

Summary of Research Activities by Key Approach and Resource

Research Training and Career Development

For years the sense of smell had remained the most enigmatic of our senses. The basic principles for recognizing and remembering about 10,000 different odors were not understood. However, in 2004 Dr. Richard Axel and Dr. Linda Buck received the Nobel Prize in Physiology or Medicine for determining how the sense of smell or olfaction actually works. Their seminal discovery was that the mammalian genome contains a family of genes that make receptors for odorants. They also found that these receptors are located on olfactory receptor cells, which occupy a small area in the inner lining of the nose, where they bind odorant molecules and signal the brain that a smell has been detected. The NIH is particularly proud that Dr. Buck was awarded a Nobel Prize because, as she followed the long path to becoming a scientist, Dr. Buck was the recipient of a National Research Service Award fellowship, which supported her postdoctoral research training from 1980 to 1982, training that very likely contributed to solving the mystery of the sense of smell.

Introduction

Louis Pasteur wrote that “Chance favors the prepared mind.” NIH research training and career development programs aim to prepare new minds for research and ensure that diverse pools of highly trained scientists are available in adequate numbers and with appropriate expertise to generate new discoveries, meet the needs of rapidly moving science, and address complex and evolving health care challenges. These critical means of building and maintaining research capacity are long-term investments that bring competitive advantage to the Nation as well as dividends in the form of renewed generations of investigators with novel and bright ideas. Training is where cures begin. This investment in “intellectual capital” provides the source of ideas for investigator-initiated research projects, which historically have been the primary engine for generating scientific breakthroughs. Each generation of scientists paves the way for the discoveries of the next generation; thus, it is critical to ensure that there is a continually reconstituted pool of highly trained investigators in the pipeline pursuing new knowledge and better therapies. NIH’s research training and career development programs cover a broad range of basic biomedical, behavioral, and clinical research, including the interdisciplinary junctures among the fields.

By sponsoring training and career development programs in universities, teaching hospitals, NIH laboratories, and other research-intensive settings, NIH expects that trainees and newly trained investigators not only will be exposed to the latest research findings and techniques, but also will be prepared to rise to the challenge of emerging problems in medicine and health. To further ensure that the research workforce will be poised to respond to evolving public health needs, NIH takes steps to recruit future researchers from underserved and underrepresented populations; strengthen research capacity in developing countries from which health threats often originate; and encourage individuals to focus on targeted or underresearched areas (such as clinical and translational research, rare diseases, health disparities, and global health priorities).

Aligning the requisite expertise with public health needs is complicated by the evolving nature of biomedical, behavioral, and clinical research; the time required for research training; the international nature of research; and the global mobility of the research workforce. Preparing for a career in research generally requires a commitment of 8 to 12 years or more of predoctoral and postdoctoral training and career development, during which time science is advancing, new diseases are emerging, and existing diseases are becoming better understood, diagnosed, and prevented.

In determining how best to sustain the continuing need for biomedical and behavioral scientists, NIH is guided by regularly scheduled analyses of the research workforce. Chief among these assessments are recurring studies conducted by the National Academies, which provide guidance on the fields in which researchers are likely to be required and on the number of new investigators needed in the basic biomedical, behavioral, and clinical sciences. NIH also routinely evaluates the outcomes of its training programs, comparing the subsequent research involvement of students and postdoctoral scholars who participate in NIH research training with their counterparts who were trained through other channels. Beyond such agency-wide assessments, individual ICs determine the need for new scientific personnel in mission-specific research areas through targeted evaluations, input from extramural investigators, and guidance from their national advisory councils.

NIH offers a broad range of research training and career development opportunities in the extramural and intramural research communities, through institutional training awards and individual fellowships, individual and institutional career development awards, continuing education, workshops, research grants, and awards and supplements to promote diversity or reentry into health-related research careers. While its programs are largely directed toward graduate students and newly trained investigators, NIH offers a number of highly focused training and career development opportunities for individuals at other career stages, including college students and established scientists.

All NIH training and career development programs foster and encourage participation of a diverse population of subjects. NIH expects that efforts to diversify the scientific workforce will lead to the recruitment of the most talented researchers from all groups, improved quality of the educational and training environment, more balanced and broader perspectives in setting research priorities, enhanced ability to recruit subjects from diverse backgrounds into clinical research protocols, and improved capacity to address and eliminate health disparities. In addition to NIH's dedication to inclusion of minorities and other disadvantaged populations in the biomedical research workforce (see section on Minority Health and Health Disparities in Chapter 2), NIH also is committed to the recruitment, retention, reentry, and advancement of women in biomedical research careers. Perhaps the most visible recent NIH activity in this regard is the NIH Director's establishment of the [NIH Working Group on Women in Biomedical Careers](#). This Working Group is examining the issues raised and the challenges posed by [Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering](#), a 2007 report from the National Academies. The report itself was stimulated by NIH hearings and a workshop. Now, with the report in hand, NIH is carefully considering its recommendations to government agencies on maximizing the potential of women scientists and will develop innovative strategies to advance women's careers.

Summary of NIH Activities

Extramural Programs and Progress: Research Training

Trans-NIH Programs and Initiatives

Training for a career in research typically requires a combination of specialized coursework and hands-on research experiences under the guidance of an established investigator. A majority of NIH-supported research training activities are focused on predoctoral students and postdoctoral scholars and are provided through institutional training grants (T awards) or individual fellowships (F awards). The principal NIH research training program for U.S. citizens and permanent residents, in size and breadth of coverage, is the [Ruth L. Kirschstein National Research Service Award](#) (NRSA) program. The goal of the NRSA program is to support promising students and postdoctoral scholars with the potential to become productive, independent investigators in fields relevant to NIH's mission. 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 NIH mission. All ICs with funding authority award NRSA institutional research training grants and fellowships, except FIC and NLM. Reflecting the unique nature of their missions, the latter two ICs have distinct training authorities, separate from the NRSA program. NIH also supports a

substantial amount of research training indirectly through its research grants. Though not an NIH “program” per se, the impact of this support is significant. Graduate students and recent postdoctoral scholars participating as research assistants gain knowledge, skills, and experience that help prepare them for careers in research.

Through the NIH-wide program of NRSA institutional training grants and fellowships, NIH ICs supported nearly 16,600 graduate students and postdoctoral scholars at universities, teaching hospitals, and research centers in nearly every State in FY 2006. Institutional training grants form the core of NIH's research training programs, providing support to more than 80 percent of all NRSA program participants. Training grants play a particularly important role at the predoctoral level: approximately three-fifths of trainees are graduate students, often engaged in coursework and laboratory rotations in preparation for identifying an area of research for focused study. (See Appendix D for a breakdown on the demographics of NRSA participants and a summary of the number and type of doctoral degrees awarded to predoctoral NRSA recipients.)

Individuals interested in research training in universities or departments where there are no institutional training grants, as well as advanced students and postdoctoral scholars seeking tailored training opportunities, have the option of applying directly to NIH for an individual research training fellowship. Slightly more than one-half of the NRSA fellowships in FY 2006 were awarded to postdoctoral scholars, providing recipients valuable experience in initiating and testing their own research ideas before becoming full-fledged investigators¹⁶.

NRSA training grants and fellowships may target broad-based or field-specific research training, depending on the needs identified by the administering IC. In recent years, this flexibility has allowed the NRSA program to respond to interest in greater integration of training activities across NIH in order to fulfill workforce needs shared by multiple ICs. The result has been a series of trans-NIH research training initiatives through the [NIH Roadmap for Medical Research](#) and other channels.

At its inception in 2003, for example, the NIH Roadmap identified interdisciplinary and clinical research training as NIH-wide priorities and initiated new NRSA research training awards in these areas. The Roadmap Interdisciplinary Research Training Initiative, in particular, is designed to overcome disciplinary boundaries and broaden the knowledge base of future investigators so they might bring new insights and analytical approaches to health problems.

As the early Roadmap research training initiatives have matured, some have been selected for continuation and further expansion. One such former Roadmap initiative—a trans-NIH NRSA institutional research training grant in clinical and translational research—has now been incorporated as an option in every [Clinical and Translational Science Award](#) (CTSA). The CTSA program is an ambitious effort to spur the transformation of clinical and translational research in order to accelerate the development of new treatments. Creating multidisciplinary research teams that include physicians, basic scientists, statisticians, specially trained research nurses, informatics experts, and others is central to this transformation. The CTSA program will grow through 2012 to serve about 60 academic sites, providing research training and career development opportunities in areas such as clinical research design, epidemiology, biostatistics, pharmacology, biomedical informatics, behavioral science, and ethics to more than 1,200 NRSA trainees and new investigators. (CTSA trainees are included in the data provided in Appendix D.)

Efforts to coordinate research training in neuroscience preceded the NIH Roadmap by several years and provided an early model for addressing research training challenges across NIH. In 1997, a number of ICs announced that [the Jointly Sponsored Predoctoral Training Program in the Neurosciences](#) would support NRSA institutional training grants to provide broad neuroscience training for graduate students in the first and second years of study. This program has since become affiliated with the [NIH Blueprint for Neuroscience Research](#), a framework that brings together the 16 NIH Institutes, Centers, and Offices that support neuroscience research and training, and provides a channel for coordinating their efforts. Other more recent Neuroscience Blueprint research training activities

¹⁶ For more information, see

http://report.nih.gov/NIH_Investment/PPT_sectionwise/NIH_Extramural_Data_Book/NEDB%20TRAINING_FELLOWSHIP.ppt

include initiatives to provide training in translational research relevant to neurobiology of disease, neuroimaging, computational neuroscience, and neurodegeneration. Many programs funded through these new initiatives will include special features to foster collaborative interdisciplinary relationships, such as cross-training basic and clinical researchers and providing dual mentors to every trainee, each with a different area of expertise.

To help ensure the diversity of the research workforce, NRSA training grants and fellowships include features designed to provide research training opportunities to individuals from populations and backgrounds typically underrepresented in research (see also the section on *Minority Health and Health Disparities* in Chapter 2). Consistent with Section 487(a)(4) of the PHS Act, NRSA policy requires institutional training grant directors to take steps to recruit and retain trainees from disadvantaged backgrounds (including racial and ethnic minorities). Through the [Ruth L. Kirschstein NRSA Individual Predoctoral Fellowship \(F31\) to Promote Diversity in Health-Related Research](#), NIH supports biomedical and behavioral research training designed to result in the recruitment of individual graduate students from these backgrounds.

Part of the inherent challenge of recruiting talented individuals into graduate programs is to have a pool of competitive undergraduates from which to draw. [The Minority Access to Research Careers \(MARC\) Undergraduate Student Training in Academic Research, Institutional NRSA Research Training Grant \(T34\)](#) is intended to support undergraduate research training 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. These are honors students majoring in the sciences who have an express interest in a biomedical research career and who intend to pursue postgraduate education leading to the Ph.D., M.D.-Ph.D., or other combined degree. To help program directors recruit suitable students for doctoral programs, the Community for Advanced Graduate Training was launched in 2007 to connect MARC undergraduate students with predoctoral research training grant programs. The MARC program is an institutional program and does not use race/ethnicity as a criterion for individuals supported by the program.

The relative diversity of NRSA participants reflects NIH's commitment to cultivating a broad-based scientific workforce. Among FY 2006 trainees and fellows who reported their race and ethnicity, 67 percent were White, 14.8 percent were Asian, 9.1 percent were African American, 6.5 percent were Hispanic, 1.1 percent were Native American, and 0.06 percent were Native Hawaiian or Pacific Islanders. Nearly 52 percent of NRSA trainees and fellows in FY 2006 were women¹⁷.

IC Programs and Initiatives

Because each NIH IC has its own specific research agenda, individual ICs are responsible for specifying the need for scientists in their respective scientific fields, selecting individuals and institutions for NRSA or other research training awards to meet the needs identified, and reviewing annual progress toward building or enhancing capacity in the research workforce. Areas targeted for research training initiatives reflect the full array of IC funding interests, from basic research training in biology, biostatistics, dentistry, epidemiology, and population, to topics at the intersection of two or more fields. As an example, NIGMS promotes interdisciplinary, collaborative, and innovative research through 11 different predoctoral training areas of interest to the Institute. In July 2007, it funded the first two awards of a new institutional NRSA training grant program focused on [Predoctoral Training at the Interface of the Behavioral and Biomedical Sciences](#). Several ICs support combined M.D./Ph.D. training, including NIGMS, which funds the [Medical Scientist Training Program](#). This program supports exceptional students pursuing an integrated program of graduate training in the biomedical sciences and clinical training offered through medical schools.

Other current IC initiatives include research training programs in the areas of chemical biology of cancer; infectious diseases; complementary and alternative medicine; chemistry related to drug abuse and addiction; genomic analysis; human genes and the environment; reproductive, perinatal, and pediatric epidemiology; medical informatics; and interdisciplinary research; as well as fellowship opportunities in complementary and alternative

¹⁷ For more information, see http://grants.nih.gov/grants/policy/sex_gender/q_a.htm#q13

medicine, nursing, orthopedic surgery, muscle disease, and embryonic stem cell research.

While focusing on and supporting activities that address their respective missions and disease areas, ICs follow NIH-wide guidelines for NRSA research training and frequently collaborate to sponsor specific initiatives where there are overlapping interests or to stimulate interest in emerging fields. For example, in January 2007, NIEHS and NHGRI jointly sponsored a new [Human Genes and the Environment Training Program](#) that seeks to build on the established foundations in exposure biology and high-throughput genomics, to produce a new generation of scientists who are equally at home in genomics and environmental health sciences and can seamlessly interact with investigators from both fields. This new cadre of scientists not only will be equipped to advance methodologies and technologies in environmental genomics/genetics, but also will be able to use these tools and resources to disentangle and evaluate the enormous number of environmental factors that directly influence or interact with genetic factors to cause disease.

[NLM institutional training grants and fellowships](#) generally parallel the structure and requirements of the NRSA program and reflect NLM's unique role as the primary federal sponsor of biomedical informatics research and training. Like the ICs that provide NRSA research training, NLM prepares the next generation of informatics researchers and health information specialists through both institutional grants (T15s) and fellowships (F37s). The institutional programs support graduate and postdoctoral training in a broad range of topics, including health care information, bioinformatics, systems biology, imaging informatics, and public health informatics. NLM's individual fellowship programs provide opportunities for librarians, scientists, health professionals, and others interested in serving as information-specialist members of professional teams, whether in clinical or basic biomedical research or related health fields. Unlike NRSA research training awards, some NLM training programs are open to master's degree holders seeking further graduate level coursework and hands-on training.

Reflecting the FIC mission to build research capacity in the developing world, FIC institutional training grants (D43s) differ from those offered by the NRSA program or by NLM by allowing a broader range of participants and emphasizing the development of institutional partnerships and collaborations between U.S. and international universities and scientists. Most FIC programs focus on providing research training to individuals from developing nations, but a number of selected programs provide opportunities to U.S. students and postdoctoral scholars interested in international health research. FIC training programs are contributing to the building of sustainable research capacity in the developing world to enhance prevention, treatment, and control of infectious diseases, including HIV/AIDS, TB, and malaria, which are major causes of morbidity and mortality in those regions. Other FIC programs target research training in the areas of clinical, operational, and health services research; noncommunicable diseases; population studies and reproductive biology; environmental and occupational health; trauma and injury; and informatics training for global health. In order to foster long-term scientific partnerships between U.S. and foreign investigators, most FIC training grants require a joint collaboration between an American and a foreign institution.

Strength From Partnerships

Research training involves collaboration between NIH and its grantee institutions in the form of shared responsibilities and funding. In making NRSA training grant awards, for example, NIH relies on universities and other sites that receive support to select the best trainees, determine the curriculum and other aspects of the training program, and provide mentorship and supplemental funding to participating students and postdoctoral trainees. Although NRSA fellowships are targeted to individual students or postdoctoral scholars, NIH expects the sponsoring institutions to provide fellows with experienced mentors and supplemental research funding support. In some targeted NRSA research training programs, NIH also partners with other agencies, private foundations, and professional societies to achieve shared research training goals.

Partnerships between NIH and the private sector are helping to accelerate research training in creative ways. In 2006, for example, NIH announced public-private partnerships with the American Skin Association and the Orthopaedic Research and Education Foundation to increase the number of dermatologists and orthopedic surgeons with research training in epidemiology, clinical trials, and outcomes research. The ultimate goal of these two research training initiatives is to enhance the workforce of trained investigators who can design and carry out

studies on the prevalence of skin diseases and bone conditions and hasten progress in their treatment by evaluating the effectiveness of therapeutic interventions. The fellowships resulting from this public-private partnership support up to 2 years of advanced training and provide approximately \$30,000 in additional funds annually to supplement stipends or other research training expenses for each fellow.

NIH Training Program Evaluations and Assessments

Since the NRSA program was established in 1974, NIH training programs have been regularly reviewed and evaluated. The National Academies have undertaken regular reviews of the medical research workforce and made recommendations for modifications in the size and focus of the NRSA program. In addition, the NRSA program has undergone multiple independent outcome evaluations, has assessed its processes and outcomes against several Government Performance and Results Act (GPRA) goals, and recently completed a Program Assessment Rating Tool review by the White House Office of Management and Budget (OMB) with flying colors. These reviews have been coordinated by the NIH Office of Extramural Research (OER), which oversees the NRSA program. Increasingly, however, individual ICs also are undertaking evaluations of their specific NRSA and other research training programs.

National Academies Reviews. Over the past 30 years, the NRSA program has been the subject of more than a dozen studies by NAS, which have provided expert guidance on the fields in which researchers are likely to be required and on the number of new investigators needed in the basic biomedical, behavioral, and clinical sciences. The recurring nature of these studies ensures that NIH research training programs reflect changes in science and research needs that inevitably occur over time. In the early 1980s, for example, NIH reduced the size of the NRSA training program after committees of the National Academies concluded that the number of new scientists entering the research workforce exceeded the number of permanent research positions available. More recently, NIH has followed recommendations from National Academies committees for enhancing stipend levels, promoting the early completion of research training, and improving workforce data collection and analysis.

Members of the committee producing the most recent report from the National Academies, published in 2005, commended the NRSA program, noting “quality is an essential ingredient for progress. In this regard, the NRSA Program plays a unique role... [setting] the standards for the entire research training establishment. In addition, they attract high-quality students into research and into fields of particular need. The record of success of NRSA holders in obtaining research funding is impressive.”¹⁸

Independent Outcome Evaluations of NRSA Training. Evaluations of the outcomes of NRSA research training routinely have found that graduate students participating in NRSA programs complete their degrees faster, are more likely to pursue research careers, and have greater subsequent success in research than do students not participating in NRSA programs^{19, 20}. Similarly, a 2006 evaluation of NRSA postdoctoral training found that NRSA postdoctoral fellows were more likely to successfully pursue research careers. Over 32 percent of former NRSA postdoctoral fellows applied for and successfully received NIH research funding within 10 years of completing their training, compared to about 20 percent of other postdoctoral fellows²¹.

Government Performance and Results Act (GPRA) Goals. Every year, NIH assesses NRSA research training outcomes and program management against two goals established under GPRA. In the first of these goals, NIH seeks to measure the quality of its programs and ensure that substantial numbers of trainees and fellows are retained in research careers, by comparing the proportion of former NRSA trainees and fellows that apply for and

¹⁸ For more information, see http://www.nap.edu/catalog.php?record_id=11275#toc

¹⁹ For more information, see http://grants.nih.gov/training/career_progress/index.htm

²⁰ For more information, see http://www.nsf.gov/statistics/showsrvy.cfm?srvy_CatID=3&srvy_Seri=5

²¹ For more information, see http://grants1.nih.gov/training/NRSA_report_5_16_06-2.doc

successfully receive NIH support against their peers. Subsequent NIH support reflects the impact of NRSA research training on the ability of trainees and fellows to successfully pursue and sustain a research career.

The second training-related GPRA goal measures NIH progress in improving the efficiency of NRSA program management by developing and implementing an electronic system for appointing trainees to institutional training grants. By 2012, NIH expects the new system to be fully implemented and that 100 percent of trainees will be appointed to training grants electronically rather than through paper appointment forms. The new system, known as xTrain, will be pilot-tested by nine institutions beginning in fall 2007. When available for general use, xTrain is expected to save substantial staff time and eliminate data entry errors, increasing NIH's efficiency and enhancing the integrity of NRSA data used for program monitoring and evaluation purposes²².

Program Assessment Rating Tool Review. In 2006, NIH training and career development programs underwent a Program Assessment Rating Tool review and received the highest rating possible from OMB examiners. OMB judged the NIH Research Training and Career Development programs as “effective” in training and retaining researchers in the biomedical research field, recognized the programs for having successfully met ambitious long-term and annual goals, and praised NIH for its long tradition of independent evaluation.

Institute and Center Training Evaluations. In addition to scheduled NIH-wide assessments of the programs coordinated through OER, individual NIH ICs undertake periodic, targeted evaluations to improve implementation and assess outcomes of their own training programs. Institute-specific evaluations typically focus on research training needs in particular areas and are often conducted by independent “blue ribbon” panels of scientific leaders from around the country. For example, NCCAM convened an independent expert panel to evaluate its programs in light of the unique training needs of complementary and alternative medicine research²³. Other ongoing IC assessments include evaluations of how effectively CTSA training grants foster pediatric and other clinical researchers and of the outcomes of the NIAMS research training (T32 and F32) programs.

Extramural Programs and Progress: Career Development

Given the pace at which science advances, novel techniques and methods are introduced, and new fields emerge, maintaining a vibrant workforce requires support for scientific talent to fully develop and stay up to date. NIH [Career Development Awards](#) (K awards) address that need²⁴. Collectively, more than a dozen types of K awards support investigators as they establish their research careers, pursue new directions, or dedicate themselves to training and mentoring the next generation of scientists. Like the T and F training awards, some career development awards support institutional activities to nurture careers and others directly support individual development.

Many career development awards are designed for researchers at specific career stages, particularly newly trained investigators. The new NIH-wide [Pathway to Independence Award](#) accelerates the transition from mentored to independent research by providing a bridging mechanism. The initial 1- to 2-year mentored phase of the award allows investigators to complete their supervised research work, publish results, and search for an independent research position. The second, independent phase, allows awardees to establish their own research program and apply for independent research support. In addition, many ICs offer their own Career Transition Award to support new investigators as they make the move to faculty positions. Other “mentored” career development awards provide support for a sustained period of protected time for intensive research career development under the guidance of an experienced mentor, or sponsor. The expectation is that, with this experience, awardees will be able to take the final steps toward establishing independent research careers and becoming competitive for new

²² NIH FY 2008 Performance Detail, pp. 275-76.

²³ For more information, see <http://nccam.nih.gov/training/report.htm>

²⁴ For more information, see <http://grants.nih.gov/training/careerdevelopmentawards.htm>

research project grant funding. For example, ORWH supports the [Building Interdisciplinary Research Careers in Women's Health](#) program, which pairs junior faculty with senior investigators in an interdisciplinary environment. At the other end of the career spectrum, a number of ICs provide Senior Scientist Research and Mentorship Awards. These awards provide salary support for outstanding senior scientists and recognized leaders so that, through an interval of protected time, they can focus intensively on their research and mentor new investigators.

Several career development awards foster the involvement of clinicians in research. The Mentored Clinical Scientist Research Career Development Award continues a long-standing NIH commitment to provide support and protected time to individuals with a clinical doctoral degree so that they can engage in an intensive, supervised research career development experience. The award supports both didactic study and mentored research for individuals with a wide variety of clinical degrees, including the M.D., D.D.S., D.V.M., and Pharm.D. A sister program, the Mentored Patient-Oriented Research Career Development Award, supports the career development of clinically trained professionals who have the potential to develop into productive, clinical investigators focusing on patient-oriented research.

Other career development programs target specific areas of science. Examples here include the [Career Enhancement Award for Stem Cell Research](#), which enables investigators to acquire new research capabilities in the use of human or animal embryonic, adult, or cord blood stem cells, and the Mentored Quantitative Research Career Development Award, which encourages investigators from quantitative science and engineering fields to focus on questions of health and disease.

Coordination and Oversight by the NIH Office of Extramural Research

Much as NIH collaborates with grantee institutions in conducting research training, OER partners with ICs to coordinate and monitor awards for research training and career development across NIH. With active input from the ICs, OER establishes and implements policies and guidelines for each of the programs; determines broad national needs for basic biomedical, behavioral, and clinical research personnel; coordinates NIH-wide evaluations; develops trans-NIH research initiatives in which NIH ICs participate; and develops and maintains information systems to enhance program efficiencies. OER convenes monthly meetings of the NIH Training Advisory Committee to provide an agency-wide forum to identify and discuss issues related to research training and to provide opportunities to coordinate activities pertinent to the review, administration, management, and evaluation of training grants and fellowships.

Intramural Activities

The NIH intramural program provides opportunities for students, postdoctoral scholars, and clinicians to gain research experience within the more than 1,140 intramural laboratories of NIH²⁵. A multifaceted array of programs provides a vibrant, scholarly environment and ensures strong research training experiences for future investigators and the continued professional development of intramural scientists.

Summer internships are available for high school, college, and graduate students. Recent college graduates who plan to apply to graduate or professional school can spend a year engaged in biomedical research working side by side with NIH scientists. Current graduate students can spend a summer, or even a year, as fellows engaged in biomedical research at NIH. The [Graduate Partnerships Program](#) (GPP) enables students to pursue research at NIH toward their degrees in partnership with a participating academic institution. By linking academic environments with the breadth and depth of research at NIH, the GPP creates a valuable graduate experience, one that purposefully focuses on skills of the future scientist and how discoveries will be made in the decades ahead. The [Clinical Research Training Program](#) (CRTP) is a yearlong program designed to attract the most creative, research-oriented medical and dental students to the NIH campus. CRTP fellows spend a year engaged in a mentored clinical or translational research project, in an area that matches their personal interests and goals.

²⁵For more information, see <http://www.training.nih.gov/>

Training opportunities continue when scholars gain their graduate degrees. Year-round, NIH intramural laboratories employ fellows from the United States and abroad, creating a thriving, multidisciplinary intramural research community. The [Postdoctoral Intramural Research Training Award](#) provides the opportunity for recent doctoral degree recipients, who are U.S. citizens or permanent residents, to enhance their research skills in the NIH intramural environment. Trainees pursue both basic and clinical research. A parallel program, Visiting Fellowships, serves foreign national doctoral-level scientists. For clinicians, there are opportunities for residency and subspecialty training, including graduate medical education-accredited programs (for program completion data, see Appendix D). A wide array of accredited joint, NIH, and other sponsored programs are available. These GME programs enable research-oriented clinicians to weave research experience and training into their post-medical school training.

The intramural program also offers numerous targeted training programs and fellowships as varied as the [Imaging Sciences Training Program](#), the NIH Dietetic Internship, and the Social Work Field Instruction Program. Many specialized programs address the need for a diverse research workforce, including the [Women's Health Postdoctoral Fellowship](#). (Also see the *Minority Health and Health Disparities* section of Chapter 2).

All members of the NIH community benefit from access to a plethora of NIH courses, seminars, and science career resources. For example, every day across the NIH campus there are scientific seminars and frequent colloquia addressing the latest developments and discoveries in biomedical science; meetings of more than 100 Scientific Interest Groups that host forums and lecture series on cutting-edge issues of interest ranging from the Bioethics Interest Group to the Integrative Neural Immune Interest Group; and short- and long-term course offerings such as “*Introduction to the Principles and Practice of Clinical Research*” and “*Principles of Clinical Pharmacology*.”

NIH Loan Repayment Programs

The NIH Loan Repayment Programs (LRP) are a vital component of our Nation's efforts to attract eligible doctoral-level professionals to research careers in fields of special importance—clinical, pediatric, health disparities, contraception and infertility, and AIDS research. To encourage qualified scientists to pursue research in these critical areas, the LRP provides financial assistance for educational debt in exchange for a 2- or 3-year research commitment. Program participants may receive up to \$35,000 annually in loan repayment and can fulfill their commitments by conducting research in the specified fields in any nonprofit, university, or government organization, or as an NIH employee. The LRP serves the extramural and intramural communities by awarding LRP benefits to more than 1,600 research scientists annually²⁶. Each program is competitive and serves to recruit talented biomedical scientists and physicians to research careers addressing important public health needs.

Conclusion

The initiatives and program reviews highlighted in the next section all point to the considerable progress made by NIH in meeting the long-term goal of building and maintaining research capacity to help ensure that highly trained scientists are available to address biomedical, behavioral, and clinical research needs, with the ultimate goal of uncovering new knowledge that will lead to better health for all Americans.

Notable Examples of NIH Activity

Key for Bulleted Items:

E = Supported through Extramural research

²⁶ <http://www.lrp.nih.gov/brochure.pdf>

I = Supported through Intramural research
O = Other (e.g., policy, planning, and communication)
COE = Supported through a congressionally mandated Center of Excellence program
GPRA Goal = Concerns tracked under the Government Performance and Results Act

Trans-NIH Initiatives and Major Programs

Ruth L. Kirschstein National Research Service Award (NRSA) Institutional Research Training Grants (T32): The objective of the NRSA program is to support graduate and postdoctoral research training to help ensure that a diverse and highly trained workforce is available to carry out and lead the Nation's biomedical, behavioral, and clinical research agenda. This program supports predoctoral and postdoctoral research training programs at domestic institutions of higher education. The NRSA program has been the primary means of supporting graduate and postdoctoral research training programs since enactment of the NRSA legislation in 1974. Training activities can be in basic biomedical or clinical sciences, in behavioral and social sciences, in health services research, or in any other discipline relevant to the NIH mission. Institutional research training grants allow universities, research institutes, and teaching hospitals to select specific trainees and develop a curriculum of study and research experiences tailored to provide high-quality research training. The training grant award provides stipends and offsets the cost of tuition for appointed trainees.

- For more information, see <http://grants.nih.gov/grants/guide/pa-files/PA-06-468.html>
- For more information, see <http://grants.nih.gov/training/nrsa.htm>
- (E) (OD/OER)

Interdisciplinary Research Training Programs: The NIH Roadmap Interdisciplinary Research Teams of the Future program addresses the challenges of developing, sustaining, and administering interdisciplinary research and team science. Interdisciplinary research is the melding of multiple disciplines to arrive at new experimental approaches, and it requires the participants to be educated in more than one discipline. Although this is often accomplished through teams of investigators learning from each other via collaborations, formal training in multiple disciplines can allow individual investigators to develop interdisciplinary approaches. The NIH Roadmap Interdisciplinary Training Program consists of four initiatives that were intended to provide this type of formal training to investigators at all levels of their careers.

- *Training for a New Interdisciplinary Research Workforce.* These institutional training grants aim to catalyze the production of a scientific workforce capable of integrative research crossing traditional disciplinary boundaries. Awardees develop and implement novel training programs focused on interdisciplinary science.
 - *Interdisciplinary Health Research Training—Behavior, Environment, and Biology.* Institutional Training Grants provide doctoral-level trainees with additional postdoctoral training in a new discipline. Trainees must either have been trained in the social and behavioral sciences or be seeking training in these areas. The intent is to encourage interdisciplinary approaches to complex health problems involving behavioral and social factors.
 - *Short Programs for Interdisciplinary Research Training.* These programs range from 2 to 8 weeks in duration and are intended to provide an opportunity for investigators at all career stages to receive basic instruction in a new discipline.
 - *Curriculum Development Award in Interdisciplinary Research.* These awards provide funds to develop creative curricula for interdisciplinary training. Once developed, these curricula are intended to be broadly available for use in multiple settings.
- For more information, see <http://nihroadmap.nih.gov/interdisciplinary/fundedresearch.asp>
 - (E) (Roadmap—all ICs participate)

Training Activities of the Clinical and Translational Science Award Program: Comparing new disease treatments

and prevention strategies against those in current use requires dedicated clinical and translational research teams that include physicians, basic scientists, and statisticians and informatics experts, among others. Clinical research requires unique skills in addition to those needed to care for patients, so academic health centers must equip promising individuals with the special training they need to succeed in research careers. To address this need, NIH has expanded its clinical research training programs, first through the Roadmap T32 and K12 programs and, more recently, through Clinical and Translational Science Awards (CTSAs). Each program is based on placing the trainees in a mentored environment, where they learn the skills needed to cultivate multidisciplinary research team collaborations and design research projects to successfully compete for funding. The CTSA program will grow through 2012 to serve about 60 academic sites, providing research training and career development opportunities to a combined total of more than 1,200 trainees and new investigators covering multiple individual disciplines.

As mandated in Section 106 of the National Institutes of Health Reform Act (Pub. L. No. 109-482), NIH will conduct an evaluation and comparison of the outcomes and effectiveness of the CTSA training programs. This evaluation will be part of a much larger comprehensive evaluation of the CTSA program as a whole. Each individual CTSA is expected to include its training activities in its own evaluation. To coordinate and share information, including results of training activity evaluations, there is a CTSA Education/Career Development Steering Committee which provides a forum for the advancement of integrated and interdisciplinary education, training, and career development in the clinical and translational sciences and serves as a clearinghouse for clinical research training. Since the CTSA program was only recently initiated (September 2006), significant evidence of the long-term impact of the CTSA program is more likely to be measurable after 7 or more years. However, short-term process milestones and intermediate outcomes are expected in 1 to 7 years.

- For more information, see nihroadmap.nih.gov/clinicalresearch/overview-training.asp
- For more information, see <http://www.ctsaweb.org/>
- This example also appears in Chapter 3: *Clinical and Translational Research*.
- (E) (Roadmap—all ICs participate)

The NIH Blueprint for Neuroscience Research: The Blueprint is a collaborative framework that brings together 16 NIH Institutes, Centers (IC), and Offices that support neuroscience research. The Blueprint catalyzes research progress by developing tools, resources, and training opportunities that transcend the mission of any single NIH IC and serve the entire neuroscience community. In FY 2006, the Blueprint launched initiatives to develop new neuroimaging technologies; a clearinghouse to distribute and improve existing neuroimaging software; core resource centers; a neurological and behavioral assessment tool; and new genetically modified mouse models. The Blueprint also supported training programs in neuroimaging, computational neuroscience, and translational research. In FY 2007, the Blueprint released funding announcements to identify biomarkers for neurodegeneration, develop new ways to deliver therapeutics to the nervous system, and provide interdisciplinary training in neurodegeneration research.

- For more information, see <http://www.neuroscienceblueprint.nih.gov/>
- This example also appears in Chapter 2: *Neuroscience and Disorders of the Nervous System*.
- (E) (NINDS, NCCAM, NCR, NEI, NIA, NIAAA, NIBIB, NICHD, NIDA, NIDCD, NIDCR, NIEHS, NIGMS, NIMH, NINR, OBSSR)

HIV Research Training Programs: The AIDS International Training and Research Program (AITRP) builds institutional, national, and regional HIV research capacity in low- and middle-income countries. Over the past 19 years, this program has been responsible for many of the first generation of research scientists from these countries, with many more in the pipeline. The program offers multidisciplinary biomedical, behavioral, and social science research training to a wide range of professionals. Building on the AITRP, the Clinical, Operational and Health Services Research Training Program for HIV/AIDS and TB (ICOHRTA AIDS/TB) began in 2002 to strengthen the capacity for clinical, operational, and health services research in low- and middle-income countries where AIDS, TB, or both are significant problems. Through training health professionals that reach across the spectrum of clinical and public health research, this program is strengthening the capacity of scientists, program managers, and policymakers to evaluate and better implement large-scale prevention, treatment, and care interventions that are

locally relevant and effective. Many local leaders of programs supported by the President's Emergency Plan for AIDS Relief have received or are receiving their research training through the AITRP and the ICOHRTA AIDS/TB programs.

- For more information, see http://www.fic.nih.gov/programs/training_grants/aitrp/index.htm
- For more information, see http://www.fic.nih.gov/programs/training_grants/icohrta/aids_tb.htm
- This example also appears in Chapter 3: *Clinical and Translational Research* and Chapter 2: *Infectious Diseases and Biodefense*.
- (E) (FIC, NCI, NHLBI, NIDA, NIDCR, NIMH, NINDS, NINR, OAR, ORWH)

Research Career Development Programs: One of the most challenging transitions in any research career is the transition from postdoctoral trainee to independent scientist. NIH has long used the [Research Scientist Development Award \(K01\)](#) to support the successful transition of individuals who hold a research or health-professional doctoral degree or equivalent, as well as newly independent investigators and midcareer investigators who need protected time to make a shift in their research careers or enhance their ability to conduct scientifically sophisticated studies in their chosen fields. Junior-level clinically-trained individuals are encouraged to apply for the [Mentored Clinical Scientist Development Award \(K08\)](#), or the [Mentored Patient-Oriented Research Career Development Award \(K23\)](#), as appropriate, to realize their potential to develop into productive clinical investigators. Transition awards such as the Career Transition Award (K22) and the [Pathway to Independence Program \(K99/R00\)](#) provide mentoring, protected time, and financial support to postdoctoral fellows seeking to transition to faculty positions. Many specific career development awards are tailored to meet the needs of different research areas and recipients at different career levels.

- For more information, see <http://grants.nih.gov/training/careerdevelopmentawards.htm>
- For more information, see <http://grants.nih.gov/grants/guide/pa-files/PA-06-001.html> (K01)
- For more information, see <http://grants.nih.gov/grants/guide/pa-files/PA-06-512.html> (K08)
- For more information, see <http://grants.nih.gov/grants/guide/pa-files/PA-05-143.html> (K23)
- For more information, see <http://grants.nih.gov/grants/guide/pa-files/PA-06-133.html> (K99/R00)
- (E) (OD/OER)

NIH Basic and Clinical Intramural Research Training: Candidates selected for NIH intramural research training and career development programs may be funded by any one of a number of mechanisms depending on availability of funding, the type of research to be conducted, the center or laboratory sponsoring the research, and qualifications of the candidate. These mechanisms include the NIH [Postdoctoral Intramural Research Training Award \(IRTA\)](#), which enables recent doctoral degree recipients to enhance their research skills by pursuing basic or clinical research at NIH, and the [Clinical Research Training Program \(CRTTP\)](#), which enables research-oriented medical and dental students to engage in mentored clinical or translational research projects, again, in NIH laboratories.

- For more information, see <http://www.training.nih.gov/postdoctoral/pdopps.asp>
- (I) (OIR)

LRP Outreach Campaign: The NIH's Loan Repayment Program (LRP) "Strength in Numbers" campaign debuted September 6, 2007. This campaign offers a renewed commitment to qualified postdoctoral scientists who are seeking careers in biomedical and behavioral research. The program funds up to \$35,000 annually in loan repayment for eligible individuals. From September 1 to December 1, 2007, the NIH accepted applications for health professionals pursuing careers in one of the five LRPs offered by the NIH (Clinical Research, Clinical Research for Individuals from Disadvantaged Backgrounds, Contraception and Infertility Research, Health Disparities Research, and Pediatric Research). The programs also provide reimbursement for Federal and State tax liabilities resulting from the loan repayment award.

- For more information, see <http://www.lrp.nih.gov/HomePage.aspx>
- (E) (OER)

Re-entry Program: The Re-entry Program, now supported by 23 NIH institutes, was originally developed to help fully trained scientists (women and men) reestablish careers in biomedical or behavioral science after taking time off to care for children or parents, or to attend to other family responsibilities. The program was expanded in concept and participants during FY 2006 and FY 2007 and provides administrative supplements to existing NIH research grants to support full-time or part-time research by these individuals in a program geared to update research skills and knowledge.

- For more information, see <http://grants.nih.gov/grants/guide/notice-files/NOT-OD-07-068.html>
- For more information, see <http://grants.nih.gov/grants/guide/pa-files/PA-04-126.html>
- (E) (ORWH, NIA, NIAAA, NIAID, NIAMS, NIBIB, NCI, NICHD, NIDCD, NIDCR, NIDDK, NIDA, NIEHS, NEI, NIGMS, NHLBI, NHGRI, NIMH, NINDS, NLM, NINR, NCRR, NCCAM, FIC, ODS)

NIH Working Group on Women in Biomedical Careers: Led by the NIH Director and the Director, ORWH, this working group is reviewing NIH policies and programs to determine ways to enhance the careers of women in science, research, and engineering. The working group is also reviewing recommendations from the National Academies Report: *Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering* and concerns of intramural women scientists.

- For more information, see <http://womeninscience.nih.gov/>
- For more information, see http://www.nap.edu/catalog.php?record_id=11741
- (E, I) (ORWH, OD)

ORWH/Office of Intramural Training and Education Programs: NIH supports a series of training programs for postdoctoral fellows, graduate students, summer students, and postbaccalaureate trainees, as well as career enhancement workshops for intramural scientists.

- For more information, see <http://www.training.nih.gov/postdoctoral/womenshealth.asp>
- (I) (ORWH, OIR)

Intramural Program on Research on Women's Health (IPRWH): The IPRWH is a trans-NIH interdisciplinary collaboration on women's health and sex/gender research. The IPRWH consists of:

- The Women's Health Special Interest Group (WHSIG), which is a focused research interest group that, among other activities, sponsors scientific lectures of interest to intramural women's health researchers.
- The ORWH Women's Health Seminar Series, which features nationally recognized leaders in women's health research who present the latest information on topics important to women's health for the NIH extramural and intramural scientific and public communities.
- The NIH Women's Health Fellowships in Intramural Women's Health Research, which, in 2006, announced the selection of the first recipients.

- For more information, see <http://orwh.od.nih.gov/news/iprwh.html>
- For more information, see <http://orwh.od.nih.gov/news/whsig.html>
- For more information, see http://tango01.cit.nih.gov/sig/home.taf?function=main&SIGInfo_SIGID=122
- For more information, see <http://orwh.od.nih.gov/news/whss.html>
- For more information, see <http://orwh.od.nih.gov/news/2006Fellows.html>
- (I) (ORWH)

IC-Specific Programs and Initiatives

Medical Scientist Training Program: The need for investigators who are well trained in both basic science and clinical medicine has long been recognized within the biomedical science community. To help meet this need, NIH established the Medical Scientist Training Program (MSTP). This program encourages and supports the training of

students with outstanding credentials and potential who are motivated to undertake careers in biomedical research and academic medicine. MSTP students participate in an integrated program of graduate training in the biomedical sciences and clinical training offered through medical schools. Graduates receive the combined M.D.-Ph.D. degree, and the majority of them pursue careers in basic biomedical or clinical research. MSTP grants are a type of National Research Service Award.

- For more information, see <http://www.nigms.nih.gov/Training/InstPredoc/PredocOverview-MSTP.htm>
- (E) (NIGMS)

NIGMS Community for Advanced Graduate Training (CAGT): To increase interactions between the Institute's MARC prebaccalaureate research training programs and its predoctoral graduate-level research training programs, NIGMS has created the Community for Advanced Graduate Training (CAGT) network. Launched in summer 2007, the CAGT is an interactive Web-based system that works to identify mentoring opportunities between MARC undergraduate students and NIGMS predoctoral research training grant program directors. The system aims to improve the ability of MARC students to find suitable predoctoral training opportunities and to apply directly to those graduate institutions. The system also will boost the ability of NIGMS research training grant program directors to recruit suitable students for their graduate (Ph.D.) programs. Moreover, MARC students will be able to access information regarding summer recruitment opportunities at these research-intensive graduate institutions.

- (E) (NIGMS)

HIV Research Training Programs: The AIDS International Training and Research Program (AITRP) builds institutional, national, and regional HIV research capacity in low- and middle-income countries. Over the past 19 years, this program has been responsible for many of the first generation of research scientists from these countries, with many more in the pipeline. The program offers multidisciplinary biomedical, behavioral, and social science research training to a wide range of professionals. Building on the AITRP, the International Clinical, Operational and Health Services Research and Training Award for HIV/AIDS and TB (ICOHRTA AIDS/TB) Program began in 2002 to strengthen the capacity for clinical, operational, and health services research in low- and middle-income countries where AIDS, TB, or both are significant problems. Through training health professionals who reach across the spectrum of clinical and public health research, this program is strengthening the capacity of scientists, program managers, and policymakers to evaluate and better implement large-scale prevention, treatment, and care interventions that are locally relevant and effective. Many local leaders of programs supported by the President's Emergency Plan for AIDS Relief have received or are receiving their research training through the AITRP and the ICOHRTA AIDS/TB programs.

- For more information, see http://www.fic.nih.gov/programs/training_grants/aitrp/index.htm
- For more information, see http://www.fic.nih.gov/programs/training_grants/icohrta/aids_tb.htm
- This example also appears in Chapter 3: *Clinical and Translational Research* and Chapter 2: *Infectious Diseases and Biodefense*.
- (E) (FIC, NCI, NHLBI, NIDA, NIDCR, NIMH, NINDS, NINR, OAR, ORWH)

Global Infectious Disease Research Training: A major barrier to improved treatment and control of infectious diseases is the scarcity in endemic countries of scientists with infectious disease research expertise. This program supports U.S. and developing country institutions to train scientists from developing countries to engage in non-HIV/AIDS infectious disease research. It is contributing to the long-term goal of building sustainable research capacity in endemic infectious diseases at developing country institutions to enhance prevention, treatment, and control of infectious diseases that cause major morbidity and mortality in the developing world.

- For more information, see http://www.fic.nih.gov/programs/training_grants/gid.htm
- This example also appears in Chapter 2: *Infectious Diseases and Biodefense*.
- (E) (FIC, NIAID)

Informatics Training for Global Health: Information technology is required in almost all research programs, both to access the vast information resources available internationally and to apply to research design and analysis. This program is intended to increase the capacity of developing country scientists and medical professionals to design, access, and use modern information technology in support of health sciences research. Specifically, this program supports innovative training programs for developing country biomedical and behavioral scientists and engineers, clinicians, librarians, and other health professionals to increase their capacity to access, manage, analyze, interpret, manipulate, model, display, and share biomedical information electronically. Among other skills, this will increase their ability to conduct multisite clinical trials and international disease surveillance and prevention programs.

- For more information, see http://www.fic.nih.gov/programs/training_grants/itgh/index.htm
- This example also appears in Chapter 3: *Disease Registries, Databases, and Biomedical Information Systems*.
- (E) (FIC, NHGRI, NIBIB, NLM)

International Collaborative Trauma and Injury Research Training Program: Each year, more than 5 million deaths and countless disabilities result from injuries. This program is strengthening the scientific expertise in developing countries in human injury-related research and funds 11 collaborations between institutions in high-income countries and low- or middle-income countries. These collaborations support research training in applied science, the epidemiology of risk factors, acute care and survival, rehabilitation, and long-term mental health consequences of trauma and injury. The program is also supported by the World Health Organization, Pan American Health Organization, and Centers for Disease Control and Prevention.

- For more information, see http://www.fic.nih.gov/programs/training_grants/trauma/index.htm
- This example also appears in Chapter 2: *Life Stages, Human Development, and Rehabilitation*.
- (E) (FIC, NHLBI, NIAAA, NIBIB, NIMH, NINR, OBSSR, ORWH)

International Training and Research in Environmental and Occupational Health: This program is building global capacity and collaboration to better understand, investigate, control, and prevent environmental and occupational health problems in developing countries and in the United States. Through this program, NIH is developing and strengthening centers of research excellence in environmental and occupational health-related sciences in target countries through long-term partnerships with U.S. institutions, with particular emphasis on research activities that will have the potential to benefit a whole region. The program was recompleted in 2007 and is jointly funded by NIH and the Centers for Disease Control and Prevention.

- For more information, see http://www.fic.nih.gov/programs/training_grants/itreoh/index.htm
- (E) (FIC, NIEHS)

International Training and Research Program in Population and Health: This program supports U.S. universities that provide training to scientists from developing countries in population studies or reproductive biology. Objectives of this program include enhancing population research programs and international collaborative studies on (a) reproductive processes and contraceptive development and (b) demographic processes, including aging, mortality, morbidity, fertility, migration, and linkages between health and economic development; strengthening the ability of scientists from developing nations to contribute to global population research efforts and advance knowledge in support of population policies appropriate for their home countries; and developing and strengthening centers of research excellence in population-related sciences in developing countries.

- For more information, see http://www.fic.nih.gov/programs/training_grants/itrph/index.htm
- This example also appears in Chapter 3: *Epidemiological and Longitudinal Studies*.
- (E) (FIC, NICHD, ODS)

Interdisciplinary Training in Environmental Health Science and Genetics: The new Human Genes and the

Environment Training Program, as a part of the Genes, Environment and Health Initiative, will provide grants to train scientists in the emerging inter-discipline of environmental genomics/genetics to pursue a career path that integrates environmental sciences with human genetics and population genetics and genomics. This cadre of scientists will not only be equipped to advance methodologies and technologies in environmental genomics/genetics, but will also use these tools and resources to disentangle and evaluate the enormous number of environmental factors which directly influence or interact with some genotypes to determine the resultant phenotypic expression and clinical or physiologic endpoints associated with the etiology and treatment of complex diseases.

- For more information, see <http://www.gei.nih.gov/traininggrants.asp>
- (E) (NIEHS, NHGRI)

Predoctoral Research Training in Biostatistics: A workforce of biostatisticians with a deep understanding of statistical theory and new methodologies is vital to meet the biomedical, clinical, and behavioral research needs of the United States. With that end in mind, NIGMS has funded 13 predoctoral training programs in biostatistics to support 43 predoctoral trainees. The program was initiated at the request of several NIH institutes, which provided cofunding to help launch the effort. The training program integrates biostatistical theory and evolving methodologies with basic biomedical research, including bioinformatics, genetics, molecular biology, cellular processes, and physiology, as well as epidemiological, clinical, and behavioral studies.

- For more information, see <http://grants.nih.gov/grants/guide/pa-files/par-04-132.html>
- (E) (NIGMS)

Predoctoral Training at the Interface of the Behavioral and Biomedical Sciences: In 2006, NIGMS announced a new institutional training grant program focused on "Training at the Interface of the Behavioral and Biomedical Sciences." The first two awards were made in July 2007. The programs provide an interdisciplinary research training experience and curriculum for predoctoral trainees that integrate both behavioral and biomedical perspectives, approaches, and methodologies. Through coursework, laboratory rotations, and programmatic activities that reinforce training at this interface, the program aims to develop basic behavioral scientists with rigorous training in the biomedical sciences who are available to assume leadership roles related to the Nation's biomedical, behavioral, and clinical research needs. This new training grant program is one of eleven predoctoral research training areas supported by NIGMS that promotes interdisciplinary, collaborative, and innovative research training.

- For more information, see <http://grants.nih.gov/grants/guide/pa-files/PAR-06-503.html>
- For more information, see <http://www.nigms.nih.gov/News/Results/BehavioralBiomedical070207.htm>
- (E) (NIGMS)

Research on Interventions That Promote Research Careers: This new initiative funds research that will inform programs designed to increase the number of underrepresented minority students entering careers in mainstream biomedical and behavioral research. Comparative research will analyze the experience of all ethnicities in order to place that of underrepresented students in context and to learn whether and how interventions should be tailored to make more underrepresented students successful in biomedical careers. The results of this initiative could inform the NRSA training communities about diversity recruitment.

- For more information, see <http://grants.nih.gov/grants/guide/rfa-files/RFA-GM-08-005.html>
- (E) (NIGMS)

NINR Intramural Training Initiatives: NIH concluded its 6th and 7th annual Summer Genetics Institutes (SGI) in June/July 2006 and 2007, respectively. The SGI is an intense, 2-month, full-time summer research training program targeted at faculty, graduate students, and advanced-practice nurses. Hosted by NINR's Division of Intramural

Research, the SGI features classroom and laboratory components that are designed to provide a foundation in molecular genetics for use in clinical practice and the research laboratory. The SGI develops research capacity among graduate students and faculty in nursing and provides a basis for clinical practice in genetics among advanced-practice nurses.

For recently graduated, doctorally prepared nurse scientists, NIH sponsors the K22 Career Transition Awards, which are designed to facilitate the successful transition of postdoctoral trainees to independent research careers. Awardees receive up to 3 years of postdoctoral research training in the NINR intramural laboratories in Bethesda, Maryland, followed by 2 years of extramural support as they begin tenure-track faculty positions. In addition, NINR participates in the NIH Graduate Partnership Program, in which the Institute partners with schools of nursing to support the research training of doctoral students in symptom management, genetics, or end-of-life/palliative care in the NIH intramural laboratories. In supporting such initiatives, NIH seeks to expedite the development of productive nurse scientists, many of whom can also go on to serve as nursing faculty.

- For more information, see <http://www.ninr.nih.gov/Training/TrainingOpportunitiesIntramural/>
- (I) (NINR)

Building Interdisciplinary Research Careers in Women's Health (BIRCWH): BIRCWH is an innovative career development program to support the training of junior faculty researchers in an interdisciplinary mentored environment in women's health research by pairing junior researchers with senior investigators. The program bridges advanced training with research independence, in addition to integrating scientific disciplines in an interdisciplinary nature. In FY 2006 and FY 2007, the BIRCWH program funded 36 additional awards.

- For more information, see <http://orwh.od.nih.gov/interdisciplinary/bircwhmenu.html>
- (E) (ORWH, ODS, NICHD, NIA, NIDA, AHRQ)

Women's Reproductive Health Research Career Development Program: The ORWH cosponsored with NICHD the funding of 20 institutional career development awards designed to increase the number of obstetricians and gynecologists conducting research in women's health.

- For more information, see <http://www.nichd.nih.gov/research/supported/wrhr.cfm>
- This example also appears in Chapter 2: *Life Stages, Human Development, and Rehabilitation*.
- (E) (ORWH, NICHD)

Informatics Research Training Programs: To address the national need for computational scientists competent in biology and medicine, NLM reviewed its University Informatics Research Training Programs and issued a new call for applications. Curricula were updated to reflect current computing needs in clinical translational research and public health. Eighteen 5-year grants, totaling more than \$75 million, for research training in biomedical informatics, were awarded in 2006. Approximately 270 trainees are currently enrolled in these programs.

- For more information, see <http://www.nlm.nih.gov/ep/AwardsTrainInstitute.html>
- This example also appears in Chapter 3: *Disease Registries, Databases, and Biomedical Information Systems*.
- (E) (NLM)

Addressing the Unique Training Needs of CAM Research: NCCAM supports two unique NRSA funding opportunities for predoctoral and postdoctoral fellows who wish to be trained specifically in research related to complementary and alternative medicine. These programs support conventional researchers and trainees as well as CAM practitioners. NCCAM also supports NRSA institutional training grants (T32) through the NIH-wide mechanism. Many of the training programs supported are unique in that they accept CAM practitioners who wish to transition to a research career. Others involve collaboration between a conventional research intensive institution and a school that trains CAM practitioners. For example a partnership between Bastyr University School

of Naturopathic Medicine and the University of Washington provides postdoctoral training opportunities for CAM practitioners as well as individuals with conventional scientific academic backgrounds.

- For more information, see <http://grants.nih.gov/grants/guide/pa-files/PA-07-384.html>
- For more information, see <http://grants.nih.gov/grants/guide/pa-files/PA-07-319.html>
- For more information, see <http://grants2.nih.gov/grants/guide/pa-files/PA-06-468.html>
- (E) (NCCAM)

International Research Scientist Development Award (IRSDA): Through IRSDA, Fogarty International Center provides career development and research support to U.S. postdoctoral scientists in the formative stages of their careers to solidify their commitment to global health research. For example, under this program, Fogarty supported the career development of Dr. Nathan Wolfe, whose work in Cameroon advanced our understanding of how retroviruses enter into human populations, and determined that the likely point of transmission of the HIV virus occurred between primates and bushmeat hunters. Dr. Wolfe has now received the NIH Director's Pioneer Award. Cofunded by Fogarty and NIAID, this award builds on Dr. Wolfe's IRSDA-supported research and is enabling the establishment of the first global network to monitor the transmission of new viruses—including pandemic disease threats such as ebola, anthrax, and monkeypox—from animals into human populations. This hunter cohort distributed throughout key habitats will provide a framework for a range of research projects aimed at predicting and preventing disease emergence, including studies of risk factors associated with primary and secondary infections with zoonotic microorganisms, anthropological studies of hunting and meat processing practices that lead to exposure, and ecological studies of the animal and human populations that influence transmission among and between groups.

- [Wolfe ND, et al. *Proc Natl Acad Sci U S A* 2005;102:7994-9](#), PMID: 15911757
- For more information, see http://www.fic.nih.gov/programs/training_grants/irsd.htm
- This example also appears in Chapter 2: *Infectious Diseases and Biodefense*.
- (E) (FIC, NIAID)

Public-Private Partnerships

Partnerships to Support Training for Research on Aging: NIH collaborates with private organizations and foundations to prepare scholars for research on aging. For example, partnerships with the American Federation for Aging Research, the John A. Hartford Foundation, and other foundation partners support two efforts:

- The Summer Research Training in Aging for Medical Students program provides a series of coordinated Institutional National Research Service Award (NRSA) grants designed to expose medical students, early in their training, to the excitement of ongoing research and encourage them to consider careers in research on aging.
 - The Paul B. Beeson Career Development Awards in Aging Research offer 3- to 5-year faculty development awards to outstanding junior and mid-career faculty committed to academic careers in aging-related research, training, and practice. For over a decade, these awards have been extraordinarily successful in preparing participants to take leadership roles in research that has added exponentially to our understanding of aging and age-related diseases and conditions.
 - A third partnership is with the Alzheimer's Association to support the unique and highly successful Summer Institute on Aging Research. For 21 years, this program has assisted emerging scholars in making the transition to independent funding for research relevant to aging. The program provides junior investigators an opportunity to be mentored in the substance and methodology of aging research by recognized experts in the field with the goal to enhance participants' potential for success as independent investigators. In 2004, the John A. Hartford Foundation partnered with NIH to sponsor a preconference to the Summer Institute to address issues of clinical research.
- For more information, see <http://grants.nih.gov/grants/guide/rfa-files/RFA-AG-05-002.html>

- For more information, see <http://grants.nih.gov/grants/guide/rfa-files/RFA-AG-07-001.html>
- For more information, see <http://www.nia.nih.gov/NewsandEvents/summer2007.htm>
- (E) (NIA, ODS)

Research Training Partnerships: NIH has signed a Memorandum of Understanding with both the American Skin Association and the Orthopaedic Research and Education Foundation to provide supplemental support to fellows funded under the National Research Service Award program.

- For more information, see <http://grants.nih.gov/grants/guide/pa-files/PA-06-536.html>
- For more information, see <http://grants.nih.gov/grants/guide/pa-files/PA-06-539.html>
- (E) (NIAMS)

HHMI-NIH Interfaces Initiative: Interdisciplinary research that builds from the foundations of multiple traditional disciplines including biology, physics, engineering, chemistry, informatics, and medicine has become an essential feature of modern biomedical research. Training the interdisciplinary researchers of the future and reducing the barriers to interdisciplinary graduate education is the goal of a public-private partnership between NIH and the Howard Hughes Medical Institute (HHMI). This initiative is developing cross-department mentoring programs, interdisciplinary courses, and a cadre of students being trained in an interdisciplinary environment. Programs are under development at 10 universities at the present time.

- For more information, see <http://www.hhmi.org/grants/institutions/nibib.html>
- For more information, see <http://grants.nih.gov/grants/guide/notice-files/NOT-FB-05-002.html>
- For more information, see <http://www.nibib.nih.gov/Training/Predocutorial#HHMI>
- (E) (NIBIB)

NIH Training Program Evaluation

Annual Assessments of Research Training: Every year, NIH assesses NRSA research training outcomes and program management against two goals established under the Government Performance and Results Act (GPRA). In the first of these goals, NIH seeks to measure the quality of its programs and ensure that substantial numbers of trainees and fellows are retained in research careers, by comparing the subsequent research activity of former NRSA trainees and fellows against their peers. The second of these two GPRA goal measures NIH progress on improving the efficiency of the NRSA program by developing and implementing an electronic system for appointing trainees to institutional training grants. By 2012, NIH expects the new system to be fully implemented and that 100 percent of trainees will be appointed to training grants electronically rather than through paper appointment forms. This is a new goal and NIH will report its performance in transitioning to electronic appointments in February 2009.

- For more information, see [http://officeofbudget.od.nih.gov/PDF/FY08%20PB%20Performance%20Detail%20Vol%20II%20FINAL%20\(PB%20Submitted\).pdf](http://officeofbudget.od.nih.gov/PDF/FY08%20PB%20Performance%20Detail%20Vol%20II%20FINAL%20(PB%20Submitted).pdf)
- (O) (OD/OER) (GPRA Goal)

Program Assessment Rating Tool (PART) Review of NIH Research Training: In 2006, NIH training programs underwent PART review by the Office of Management and Budget and received the highest rating possible. The OMB judged the NIH program to be “effective at training and retaining researchers in the biomedical research field,” to be successfully meeting “its ambitious long-term and annual goals,” and to have conducted independent evaluations of the program since its inception in 1974. The NIH training program also has a plan to improve performance and management over time, and held accountable for meeting improvement targets.

- For more information, see <http://www.whitehouse.gov/omb/expectmore/summary/10003543.2006.html>
- (O) (OD/OER)

Evaluation of Extramural Research Training and Career Development Programs at NIAMS: The NIAMS is currently conducting an outcome evaluation designed to examine the effectiveness of its research training (T32 and F32) programs and career development award (K01 and K08) programs.

- (O) (NIAMS)

Assessment of CAM Research Training Needs: A formal evaluation by an independent expert panel of opportunities for training in research on complementary and alternative medicine (CAM) highlighted the unique needs of the field. In particular, building capacity in the CAM research workforce requires specific efforts targeted at: 1) training CAM experts, who frequently have little scientific background, in scientific research methodology; and 2) creating opportunities for investigators from conventional scientific, who generally know little about CAM, to learn about CAM practices and modalities. This report continues to guide NCCAM's training initiatives which are aimed at creating programs to establish sustainable research training infrastructure, programs targeted to CAM practitioners, and career transition awards specifically aimed at helping CAM researchers establish independent research careers.

- For more information, see <http://nccam.nih.gov/training/report.htm>
- (O) (NCCAM)