

HOWARD HUGHES MEDICAL INSTITUTE
NATIONAL INSTITUTE OF BIOMEDICAL
IMAGING AND BIOENGINEERING

HHMI-NIBIB INTERFACES INITIATIVE

For Interdisciplinary Graduate Research Training

Program Announcement
2005



Revised November 1, 2004

Register intent to apply by January 20, 2005
Proposal submission deadline: June 15, 2005
Awards announcement: November 2005

HHMI
HOWARD HUGHES MEDICAL INSTITUTE
Graduate Science Education Program



National Institute of Biomedical
Imaging and Bioengineering

HHMI-NIBIB INTERFACES INITIATIVE

Progress in the biomedical sciences increasingly relies on the input of new ideas, methodologies, and investigative strategies from the physical sciences, engineering, and mathematics. The recent development of techniques that produce large quantities of data and a detailed understanding of the numerous elements of complex biological systems has further emphasized the need to translate useful data management and systems analysis tools from the physical science, engineering, and computational disciplines. As these approaches become more central to biology, it is increasingly important for biologists to have a clear understanding of the power and limitations of these approaches, as well to collaborate with individuals from the relevant disciplines. It is similarly important that physical and engineering scientists develop a deep understanding of the breadth and nature of biological scientific questions. The importance of interdisciplinary research for the advancement of biomedical science is widely recognized in the scientific community.

Both HHMI and NIH are committing resources to develop interdisciplinary research. HHMI is constructing a new facility, the Janelia Farm Research Campus, where biologists, computational scientists, engineers, physicists, and chemists will work together to carry out collaborative biomedical research. Many aspects of the new NIH Roadmap (nihroadmap.nih.gov) relate to such interdisciplinary efforts. Beyond their commitment to collaborative interdisciplinary research, HHMI and NIH also share the growing realization that tomorrow's biomedical investigators must be prepared to use the concepts, approaches, and tools of formerly separate disciplines.

The primary goal of this initiative is to facilitate the development of new training opportunities in emerging interdisciplinary research environments. It represents an innovative new partnership between HHMI and NIBIB at NIH that takes advantage of the different strengths of the two organizations.

The initiative consists of two phases. Phase I, described in this announcement, is funded by HHMI and supports the establishment of new interdisciplinary training programs. HHMI will award up to \$10 million in grants to as many as 10 institutions. The grant term is three years, and the total award for each grant is a maximum of \$1 million. The number of awards made in 2005 will be based on the quality of the proposals. If an insufficient number of exceptional proposals are received in this competition (with the deadline for application of June 15, 2005), fewer than 10 awards may be made, and a subsequent competition will be held in 2006.

Phase II, funded by NIBIB, will sustain the training programs through their critical early years. NIBIB will conduct the Phase II competition in early 2008. These grants will employ a funding mechanism similar to an NIH T32 institutional training grant and have five-year terms. Because of the phased approach to this program, the Phase II review will include additional review requirements, as well as the standard criteria for NIH institutional training grant programs (<http://grants.nih.gov/grants/guide/pa-files/PA-02-109.html>). The additional requirements represent the milestones that are expected to be accomplished during Phase I to have a robust program foundation for Phase II. Institutions supported for Phase I are expected to apply for Phase II. In addition, any institutions that can demonstrate that they meet the criteria for the NIH institutional training program and the equivalent milestones for Phase I will be eligible to apply. Because of differences in institutional costs, no specific budget cap will be set. However, a maximum of 10 slots will be considered. It is expected that grantees that have received funding for both phases will be highly competitive for further NIH or other training support mechanisms.

This program announcement provides a general description of the initiative's goals and objectives, eligibility criteria, core program development areas, electronic proposal submission, deadlines, and criteria for proposal evaluation for Phase I grants.

Applicants should access HHMI's online competition system at www.hhmi.org/grants/gcs to obtain detailed information on this competition, register their intent to apply, access the online application materials, and submit applications. The login ID is guest, and the password is register.

GOALS AND OBJECTIVES

The primary goal of this new initiative is to train a cadre of Ph.D. scientists who possess the knowledge and skills to conduct interdisciplinary research at the interface between the biomedical sciences and the physical science, computational, engineering, or mathematical disciplines. Another goal is to reduce barriers to interdisciplinary graduate science education. Initiative objectives include the following:

1. Developing exemplary educational graduate programs and educational tools, resources, and activities that provide effective interdisciplinary Ph.D. training for biomedical research. Examples include:
 - Curricular development, such as integrated courses, laboratory experiences, and other innovative educational mechanisms for graduate trainees with different scientific backgrounds.
 - Creation of models by which universities can establish or modify academic and administrative structures to facilitate interdisciplinary graduate study.
2. Preparing students for interdisciplinary research careers in the biomedical sciences by providing opportunities to:
 - Develop the knowledge base and skills necessary to understand and use the approaches of other disciplines.
 - Learn how various scientific disciplines approach scientific problems.
 - Develop an understanding of mathematical, computational, and problem-solving paradigms used by various disciplines.
 - Learn the language, culture, technology, literature, and unique means of expression used by other scientific disciplines.
 - Learn the skills needed to work effectively in an interdisciplinary research team.
3. Supporting the professional development of current and future teaching faculty in developing educational approaches appropriate to interdisciplinary science and engineering education.

4. Developing means to attract participation in interdisciplinary biomedical science research by those currently underrepresented in this area.
5. Reducing or eliminating institutional, departmental, and administrative barriers to interdisciplinary research and research training.
6. Generating a self-sustaining community of interdisciplinary researchers and educators.
7. Integrating teaching and research activities across traditional disciplinary departments.
8. Encouraging intra- and interinstitutional access to core and shared facilities to foster interdisciplinary training and research collaboration.
9. Recognizing and dealing with ethical issues in interdisciplinary research.

ELIGIBLE INSTITUTIONS

All U.S. institutions that grant Ph.D. degrees in appropriate science or engineering disciplines are eligible to apply for support through this initiative. Collaborative programs between two or more institutions are acceptable, but a clear academic and financial management plan must be provided. HHMI will provide the grant funds to a single accountable institution, which then must distribute funds to any partner institutions. Institutions may be designated a primary institution on only two proposals. Designations must be made at the level of the institution's president.

ELIGIBLE AREAS

Programs eligible for funding through this initiative must integrate the biomedical sciences with the engineering, physical science, computational, or mathematical disciplines. These fields may include, but are not limited to, chemistry, imaging science, materials science, nanotechnology, and physics. Biomedical interdisciplinary research has been defined in the NIH Roadmap as the integration of the strengths of two or more often-disparate scientific disciplines to solve a given biological problem. It is further recognized that by engaging historically unrelated disciplines,

traditional differences in terminology, approach, and methodology may also be diminished or eliminated. Training programs that provide strategies to remove barriers between areas of research will be considered for funding, though this initiative is meant to enhance interdisciplinary graduate education, *not* to support research. All expenditures, including equipment purchases and facility modifications, must be used to support the training program.

Proposals should reflect the unique educational and scientific capabilities and strengths of the applicant institution(s) as well as address the specific goals of the initiative. This funding effort is explicitly aimed at initiating and developing new integrated, coordinated, and structurally cohesive graduate education programs. Loose coalitions of a few individual research investigators or teaching faculty with unstructured educational plans are not responsive to this initiative. Existing programs generally will not be supported unless major modifications will be made.

PROGRAM DEVELOPMENT AREAS

The core areas for program development are the following:

Program Leadership
Curriculum and Educational Resources
Faculty
Graduate Students
Program Administration
Program Assessment

Program Leadership

Since interdisciplinary training efforts must span at least two academic disciplines, it may be appropriate to have co-directors participating in the oversight of the program. However, a primary program director must be identified in the application who will assume fiscal responsibility and ultimate responsibility for the conduct of the grant. Applicants may wish to keep in mind that senior faculty most likely possess the skills and time required to initiate and develop a new effort. Applications must detail appropriate roles and address the commitment and qualifications of the leadership team (program director, co-director, professional personnel, and

faculty members). Applicants also must list and attach biographical sketches for up to 10 faculty members (in addition to the program director and co-director) who will be members of the leadership team or otherwise participate in the new program. Note that financial support for department faculty should be budgeted under the faculty program area unless a person is a member of the program leadership team.

Curricula and Educational Resources

Curricula, courses, formal laboratories, and research experiences define the nature of graduate study. All these educational elements have generally been taught from a disciplinary perspective. Interdisciplinary graduate education must provide means by which the various disciplines can make unique contributions to biomedical research. This initiative will support the development of unique courses, laboratories, and research experiences that convey the knowledge and power of the various disciplines and the values of team science. Proposed programs may include the following:

- Development of new graduate education curricula and courses that bridge scientific disciplines and integrate the biomedical sciences with the engineering, physical science, computational, or mathematical disciplines.
- Expansion and updating of educational facilities.
- Purchase or modification of equipment used primarily for the proposed graduate education program.

Any request for equipment or facility modification should be well justified and tied closely to specific plans for educational enhancement. Large expenditures will be closely evaluated to ensure that they are thoroughly justified in terms of benefit to the graduate education program.

Faculty

A critical component of effective interdisciplinary graduate education is appropriate research training. Meaningful experiences can be provided by existing faculty with vibrant interdisciplinary research activities or by newly recruited faculty committed to interdisciplinary

research. Legitimate expenditures for faculty development may include support for new or existing faculty members.

Funds may be used for initial salary or start-up support of new faculty hired to broaden research and education of graduate students. Applications should clearly justify the educational need for any new faculty positions. Reviewers will carefully evaluate if the amount of new faculty time that is allocated for the program is sufficient to meet program needs. It is expected that any new faculty positions will be tenure track and that support for faculty hired for a proposed program will be continued by the institution beyond the Phase I grant period. Applications should address the means by which new faculty will be supported when Phase I grant funding ends, as well as the faculty's continued involvement in Phase II.

Funds may also be used to procure a limited amount of release time for current faculty to develop the curriculum for interdisciplinary courses and interdisciplinary laboratory experiences. Opportunities for diversifying faculty involvement may also be expanded through collaborations with other institutions or with nonacademic entities.

Graduate Students

The goal of this initiative is to support the development of cohesive graduate training programs that go far beyond simply supporting individual students in single laboratories. The core curricular requirements and educational path for a typical student should be clearly described. Unique challenges and solutions of the proposed interdisciplinary training experience should also be described.

It is expected that few, if any, graduate students will be supported in Phase I of the initiative. However, if student support is requested, the amount paid from HHMI funds for stipend, tuition, health insurance, and fees may not exceed that which would be paid by an NIH National Research Service Award. No additional institutional support will be paid by HHMI.

A detailed plan should be provided that describes how students will be recruited, selected, and matched with faculty advisers. It is important to discuss how the program will attract individuals from groups underrepresented in the sciences.

Program Administration

Academic administration is important for the success of any graduate program. While HHMI grants do not allow for indirect costs, up to 10 percent of the award may be budgeted for direct program administration. Appropriate charges include office support, development and distribution of recruitment materials, and limited administrative travel.

A detailed plan should be provided that describes how grant funds will be distributed across specific program elements. Note that support for the program director(s) and other members of the leadership team should be delineated under the program leadership component rather than included in the program administration category. Department faculty participating in the program who are not members of the leadership team should be delineated under the faculty component.

Program Assessment

Each project should develop an internal evaluation plan to assess the progress of the program and problems being experienced. This self-evaluation should be used to improve future activities.

It is also important that the proposal provide a longitudinal assessment plan that will follow trainees after graduation to determine whether the project was successful in accomplishing its goals. Applicant institutions must agree to cooperate in the collection of appropriate data and to provide it to HHMI for evaluation of the funding effort.

The goal of the initiative is not only to establish strong interdisciplinary graduate programs but also to solve problems inherent in interdisciplinary graduate study. Consequently, HHMI will monitor and evaluate the overall initiative with the expectation that other institutions will use successful strategies and curricular elements in future implementation of interdisciplinary training programs. As a result, we expect that all funded programs will participate in annual program directors meetings sponsored by HHMI, share successful program elements, collectively address common challenges, and test potentially useful educational interventions.

ELECTRONIC PROPOSAL SUBMISSION AND DEADLINES

Registration

Applicants must register their intent to submit a proposal by 2:00 p.m. ET, January 20, 2005, via HHMI's Web-based competition system at www.hhmi.org/grants/gcs. There is no limit to the number of interested parties from any one university who register an intention to apply. However, institutions may serve as the primary institution on only two submitted proposals. If there are multiple registrants per institution, HHMI will notify the institution's president. It is the responsibility of the president to designate to HHMI the two proposals (not necessarily registrants) that will be submitted in the competition. HHMI will notify the designees as well as the other registrants of the president's decision as soon as it is made known to HHMI. Designees will then be able to enter the system and submit proposals.

We urge institutions to register their intent to apply as early as possible in the proposal planning process. Important information regarding the application process will be sent to those who are registered.

Proposal Submission

The deadline for submitting proposals (via the competition system at www.hhmi.org/grants/gcs) and supporting materials is 2:00 p.m. ET, June 15, 2005. Application materials, instructions, contact information, and this program announcement can also be found on the competition system website.

Although two proposals may be submitted, HHMI will fund no more than one primary program from any one institution. There is no limit to the number of meaningful collaborations in which an institution may participate. Agreements to collaborate and written commitments to the program by the institutions should be provided as a part of the proposal.

Technical assistance for the electronic proposal-submission process is available at a toll-free number listed on the competition website.

Award Notification

Successful applicants will be notified in November 2005. Grant payments will be made in three annual installments starting in December 2005. Grant terms will start January 1, 2006.

APPLICATION GUIDELINES

All uploaded documents must be double spaced and in 12-point type.

Executive Summary

Not to exceed 3 pages.

The proposal should begin with an executive summary, which will be used frequently throughout the review process. The summary should include a brief description of the goals of the project and how they will be achieved.

Proposal Narrative

Not to exceed 20 pages.

Introduction. Begin the narrative with a brief description of the specific aims and major components of the proposal. Describe the need for support of the major components of the proposed activities and the strategy for their implementation. Provide an institutional and departmental context for the proposed activities, discussing how they are part of any long-term plans the applicant institution has for graduate science education.

Proposed Program Activities. Give specifics on proposed activities for any of the core areas for program development listed below that are relevant. Include background on faculty participation and provide background on the applicant institution's capacity or experience for carrying out the proposed activities. Describe expected program outcomes and discuss how the proposed activities will accomplish the proposed specific aims. Describe the specific impact the proposed project will have on the education of students at your institution(s) and how it could impact interdisciplinary graduate science education if implemented nationally. Describe the steps you will take to ensure that those parts of the program that are successful will continue at your institution.

Core areas for program development include:

Program Leadership
Curriculum and Educational Resources
Faculty
Graduate Students
Program Administration
Program Assessment

See "Program Development Areas" (page 3) for detailed descriptions.

Institutional Information

Enter the data in the form provided.

Provide the requested institutional data, including annual budget, endowment, amount of sponsored research, number of students (graduate, undergraduate, underrepresented minorities, and women for each category), number of faculty (tenured, nontenured, underrepresented minorities, and women for each category).

Department and Program Profiles

Not to exceed two pages.

Provide the history and administrative organization of the relevant graduate departments and programs, as well as relevant research programs. Also include how the proposed activities will integrate with existing programs or research emphases.

Designation of Program Director(s) and Other Relevant Faculty

Using the form provided, list the designated primary program director, any co-directors, and all relevant faculty and professional personnel, along with their associated roles. Submit a two-page biographical sketch or curriculum vitae each for the primary program director, co-director(s), and up to 10 of the other faculty participants listed. Include research and educational funding, source and amount of funding, title of the project, percent time, and the role of the person on the project.

Description of Students

Provide aggregate academic characteristics of graduate students in the relevant departments or programs. Appropriate data include undergraduate majors, GPAs, and undergraduate institution names. Admission statistics such as the number of applications, acceptances, and

matriculations may be useful to demonstrate the quality of the student body and impact of the proposed program. Discuss your plans to attract participation in your biomedical science program(s) by those currently underrepresented in this area.

Budget and Budget Narrative

To be completed using the forms provided.

The budget data and narrative will be collected separately for the program development areas:

Program Leadership

Curriculum and Educational Resources

Faculty

Graduate Students

Program Administration

Program Assessment

See “Program Development Areas” (page 3) for area-specific budget guidelines. For all areas, the reasonableness of the budget will be a factor in evaluating the merit of the application. Make sure that any significant expenditure is carefully justified.

Letters of Support and Commitment

Each applicant must submit a letter from the dean or other appropriate official detailing the institution's support of the application. The letter must address current and future institutional commitment. The applicant may also include letters from collaborating institutions. To be effective, these letters should detail the commitment that the collaborating institution will make to ensure the success of the proposed project.

PROPOSAL EVALUATION

An external panel of scientists and educators will be convened to review all proposals. The panel members will be selected in collaboration with NIBIB. It is expected that a majority of the NIBIB review panel for selecting Phase II grant recipients will come from this panel so that consistency of approach and philosophy will be maintained between the two panels. After Phase I review, the final selection of awardees will be made by HHMI, following consultation with NIBIB and taking into account the partnership's goals and objectives. Principal evaluation criteria include activities proposed, budget and administration, and long-term impact.

Activities Proposed

- The degree to which the proposed program addresses the goals and objectives of this initiative.
- The innovation, imagination, and vision of the proposed activities.
- The likelihood that the design of the proposed activities will meet the programmatic objectives identified by the applicant.
- The evidence that the institution has the capability and commitment to accomplish the proposed goals and objectives as demonstrated by the qualifications and experience of the program leadership and key faculty; the quality and characteristics of potential students as evidenced by current graduate programs; and the commitment of the applicant institution to the success of the project through financial support, commitment of faculty time, and provision of space needed for the proposed activities.
- The strategy for increasing the diversity of participating students.
- The quality of the plan to evaluate whether the proposed objectives are being met and to implement modifications as required.

Budget and Administration

- The effectiveness of the plan for management and administration of the program, including distribution of grant funds.
- The appropriateness of the budget to activities specified in the proposal.

Long-Term Impact

- Evidence of noteworthy innovations or particularly compelling approaches for effecting long-term institutional or departmental change in interdisciplinary Ph.D. science education.
- Evidence that the program will have significant impact on the long-term development of science faculty in interdisciplinary graduate education.
- Evidence that program innovations will be useful to other institutions.
- Evidence that efforts will be made to disseminate successful program elements to the biomedical science graduate education community.

REPORTING REQUIREMENTS

Grantee institutions will be required to submit annual progress reports of their program activities and annual financial reports, as well as results of assessment of their programs. Institutions are encouraged to collaborate, as are units within institutions; however, the fiscal and reporting responsibilities must reside within a single institution and academic unit. HHMI funds will be provided to a single reporting unit, and any further disbursement of resources must be made through that unit.

INFORMATION

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HOWARD HUGHES MEDICAL INSTITUTE

The Howard Hughes Medical Institute is a medical research organization dedicated to biomedical research and education. Its principal objectives are the advancement of fundamental knowledge in the biomedical sciences and the application of that knowledge to alleviate disease and promote health.

Through its grants and special programs, HHMI seeks to strengthen science education and biomedical research by supporting current and future leaders to advance scientific knowledge, develop educational products, and implement outstanding educational practices.

NATIONAL INSTITUTE OF BIOMEDICAL IMAGING AND BIOENGINEERING

The National Institute of Biomedical Imaging and Bioengineering is the newest institute at the National Institutes of Health. The NIBIB mission is to improve human health by leading the development and accelerating the application of biomedical technologies. The NIBIB is committed to integrating the engineering and physical sciences with the life sciences to advance basic research and medical care.

The goal of NIBIB training programs is to bridge the gaps between the biological, engineering, and physical sciences by attracting and training new students, as well as supporting the training and career development of existing researchers to advance the prevention, diagnosis, and treatment of disease.