD programs is essentially mentorship."

Concerning the choice of specialty: "And the reason I went into psychiatry was simply that I just enjoyed it a lot more than I enjoyed neurology when I did my rotation as a medical student. I found it was very creative."
"I certainly swam against the tide...advisors said, why are you doing psychiatry? It's a waste of time. It's a waste of your brain."
"...mental health research is not just confined to, you know, the realm of psychiatry..."

Concerning the MD/PhD career path: "There is no toughest point. At each point in the pipeline there is a different type of hurdle to overcome...there needs to be targeted intervention at each one of those different stages."

research track residents, and faculty. Mentored research experiences have been shown to stimulate interest in research and in academic medical careers (Fang & Meyer, 2003; Solomon et al., 2003). Because MD/PhDs are a uniquely trained cohort of researchers, increasing the number of MD/PhD students pursuing mental health-relevant research careers should be prioritized within this initiative. Text Box 3 provides selected quotations from MD/PhDs who met with Workgroup members.

Initiative 2: Encourage curricular reform to increase the number of physician-scientists who subsequently conduct mental health-related research. Since the "biological revolution," academic psychiatry has taken a dichotomous approach to the study of mind and brain: basic neuroscientific research has focused largely on transmitter function and, more recently, underlying genetic mechanisms while clinically-oriented research has taken descriptive approaches to enumeration and categorization of symptoms and diagnoses and their response to medications. The Workgroup identified a fundamental gap in psychiatric education at the medical school and residency level that neglects several decades of research in behaviorally-relevant scientific areas (e.g., systems, cognitive, and social neuroscience) as well as critically related areas such as computer science, psychometrics, and the mathematics of complex systems. All of these areas are central to understanding brain-behavior relationships, mental disorders, and translational research. These areas, which are among the most intellectually exciting in modern science and promise some of the most significant breakthroughs for understanding normal and abnormal behavior, remain separate from psychiatric education.

The Workgroup made recommendations at both the medical school and residency levels in order to address this gap in knowledge.

At the medical school level, the Workgroup recommends an initiative to stimulate medical schools to incorporate substantive exposure to systems, cognitive, and social neuroscience in their preclinical (didactic) training programs, including specific opportunities to pursue graduate training in these areas as part of an MD/PhD program (e.g., through formal links to appropriate departments or graduate training programs).

At the residency level, the Workgroup recommends an initiative supporting training programs to institute a formal/didactic program of training in systems, cognitive, and social neuroscience that is enriched by exposure to relevant areas of computational science, and is staffed by faculty from relevant disciplines (e.g., cognitive science, computer science, and mathematics).

These two recommendations could also be coordinated with efforts to enrich graduate education and thus enhance the synergy of the various training efforts. For example, NIMH-supported graduate training programs in fundamental neuroscience may benefit from the opportunity to develop courses in the neurobiology of mental illnesses, drug discovery, and/or translational research for PhD students conducting basic science research relevant to the NIMH mission. The NIH Blueprint for Neuroscience Research funding announcement (RFA-MH-05-011 and RFA-MH-06-006) could be a model for such an initiative. It may also be of interest to encourage NIMH-supported institutional training programs to incorporate programmatic activities that have been developed in the HHMI Med into Grad programs (see Text Box 1) to increase the synergy between PhD-trained scientists and trainees and investigators conducting clinical and translational research.

Recommendation B-3. Include international students and postdoctoral scholars

Recognizing the number of non-U.S. citizens currently in training and historic contributions of immigrants to the Nation's scientific workforce, the Workgroup made two specific recommendations. First, the NIMH should encourage the NIH to reduce regulatory barriers that limit training of non-U.S. citizens in NIH-supported research training programs. The Bridges to Independence report (National Research Council, 2005b) made a similar recommendation. Second, the NIMH should make a strategic investment in training highly promising non-U.S. citizens. One possibility to consider is to invest in the train-

ing of non-U.S. citizens who possess skill sets that are in short supply within our country's citizenry (e.g., individuals with strong quantitative backgrounds).

C. Mentoring Is Essential

Mentoring was recognized by the Workgroup as a critical element of effective research training and career development. Effective mentoring, which is often lacking, is one of the elements essential for the development of a successful research career (National Research Council, 1997). Because of unique challenges, the need for mentoring for individuals from diverse backgrounds is often heightened (National Advisory Mental Health Council Workgroup on Racial/Ethnic Diversity in Research Training and Health Disparities Research, 2001). As described in Section III, NIMH currently supports a small number of mentoring programs which focus on trainee cohorts who are at a specific research career stage and/or who are working in specific research areas (see Text Box 2 for one example). Within the context of mentoring, the Workgroup made two recommendations.

Recommendation C-1. Develop national mentoring networks

The NIMH should expand existing, and/or initiate new, national mentoring networks for individuals from diverse backgrounds. The networks should target individuals at different educational and research career stages and should be tailored to assist at critical transition points along the career path (e.g., undergraduate to predoctoral, predoctoral/residency to postdoctoral, postdoctoral to independent investigator). The Workgroup also recommends that the NIMH exert active efforts to integrate these national mentoring networks with current and proposed NIMH funding vehicles for research training. Because of their high visibility and networking capabilities, it was also noted that national scientific professional organizations may be well positioned to assist in establishing national mentoring networks.

Recommendation C-2. Develop an alumni network

NIMH should consider developing a network of established, NIMH-supported investigators and NIMH training and career development program alumni who are now established investigators. This network could serve as a standing resource for current trainees (who could then contribute to the alumni network once they transition to research independence).

As with any research training and career development initiative, careful monitoring of trainees' progress through a clearly defined tracking and evaluation process should be a required component of any mentoring initiative.

D. Expand Support for Systematic Research Training/Education Opportunities at NIMH-Supported Centers

In FY 2007, NIMH supported 49 research centers (P50 and P20 grants) at an annual cost of $74 million. The underlying research infrastructure and high caliber research conducted in NIMH-sponsored research centers provide an ideal environment for building the pipeline of individuals interested in pursuing research careers relevant to the mission of the NIMH. One of the current Center funding announcements (PAR-07-430; http://grants.nih.gov/grants/guide/pa-files/PAR-07-430.html) allows Center applicants to propose a summer undergraduate research training component that would provide an opportunity for students interested in interdisciplinary mental health-related research to participate in Center-supported research. The Workgroup recommends that the NIMH more fully utilize its Research Centers Programs for training and education experiences for trainees. Various activities could potentially be carried out at NIMH Research Centers: 1) supporting trainees and fellows from diverse backgrounds as part of research teams; 2) summer undergraduate or medical student research training; 3) expanding the breadth of existing institutional research training programs (e.g., training opportunities, retreats, symposia, technical workshops); 4) building partnerships with scientists at institutions with a high percentage of individuals from diverse groups so as to develop an additional pipeline for these individuals; and 5) summer workshops in state-of-the-art methods and technologies used at the Center to enhance their dissemination throughout the extramural research community.

E. Implement Efforts to Span Critical Transition Points in the Career Pipeline

The transition points between different stages of the research career continuum represent windows of vulnerability where promising trainees may be lost, or where continued research progress may be delayed by lack of a flexible funding vehicle that would enable expeditious transitions. To address this concern, the Workgroup recommended that NIMH develop flexible funding vehicles to span these vulnerable transition points and, when practical, to integrate them with an NIMH match-making system designed to facilitate communication between trainees and research training program directors. In addition, individuals supported by flexible funding programs should be strongly encouraged to participate in appropriate national mentoring networks. The following two recommendations target the undergraduate to predoctoral and predoctoral to postdoctoral transitions.

Recommendation E-1. Develop a match-making system

The Workgroup recommended that the NIMH develop and implement a formal match-making system to assist NIMH-supported trainees as they transition across the undergraduate-to-graduate and graduate-to-postdoctoral career stages. The idea is to assist the trainee in identifying a successful institutional training program (or NIMH-supported Center; see Recommendation D above) that provides a scientific and mentoring fit with the trainee's interests for the next stage of their training. Given the goal of increasing the diversity of NIMH's research workforce, the Workgroup further recommends that the NIMH first develop this match-making system for trainees from diverse backgrounds who are supported by any NIMH-supported research training program. Matches would be made between these individuals and NIMH-supported institutional training grants, including the Jointly Sponsored Predoctoral T32 Program in the Neurosciences. If successful, this effort could then be expanded to incorporate additional trainee populations and training programs so that more may benefit.

Recommendation E-2. Develop a diversity training merit program to increase options

In conjunction with Recommendation E-1, the Workgroup recommended that the NIMH develop a diversity training merit program for well qualified individuals from diverse groups so that they may be supported on an existing NIMH-funded institutional training grant, even when all the positions awarded to the T32 have been filled. The NIMH should also consider the advantages of expanding this recommendation to include short-term (e.g., summer) or year-off research training positions for medical students and residents who have a strong interest in a mental health-related research career.

Finally, given their enthusiasm for the potential value of flexible funding vehicles, the Workgroup encourages the NIMH to use its creativity to identify individual funding opportunities that could be modified to increase their flexibility and thereby expand the battery of options available to help promising individuals smoothly move from one career stage to the next. This may be another area where public-private partnerships (e.g., with philanthropies) may be feasible. The Workgroup noted the partnerships established between the National Institute on Aging and several philanthropies to support the Paul B. Beeson Career Development Awards in Aging (RFA-AG-09-012) and also between the National Center for Complementary and Alternative Medicine and the Bernard Osher Foundation (PAR-07-003) and encouraged the NIMH to consider such partnerships to advance its research training and career development efforts.

F. Retaining MD/PhDs in Mental Health-Related Research

MD/PhDs entering residency are uniquely trained and have already demonstrated a commitment to research. Arguably, this is the most important cohort of future investigators for NIMH. Despite this, the Workgroup learned that few of these students choose psychiatry (see Section III) and that some who enter psychiatric residency feel little support for a research career (see also Text Box 3).[9] The NIMH should make it a priority to

[9] As noted in Section I, it is expected that individuals who choose training in various clinical specialties (e.g., pediatrics and neurology) in addition to psychiatry may develop research careers related to the NIMH mission.

attract and retain MD/PhDs whose research interests align with the NIMH mission. Here the Workgroup focused its attention on the residency period, a time when many competing demands (e.g., work-life balance, updating research skill sets, and residency training requirements) can be particularly challenging for MD/PhDs who desire to continue their research during this period.

Recommendation F-1. Expand research training options during residency

The Workgroup recommended that the NIMH expand its current efforts to support research training opportunities during residency (see Section III.E.). A flexible administrative supplement program would support MD/PhDs to conduct research during their residencies. The goal of this program is to help MD/PhDs move more efficiently and effectively from their residency to the next stage of their research careers by supporting protected research time during the residency. MD/PhD residents would conduct mentored research with an established, NIMH-funded investigator. The supplement would provide salary commensurate with effort devoted to research as well as some research costs. To be successful, this program must operate on an expedited review and award cycle so that the MD/PhDs do not "age out" while waiting for a funding decision.

Recommendation F-2. Initiate a flexible postdoctoral fellowship program for research-track residents

Some Workgroup members thought that the NIMH should develop an individual postdoctoral award (F32) for research-track residents (MDs and MD/PhDs) who are in their final year of residency and who are able to devote 100% effort to research during this year. The notion is to provide up to three years of support for outstanding individuals committed to a research career as physician-scientists. Year 1 of the F32 would overlap with the last year of residency; years 2 and 3 would enable additional postdoctoral training either at the institution to which the award was initially made or at a new institution where the scholar has chosen to pursue continued postdoctoral training. In order for this initiative to be feasible, the initial award must undergo an expedited peer review and award process; the subsequent two years of funding would receive NIMH programmatic review prior to award.

Recommendation F-3. Develop a portable "Pioneer-like" award

The Workgroup recommended that the NIMH consider developing a portable "Pioneer-like" award[10] for outstanding individuals completing their MD/PhD degree who are interested in pursuing NIMH-related research. This early-career award would support the residency period as well as several years thereafter while the physician-scientist is establishing his/her independent research program. Such an award would provide early security and funds for dedicated research training during residency.

G. Implement Best Practices for Institutional Training

In addition to developing or enhancing research training programs, the Workgroup also recommended that the NIMH improve the way in which its university-based institutional training programs are internally reviewed, monitored, and administered. Although the following recommendations were made within the context of diversity research training, the Workgroup also viewed them as important to the NIMH T32 portfolio in general.

a. Establish and enforce clear expectations for T32 diversity recruitment and retention plans, efforts, and outcomes.
b. To increase the likelihood of interdisciplinary training, shift the management of training programs away from professional societies to academic institutions with structured research training environments and broad and deep research expertise.

[10] The NIH Director's Pioneer Award Program (http://nihroadmap.nih.gov/pioneer) supports individual scientists of exceptional creativity who propose innovative and possibly transforming approaches to major challenges in biomedical and behavioral research. Awardees receive $500,000 annually for five years and commit the majority of their effort to their Pioneer Award research.

c. Develop, and widely publicize, practices for how reviewers and NIMH program staff will assess required components of institutional training grant applications.
d. To enhance quality and continuity of review, the NIMH should consider establishing standing review panels for its university-based institutional training programs.

H. Program Assessment and Monitoring

The Workgroup expressed frustration with the limited data available on the Institute's research training and career development programs and their outcomes. Although the Workgroup acknowledged that current privacy policies/regulations limit the types of data that may be collected, the Workgroup strongly encouraged the NIMH to improve programmatic monitoring and assessment of the Institute's research training and career development portfolio.

The Workgroup further recommended that the NIMH make a comprehensive data collection effort concerning its research training and career development portfolio. Development of longitudinal data sets would allow for improved monitoring, assessment, and data-driven policy modifications. It was further recommended that prospective data collection and evaluation plans be required for any new programs initiated as a result of the Workgroup's recommendations.

Finally, the Workgroup recommended that a rigorous monitoring and evaluation system be implemented in a timely manner to gauge the impact of each new program implemented on its target population.

I. Strengthen Dissemination and Communication with the Extramural Research Community

The Workgroup recommended that the NIMH increase its efforts to enhance its dissemination and communication with the extramural research community. One step toward accomplishing this goal would be to develop and make broadly available a statement of best practices which could provide information related to NIMH research training and career development funding opportunities, Institute research priorities, scientific workshops and mentoring opportunities, etc. Enhanced dissemination would also facilitate awareness of NIMH-supported institutional research training programs and research education (R25) programs by individuals who seek research training and education related to the NIMH mission.

V. Summary

The NIMH has made substantial reductions in its training portfolio in the past five years. These cuts were initiated in an era of flattening budgets to balance the NIMH commitment to the pipeline with the Institute's need to protect the R01 payline. The Workgroup acknowledged the need for these financial decisions but encouraged the NIMH to look strategically at the management of its training portfolio. Specifically, the Workgroup suggested a focus on (a) who will be the future scientists making the breakthroughs for NIMH research, (b) how many trainees will be needed at each stage of the pipeline, and (c) what existing programs have been the most likely to yield NIMH-supported scientists. The Workgroup identified some specific opportunities for refocusing current funding and suggested some potential new investments. As examples of the former, the Workgroup discouraged continued support of professional societies for training interdisciplinary investigators, and the Workgroup encouraged the NIMH to shift its support of diversity training to more effective programs. Among the new investments, the Workgroup stressed the need for targeted support of MD/PhD students to increase the number of these talented young scientists who work on mental disorders. It should be noted that the focus on the above-mentioned cohorts is not intended to discount the critical role of appropriately trained PhD investigators in advancing the Institute's mission. Finally, the Workgroup stressed the importance of the NIMH pursuing an evidence-based approach to training by evaluating current and future programs for their impact on the overall NIMH mission.

VI. References

Abrams MT, Patchan KM, Boat TF (Eds). *Research Training in Psychiatry Residency: Strategies for Reform*. Washington, DC. The National Academies Press, 2003. (http://www.nap.edu/catalog/10823.htm)

Andrews NC. The other physician-scientist problem: Where have all the young girls gone? Nature Med 2002; 8(5):439-441.

Bradford WD, Anthony D, Chu CT, Pizzo SV. Career characteristics of graduates of a Medical Scientist Training Program, 1970-1990. Acad Med 1996; 71:484-487.

Carter CS, Barch DM, Buchanan RW, Bullmore E, Krystal JH, Cohen J, Geyer, M, Green M, Nuechterlein KH, Robbins T, Silverstein S, Smith EE, Strauss M, Wykes T, Heinssen R. Identifying cognitive mechanisms targeted for treatment development in schizophrenia: An overview of the first meeting of the cognitive neuroscience treatment research to improve cognition in schizophrenia initiative. Biol Psychiatry 2008; 64:4-10. doi: 10.1016/j.biopsych.2008.03.020

Chubin, DE. Modeling scientific workforce diversity. National Institute of General Medical Sciences. The big picture: Contexts for URM training. Presentation October 3, 2007. (http://public.nigms.nih.gov/mdsw/2007%20Workforce%20Diversity%20Chubin.pdf)

Fang D, Meyer RE. Effect of two Howard Hughes Medical Institute research training programs for medical students on the likelihood of pursuing research careers. Acad Med 2003; 78(12):1271-1280.

Hoffer TB, Welch V, Jr., Williams K, Lisek B, Hess M, Loew D, Guzman-Barron I. *Doctorate Recipients from United States Universities: Summary Report 2005*. Chicago: National Opinion Research Center, 2006. (This report gives the results of data collected in the Survey of Earned Doctorates, conducted for six federal agencies, NSF, NIH, USED, NEH, USDA, and NASA by NORC.) (http://www.norc.uchicago.edu/issues/docdata.htm)

Ley TJ, Rosenberg LE. The physician-scientist career pipeline in 2005. Build it, and they will come. JAMA 2005; 294(11):1343-1351.

Miller K. Successful collaborations: Helping biomedicine and computation play well together. Biomedical Computation Review 2008 Summer; 4(3):7-15. (http://biomedicalcomputationreview.org/4/3/5.pd)

Nash JM. Transdisciplinary training. Key components and prerequisites for success. Am J Prev Med 2008; 35(2Suppl): S133-S140.

National Advisory Mental Health Council Workgroup on Racial/Ethnic Diversity in Research Training and Health Disparities Research. *An Investment in America's Future: Racial/Ethnic Diversity in Mental Health Research Careers*. Washington, DC. 2001.

National Research Council. *Adviser, Teacher, Role Model, Friend*. Washington, DC. The National Academy Press, 1997.

National Research Council. *Advancing the Nation's Health Needs: NIH Research Training Programs*. Washington, DC. The National Academies Press, 2005a. (http://www.nap.edu/catalog/11275.htm)

National Research Council. *Bridges to Independence: Fostering the Independence of New Investigators in Biomedical Research*. Washington, DC. The National Academies Press, 2005b. (http://www.nap.edu/catalog/11249.html)

National Research Council. *Facilitating Interdisciplinary Research*. Washington, DC: The National Academies Press, 2005c. (http://www.nap.edu/catalog/11153.htm)

National Research Council. *Policy Implications of International Graduate Students and Postdoctoral Scholars in the United States*. Washington, DC. The National Academies Press, 2005d. (http://www.nap.edu/catalog/1289.html)

National Research Council. *Rising above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*. Washington, DC. The National Academies Press, 2007.

National Science Foundation, Division of Science Resources Statistics. *Women, Minorities, and Persons with Disabilities in Science and Engineering: 2007*, NSF 07-315. Arlington, VA. National Science Foundation, 2007. (http://www.nsf.gov/statistics/wmpd)

National Science Foundation, Division of Science Resources Statistics. *Graduate Students and Postdoctorates in Science and Engineering: Fall 2006*. NSF 08-306. Arlington, VA. National Science Foundation, 2008. (http://www.nsf.gov/statistics/nsf08306)

Pion GM. The early career progress of NRSA predoctoral trainees and fellows. U.S. Department of Health and Human Services, Bethesda, MD. NIH Publication Number 00-4900, 2001. (http://grants.nih.gov/training/career_progress/index.htm)

Solomon SS, Tom SC, Pichert J, Wasserman D, Powers AC. Impact of medical student research in the development of physician-scientists. J Investig Med 2003; 51(3):149-156.

Appendix 1. NAMHC Roster

DEPARTMENT OF HEALTH AND HUMAN SERVICES

NATIONAL INSTITUTES OF HEALTH
NATIONAL INSTITUTE OF MENTAL HEALTH
NATIONAL ADVISORY MENTAL HEALTH COUNCIL
(Terms end 9/30 of designated year)

CHAIRPERSON

Thomas R. Insel, MD
Director
National Institute of Mental Health
Bethesda, MD

EXECUTIVE SECRETARY

Jane A. Steinberg, PhD
Director
Division of Extramural Activities
National Institute of Mental Health
Bethesda, MD

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Community Mental Health Council and Foundation, Inc.
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Frank J. Bruno Professor of Social Work Research
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Medical Director
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Beaver, PA

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Secretary
Department of Health and Human Services
Washington, DC

National Institutes of Health
Elias A. Zerhouni, MD
Director
National Institutes of Health
Bethesda, MD

Veterans Affairs
Ira Katz, MD, PhD
Department of Veterans Affairs
Office of Mental Health Services
Washington DC

LIAISON REPRESENTATIVE

A. Kathryn Power, MEd
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Rockville, MD

Appendix 2: Workgroup Roster

2008 NAMHC WORKGROUP ON RESEARCH TRAINING

CHAIR

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VA San Diego Healthcare System (116A-1)
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MEMBERS

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Director, Neuroscience Program
Michigan State University
East Lansing, MI

* Denotes NAMHC Member

Appendix 3: NIMH Staff to the Workgroup

NIMH STAFF CONTRIBUTING TO THE WORKGROUP ON RESEARCH TRAINING

STAFF DIRECTORS

Nancy L Desmond, PhD
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Mark Chavez, PhD
Division of Adult Translational Research & Treatment Development

STAFF PARTICIPANTS

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David Zielinski, PhD
Office of Science Policy, Planning, and Communications

Appendix 4: Research Training and Career Development Programs

Institutional NRSA Training Programs

NIMH Career Opportunities in Research (COR) Honors Undergraduate Research Training Grant (T34) PAR-08-093

The goal of this NRSA program is to provide support for pre-baccalaureate research training to help ensure that a diverse and highly trained workforce is available to assume leadership roles related to the nation's biomedical, neuroscience, behavioral and clinical research agenda for mental health. The specific objectives are to 1) increase the number of well-prepared undergraduate students from diverse backgrounds who complete a research training program leading to a research doctorate (PhD, MD/PhD, or equivalent) in biomedical, neuroscience, behavioral and clinical sciences relevant to mental health research; and 2) develop and strengthen the undergraduate research training curricula with relevance to mental health.

Ruth L. Kirschstein National Research Service Award (NRSA) Institutional Research Training Grants (T32) PA-08-226

The purpose of the NRSA research training program is to help ensure that a diverse and highly trained workforce is available to assume leadership roles related to the nation's biomedical and behavioral research agenda. Training activities can be in basic biomedical or clinical sciences, in behavioral or social sciences, in health services research, or in any other discipline relevant to the NIMH mission. Predoctoral, postdoctoral, and combined pre- and postdoctoral programs are supported. See NOT-MH-05-001 for information about expectations for NIMH T32 programs.

Jointly Sponsored Ruth L. Kirschstein National Research Service Award Institutional Predoctoral Training Program in the Neurosciences (T32) PAR-08-101

NIMH supports this T32 program in collaboration with eight other Institutes at the NIH. The aim of this program is to encourage and support broad and fundamental, early-stage training in the neurosciences. The program supports the early years of graduate training, the first and second years, typically before full-time thesis research begins. This program encourages a curriculum that spans the breadth of neurosciences in terms of the level of analysis (genes to molecules to cells to integrated, functional systems), approaches (including translational research), and the neuroscience of disease and disorders. Training programs are expected to include, at minimum, core courses, laboratory rotations, and programmatic activities. See also http://grants.nih.gov/training/joint_predoc/jointpredoc.htm

All T32 trainees are expected to contribute full-time effort to their training program.

Institutional Research Education Programs

NIMH Research Education Grants (R25) PAR-08-079

The NIMH Research Education Grant is a flexible and specialized award designed to foster the development of mental health researchers through creative and innovative research educational programs that address one or more aspects of the Institute's mission (see http://www.nimh.nih.gov/about/compon.cfm) including basic, clinical, translational, and services research across the lifespan. A diverse array of programs, including those that are institutional, regional or national in

scope, may be appropriate. Formats for these programs may also vary, e.g., short courses, a series of seminars, workshops, structured short-term or long-term research experiences, or curriculum development, implementation, and evaluation. Applications must propose research education experiences at one or more of the following levels of professional career development: medical/graduate student, postdoctoral fellow, medical resident, and/or independent scientist.

Individual NRSA Fellowship Programs

Ruth L. Kirschstein National Research Service Awards for Individual Predoctoral MD/PhD Fellows (F30) PA-05-151

This funding opportunity supports individual predoctoral fellowships for students enrolled in a combined MD/PhD degree program with the expectation that these training opportunities will increase the number of future NIMH investigators in basic, translational and clinical research who are physician scientists.

Ruth L. Kirschstein National Research Service Awards for Individual Predoctoral Fellows (F31) PA-07-002

This program provides predoctoral training support for doctoral candidates who have successfully completed their comprehensive examinations or the equivalent by the time of award and will be performing dissertation research and training in an area relevant to the NIMH mission.

Ruth L. Kirschstein National Research Service Awards for Individual Predoctoral Fellowships (F31) to Promote Diversity in Health-Related Research PA-07-106

This initiative seeks to improve the diversity of the health-related research workforce by supporting the predoctoral training of individuals from underrepresented racial and ethnic groups, individuals with disabilities, and individuals from disadvantaged backgrounds. Eligible individuals may be supported if they are enrolled in a PhD or an MD/PhD degree-granting program.

Ruth L. Kirschstein National Research Service Awards (NRSA) for Individual Postdoctoral Fellows (F32) PA-07-107

This program provides support to promising postdoctoral individuals who have the potential to become productive and successful independent research investigators in research areas relevant to the mission of the NIMH.

Individual fellows must contribute full-time effort to their fellowship.

Individual Dissertation Support

Mental Health Dissertation Research Grant To Increase Diversity (R36) PAR-06-217

The primary objective is to increase the diversity of the mental health research workforce by stimulating and supporting the dissertation research of: students from racial and ethnic populations that are underrepresented in biomedical and behavioral science; students with disabilities; or students from socially, culturally, economically, or educationally disadvantaged backgrounds that have inhibited their ability to pursue a career in health-related research. Eligible students must have the objective of becoming successful investigators in areas of biomedical or behavioral science relevant to the mission of the NIMH.

Mentored Career Development Programs

NIH Pathway to Independence (PI) Award (K99/R00) PA-07-297

The primary goal of this initiative is to facilitate young investigators in transitioning to a stable independent research position with NIH or other independent research funding. Both U.S. and non-U.S. citizens are eligible to apply from U.S. institutions including the NIH intramural laboratories. The PI award will provide up to 5 years of support consisting of two phases. The initial mentored (K99) phase will provide support for up to 2 years for new investigators who have no more than 5 years

of postdoctoral research training experience at the time of initial application or subsequent resubmission(s). This mentored phase will allow the candidate time to obtain additional training, complete research, publish results, and bridge to an independent research position. Following the mentored phase, the individual may request up to 3 years of support to conduct research as an independent scientist at an extramural sponsoring institution to which the individual has been recruited, been offered, and has accepted a tenure-track, full-time assistant professor position (or equivalent). This (R00) support is to allow the individual to continue to work toward establishing his/her own independent research program and prepare an application for regular research grant support (R01). Support for the independent phase, however, is not automatic and is contingent upon being accepted by an appropriate extramural institution and the successful NIH programmatic review of the individual's mentored phase of the award. See also http://grants.nih.gov/grants/new_investigators/pathway_independence.htm.

Mentored Research Scientist Development Award (K01) PA-06-001

This award provides support for a sustained period of "protected time" for intensive research career development under the guidance of an experienced mentor in the biomedical, behavioral or clinical sciences leading to research independence. It is expected that this sustained period of research career development and training will enable awardees to launch funded, independent research careers. Eligible individuals may use the K01 program to obtain mentored training that would enable them to "re-tool" their research program.

Mentored Clinical Scientist Research Career Development Award (K08) PA-06-512

This program provides support and "protected time" to individuals with a clinical doctoral degree (e.g., MD/PhD, clinical PhD) for an intensive, supervised research career development experience in biomedical and behavioral research, including translational research.

Mentored Patient-Oriented Research Career Development Award (K23) PA-05-143

This program supports the career development of investigators who have made a commitment to focus their research endeavors on patient-oriented research. This mechanism provides support for supervised study and research for clinically trained professionals who have the potential to develop into productive clinical investigators focusing on patient-oriented research.

Mentored Quantitative Research Development Award (K25) PA-06-087

The K25 award provides support and "protected time" for a period of supervised study and research for productive professionals with quantitative (e.g., mathematics, statistics, economics, computer science, imaging science, informatics, physics, chemistry) and engineering backgrounds to integrate their expertise with NIH-relevant research. The program is intended for research-oriented investigators from the postdoctoral level to the level of senior faculty.

All mentored career development awards initially require a minimum of 75% effort. In some cases, effort may later be decreased to a minimum of 50%.

Non-Mentored Career Development Programs

Independent Scientist Award (K02) PA-06-527

The K02 is intended to foster the development of outstanding scientists and to enable them to expand their potential to make significant contributions to their field of research by providing "protected time." Early to mid-career faculty are eligible to apply for the K02 program at the NIMH if they have independent, peer-reviewed research support from the NIMH at the time of application. The K02 award supports a minimum of 75% (or 9.0 calendar months) of full-time professional ef-

fort conducting research and relevant career development activities during the award period.

Midcareer Investigator Award in Patient-Oriented Research (K24) PA-08-151

The purpose of the Midcareer Investigator Award in Patient-Oriented Research is to provide support for clinician investigators to allow them protected time to devote to patient-oriented research (POR) and to act as research mentors primarily for clinical residents, clinical fellows and/or junior clinical faculty. This award is generally intended for clinician investigators who are at the Associate Professor level or who are functioning at that rank in an academic setting or equivalent non-academic setting, and who have an established record of independent, peer-reviewed federal or private research grant funding in POR. This award is intended to advance both the research and the mentoring endeavors of outstanding patient-oriented investigators by supporting 25-50% effort by the PI.

NIH Extramural Loan Repayment Programs (LRP)

The Loan Repayment Programs were initiated to help attract health professionals to research careers. In exchange for a two-year commitment to their clinical research career, NIH will repay up to $35,000 per year of qualified educational debt, pay an additional 39% of the repayments to cover federal taxes, and may reimburse state taxes that result from these payments.

Clinical Research Loan Repayment Program

To participate in this program, applicants must conduct patient-oriented research for 50% or more of their total level of effort for an average of at least 20 hours per week during each quarterly service period. See http://www.lrp.nih.gov/nihlrp/about/lrp-clinical.htm

Pediatric Research Loan Repayment Program

To participate in this program, applicants must conduct qualified pediatric research which is defined as research directly related to diseases, disorders, and other conditions in children. See http://www.lrp.nih.gov/nihlrp/about/lrp-pediatric.htm. For application guidelines and procedures for these programs, see http://www.lrp.nih.gov/nihlrp/about/index.htm.

Research Grant Supplements

Research Supplements to Promote Diversity in Health-Related Research PA-08-190

Funds are available for administrative supplements to improve the diversity of the research workforce by supporting and recruiting students (high school through graduate level), postdoctorates, and eligible investigators from groups that have been shown to be underrepresented. These supplement awards must support research within the scope of the original project.

Supplements to Promote Reentry into Biomedical and Behavioral Research Careers PA-08-191

Administrative supplements are available to support individuals with high potential to reenter an active research career after taking time off to care for children or attend to other family responsibilities. This program provides administrative supplements to existing NIMH research grants to support full-time or part-time research by these individuals in a program geared to bring their existing research skills and knowledge up to date.

For NIMH-specific application guidelines and procedures for research grant supplements, see the NIMH web page for diversity and reentry research supplements.

Eligibility Criteria

Applicant Organizations

Applicant organizations for all funding opportunities described here must be non-profit organizations, public or private institutions, such as a university, college, hospital, or laboratory. For the NIMH COR (T34) program, applicant organizations must be 4-year public or private, non-profit colleges, univer-

sities, or heath professional schools with at least 50% racial/ethnic minority students. Foreign institutions are not eligible applicant organizations.

Citizenship Criteria for Individuals Supported on Funding Opportunities Described Here

Trainees must be citizens or non-citizen nationals of the United States, or must have been lawfully admitted to the United States for permanent residence. Individuals on temporary or student visas are not eligible for Kirschstein-NRSA support, Individual Dissertation Award support (R36), Research Grant Supplement Award support, or Career Development support (K01, K08, K23, K25, K02, K24). For the NIH Pathway to Independence Award (K99/R00), both U.S. and non-U.S. citizens are eligible to apply. Under certain circumstances, non-U.S. citizens may be supported on NIMH Research Education Grants (R25).

Institutional Research Education Programs (R25)

The R25 mechanism is not intended to support long-term training by NRSA-eligible individuals and may not be used to circumvent or supplement Ruth L. Kirschstein NRSA research training mechanisms. The NIMH does not allow support for full-time participants under the R25 mechanism, where a full-time participant is defined as an individual supported for 40 hours/week for a continuous 12-month period.


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