

INTEGRATIVE GRADUATE EDUCATION AND RESEARCH TRAINING PROGRAM

Program Announcement

PREPROPOSAL DEADLINE:

SEPTEMBER 8, 1997

FORMAL PROPOSAL DEADLINE:

DECEMBER 15, 1997



NATIONAL SCIENCE FOUNDATION

The challenges of educating scientists, mathematicians, and engineers for the 21st century mandate a new paradigm in graduate training. To meet the need for a cadre of broadly prepared Ph.D.s with multidisciplinary backgrounds and the technical, professional, and personal skills essential to addressing the varied career demands of the future, the National Science Foundation (NSF) announces an agency-wide, multidisciplinary, graduate training program. The goal of the Integrative Graduate Education and Research Training (IGERT) Program is to enable the development of innovative, research-based, graduate education and training activities that will produce a diverse group of new scientists and engineers well-prepared for a broad spectrum of career opportunities. Supported projects must be based upon a multidisciplinary research theme and organized around a diverse group of investigators from U.S. Ph.D.-granting institutions with appropriate research and teaching interests and expertise.

NSF organizations participating in the IGERT program include the Directorates of Biological Sciences (BIO), Computer and Information Science and Engineering (CISE), Education and Human Resources (EHR), Engineering (ENG), Geosciences (GEO), Mathematical and Physical Sciences (MPS), Social, Behavioral, and Economic Sciences (SBE), and the Office of Polar Programs (OPP).

Program Description

An effective multidisciplinary training environment is one that combines the strengths of various disciplines necessary to meet the challenges of a particular multidisciplinary research theme. The use of a multidisciplinary research theme provides a framework for the integration of research and educational activities, and for collaborative efforts in training that span disciplinary areas. Such training programs should, for example: emphasize critical and emerging areas of science and engineering; provide students with hands-on experience in state-of-the-art research instrumentation and methodologies; offer training experiences relevant to both academic and non-academic careers by linking graduate research with research in industry, national laboratories, and other non-academic settings; develop trainee communication and teamwork skills; provide training in the responsible conduct of research; facilitate the development of a diverse workforce; and foster international perspectives on research.

The research theme may draw upon investigators from one or more departments within an individual institution or from more than one institution. The emphasis of the IGERT program is on the training of graduate students; however, the program will support efforts that include undergraduate and/or postdoctoral training if such participation will strengthen the proposed training program.

All IGERT projects are expected to incorporate the following features:

- Vision, including goals and objectives, underlying an innovative program of graduate student training;
- Comprehensive multidisciplinary research theme, appropriate for doctoral-level research, to serve as the foundation for training activities;

- Training activities based on the integration of the multidisciplinary research theme with innovative educational opportunities;
- Training environment that exposes students to state-of-the-art research instrumentation and/or methodologies;
- Formal administrative plan and organizational structure that ensure the effective management of the requested resources to achieve the goals of the project;
- Institutional strategy and operational plan for student recruitment, with special consideration to members of groups underrepresented in science and engineering, i.e., women, racial and ethnic minorities, and persons with disabilities, to ensure preparation of a diverse science and engineering workforce;
- Well-defined strategy for assessment of project performance.

Two-Stage IGERT Competition

Applicants compete for support from the IGERT program in a two-stage process: in the first stage applicants submit a preliminary proposal (preproposal) that outlines the planned IGERT activity; in the second, invited applicants submit a formal proposal. Invitations to submit a formal proposal will be extended on the basis of merit review of the preproposals; only invited formal proposals will be accepted.

Eligibility

Academic institutions in the United States and its territories that grant the Ph.D. degree and have research and training programs in the sciences and engineering are invited to submit proposals. Proposals involving more than one institution are eligible, but a single institution must accept overall management responsibility. Collaborating institutions need not be academic. Details of complex, multi-institutional arrangements should be discussed with one of the directorate representatives listed at the end of this announcement before preproposal submission. To encourage the submission of innovative projects, there is no limit to the number of preproposals that may be submitted by an institution in response to this announcement. NSF does not anticipate making more than one IGERT award to a single institution as a result of the competition. An institution may submit no more than two single institution and one multi-institution formal proposals per year. Projects in any of the areas of research appropriate for funding by NSF are eligible.

Principal Investigator

The Principal Investigator should be the director of the IGERT project. The director will have overall responsibility for administration of the award, management of the project, and for interactions with the NSF. The director and the home institution are expected to develop an administrative structure that enables faculty, students and others involved in the group effort to interact productively during the award period. The director is expected to be an integral participant in the education and research training activities of the IGERT project.

Award Size and Duration

Awards will be made in amounts up to \$500,000 per year (including direct and indirect costs) for a duration not to exceed five years; up to an additional \$200,000 will be available for appropriate state-of-the-art research instrumentation and special purpose research materials during the first year of the award. The number and size of awards will depend on the advice of reviewers and on the availability of funds; about 20 awards per year are anticipated during the first three years of the IGERT program.

Proposal Format and Electronic Submission

Both preproposals and formal proposals must be prepared following margin and other quality requirements described on page 3 of the NSF document Grant Proposal Guide (GPG; NSF 95-27). The GPG, as well many other NSF publications, can be obtained from the NSF World Wide Web home page at the following Uniform Resource Locator: <http://www.nsf.gov/>. Paper copies of the GPG can be requested at no cost from:

NSF Publications and Supplies Unit
4201 Wilson Blvd., Room P15
Arlington, VA 22230
Telephone: (703) 307-1130 or
via e-mail: pubs@nsf.gov

*Preproposals and formal proposals must be submitted electronically using the NSF FastLane system for electronic proposal submission and review, available through the World Wide Web at the FastLane home page (<http://www.fastlane.nsf.gov>). Detailed instructions on "Preparing and Submitting an IGERT Preproposal" and on "Preparing and Submitting an IGERT Formal Proposal" can be obtained **after June 30, 1997** on the NSF home page (<http://www.nsf.gov/>) by accessing **IGERT** under **Crosscutting Activities** in the section entitled **Program Areas**.*

In order to use NSF FastLane to prepare and submit a proposal, you must use a browser that supports multiple buttons and file upload (e.g., Netscape 2.0 and above for Windows, UNIX, or Macintosh). In addition, Adobe Acrobat Reader is needed to view and print forms, and Adobe Acrobat 3.0 (or Adobe Exchange or Distiller) is needed for creating PDF files. To access the FastLane Proposal Preparation application, your institution needs to be a registered FastLane institution. A list of registered institutions and the FastLane registration form are located on the FastLane home page.

Preproposals and formal proposals must be submitted via FastLane no later than 5:00 PM on the deadline dates specified below, and the signed (paper) cover sheet must be mailed in time to arrive at NSF within a week of the electronic submission. For questions concerning FastLane, please send an e-mail message to fastlane@nsf.gov.

Preproposal Content

The preproposal must include the items listed below in the order shown. *No appendices or letters of endorsement are permitted*; preproposals containing appendices or such letters, or that exceed the page limits indicated below, will be returned without review.

1. **Cover Sheet for Proposals with Institutional Certifications (NSF Form 1207):** Preproposals submitted in response to this program announcement should specify "IGERT" and list the announcement number NSF 97-112 in the appropriate box. In accordance with FastLane instructions, a printed (paper) copy of the form must be endorsed by the Principal Investigator(s) and authorized institutional representative and mailed to the NSF at the following address:

IGERT Program
National Science Foundation PPU
4201 Wilson Blvd., Room P60
Arlington, VA 22230

2. **Information about Principal Investigators (NSF Form 1225):** This form provides information about PIs listed on the cover page. The form is for internal NSF use and is not made available to reviewers.
3. **Project Summary (NSF Form 1358):** On a separate page, provide a brief (200 words or less) description of the training program, including the research theme, education features and objectives.
4. **List of All Faculty Participants:** Include departmental and, if appropriate, institutional affiliation. This list is limited to one page.
5. **Project Description:** This narrative section containing the project description cannot exceed five pages of text in length, including any citations, lists, charts, figures, or tables. The narrative should include the following:
 - A. **Vision, Goals and Objectives:** Discuss the vision, including goals and objectives, and anticipated impact of the proposed project. Include a discussion of what is currently missing from graduate training or what could be done more effectively, and how the proposed project will address these issues.
 - B. **Multidisciplinary Research Theme and Major Research Efforts:** Describe the multidisciplinary research theme and the major research efforts that form the foundation for the proposed project.
 - C. **Training Program:** Describe the proposed integrative research and education activities for graduate student training. Indicate how the training activities ensure full diversity as an integral component of the proposed activity. New or novel aspects of the training program should be emphasized.
6. **Expected Resource Commitments:** Briefly describe anticipated resource commitments to the IGERT project by the institution(s) and any other sources. This section is limited to one page, and no letters of commitment or endorsement from institutions, industry or other entities are allowed.
7. **Biographical Sketches (NSF Form 1362):** For all faculty participants, provide a brief biographical sketch or curriculum vitae, including a brief description of current research support within each biographical sketch. Provide comparable infor-

mation about non-faculty mentors, if appropriate. *This section must not exceed one page per person.*

- 8. Estimated Five-Year Total Budget Summary (NSF Form 1030):** Prepare a one page, five-year summary of total estimated expenses. Specific items of equipment or special research materials need not be listed.

Preproposal Submission and Review

Preproposals must be submitted no later than 5:00 PM (EDT), September 8, 1997. Preproposals will be reviewed by multidisciplinary advisory panels using the criteria for review of formal proposals described below. Following this review, approximately 60 applicants with promising programs will be invited to submit a formal proposal.

Formal Proposal Content

Formal proposals must contain the following elements in the order indicated. Proposals that do not strictly adhere to the specified page limitations (given below), including those in required or permitted appendices, will be ineligible for consideration and will be returned without review.

- 1. Cover Sheet for Proposals with Institutional Certifications (NSF Form 1207):** Invited Formal Proposals should specify "IGERT" and list the announcement number NSF 97-112 in the appropriate box. In accordance with FastLane instructions, a printed copy of the form must be endorsed by the Principal Investigator(s) and authorized institutional representative and mailed to the NSF at the address given above for preproposals.
- 2. Information about Principal Investigators (NSF Form 1225):** This form provides information about PIs listed on the cover page. The form is for internal NSF use and is not made available to reviewers.
- 3. Table of Contents:** Provide a Table of Contents with page numbers for each section and for major subdivisions of the project description (see below).
- 4. Summary:** On a separate page, provide a brief (200 words or less) description of the training program, including the research theme, education features and objectives.
- 5. List of Faculty Participants:** Include departmental and, if appropriate, institutional affiliation. This list is limited to one page.
- 6. Project Description:** Particular attention must be paid to the following in preparing the description:
 - A. Vision, Goals, Objectives, and Anticipated Impact.** This integrated discussion may not exceed 1 page.
 - B. Thematic Basis for the Group Effort.** The research training theme provides a conceptual focus that identifies the common interests of participating faculty. The general nature and unifying aspects of the research training to be offered must be described in this section. Benefits to be realized from opportunities for cross-disciplinary coopera-

tion in education and research training should be emphasized. This section must not exceed 2 pages.

- C. Major Research Efforts.** Provide examples of ongoing or planned research that is expected to provide research training opportunities and thus serve as the foundation of the multidisciplinary graduate training program. No more than six research programs or thrust areas may be described. **This restriction is intended to limit the size of the proposal, not the number of participating faculty or the scope of the project.** These programs may represent efforts of individuals or may be collaborative efforts. In either case, the description of each program should highlight those aspects that link to the other research programs and that provide opportunities for multidisciplinary efforts relevant to the thematic focus. The faculty member(s) or other participants responsible for each program must be identified, and the programs described in sufficient detail for reviewers to assess their scientific merit and relevance to the theme. Needs for special materials, shared instruments, travel to research sites, or special courses must be justified in the context of the program(s) for which they are required. The description of each program must not exceed 4 pages inclusive of citations, tables, figures or other graphical data.
- D. Other Research.** The research of other faculty members and of any non-academic mentors who will participate in the IGERT activity should be identified with a title and brief description of how it will contribute to the training program. This section must not exceed 2 pages (total).
- E. Education and Training.** This section should emphasize any new education and training opportunities such as courses, seminars, workshops, internships, and other activities central to the proposed efforts. Identify faculty members or others with primary responsibility for these efforts. If planned training includes industrial or international internships, the potential mentors should be identified if known. This section must also indicate how the various proposed research efforts and educational experiences will be interwoven to integrate research and education into an effective and innovative graduate training program. Training in responsible conduct of research, the role of diversity as an integral part of the program, and time-to-degree expectations must be elaborated. The role of undergraduate and/or postdoctoral components, if proposed, must also be described and justified. This section must not exceed 10 pages.

In an appendix (Appendix 1), provide information about the recent training activities of each participating faculty member. This should include the numbers of undergraduates, graduate students, and postdoctoral fellows (list numbers for each category separately) who carried out research under the faculty member's direction in each of the last three years and the titles of courses taught by the faculty member during that time period. Other relevant activities such as organization of workshops or special courses may

be included; do not include lectures or publications here. This appendix is limited to 1 page per person.

- 7. Recruitment and Retention:** Plans for recruitment and retention of trainees should be described, including specific provisions for successful recruitment and retention of members of groups underrepresented in science and engineering. Identify the Ph.D. program(s) in which the IGERT graduate students may enroll.

In an appendix (Appendix 2), provide the following information about recruitment and retention of students in the participating Ph.D. programs(s) in each of the last three years: (1) total number of applicants, (2) total number of applicants accepted, (3) total number of accepted applicants who enrolled, (4) average GRE scores of those who enrolled, (5) total number of students currently enrolled in the program, indicating full- or part-time status, (6) total number of Ph.D.s awarded, (7) average time-to-degree, and (8) other relevant measures of student success. In addition to these total numbers, provide separate numbers for women and for underrepresented minorities in each of these categories. A tabular format should be used, with separate tables for each participating Ph.D. program. The appendix is limited to 1 page per participating Ph.D. program.

- 8. Organization and Management:** Plans and procedures for the development, management and assessment of the proposed activity should be described. The plan should include use of a formal mechanism that assures the fair and effective allocation of group resources. Procedures for selection of students and others who will receive stipends or otherwise share in group funds must be described, as should methods for allocation of use of shared equipment to be acquired with IGERT funds. Relationships to other faculty and equipment at the institution, and elsewhere if relevant, should be described as should the relationship to any existing grants that provide funds for related training and educational activities. This section must not exceed 3 pages.
- 9. Performance Assessment:** Each proposed project must have a performance evaluation plan which should tie goals and objectives to indicators and specific measurements for assessing the progress toward achievement of goals. Examples of some indicators which may be useful are assessment of trainees' performance, time-to-degree, numbers and types of trainee placements, percentages of members of underrepresented groups among trainees and faculty, effectiveness of the multidisciplinary enterprise, and impact of the project on graduate education within the institution(s). Although each project should propose its own indicators, some later standardization is anticipated so that the NSF can meet the requirements of the Government Performance and Review Act of 1993. This section may not exceed 2 pages.
- 10. Allowable Costs:** The major portion of awarded funds must be used for training and educational activities, and for related expenditures (including, for example, travel, publication costs and student recruitment). No funds for faculty research or

faculty salaries may be requested. Stipends for students and fellows, support for short-term visitors, and for a limited amount of administrative support may be requested. The current graduate stipend is \$15,000 per year per student, with a cost-of-education allowance of \$9,500 per year per student. Undergraduate stipends should be consistent with those of the NSF Research Experiences for Undergraduates program, and postdoctoral stipends may be determined by the institution. Each award will carry an 8% overhead allowance based on the total direct cost minus equipment and cost-of-education allowances. Stipend recipients must be citizens, nationals or permanent residents of the U.S. Personnel and shop costs may be requested for the development and construction of special instruments, computer software or other materials. Funds for the purchase, but not the maintenance, of shared, special purpose research instruments which cost more than \$5,000 may be requested. The total funds requested for equipment and special purpose materials may not exceed \$200,000; if awarded, these funds will be provided in the first year of the grant. Requests for equipment or special materials whose primary use is in instruction and requests that exceed this limit should be addressed to an appropriate NSF program (see the NSF Guide to Programs; NSF 97-30). Limited funds intended to partially defray the costs of research by students and fellows may also be requested. Funds for facility renovation or for instrument installation or maintenance may not be requested.

- 11. Budget:** Provide a budget for each year of support requested as well as a cumulative budget for all five years. NSF Form 1030 must be used. Funds for shared equipment and materials (as described in section 10, above) should be included in section D ("Permanent Equipment").
- 12. Budget Justification:** A brief justification for funds in each budget category should be provided. For shared equipment and special materials, a particular model or source and the current or expected price should be specified whenever possible. A brief explanation of the need for each requested item and of the choice of specified models should be provided. Arrangements for maintenance and operating expenses of requested equipment should be described. This section, which is limited to 3 pages, should also include details of institutional cost sharing, if any, and other sources of support for the IGERT project, such as government, industry, or private foundations. Appropriate documentation of any such commitments should be provided in an appendix (Appendix 3). If industrial internships are planned, the willingness of the industrial organization and of individual industrial mentors (if known) to participate should also be documented in this appendix. Although cost sharing is not required, any such commitment specified in the proposal will be referenced and included as a condition of an award resulting from this announcement.
- 13. Existing Facilities and Equipment:** Include a brief description of available facilities, including major instruments required for the research. Where requested equipment or materials duplicate existing items, explain the need for duplication. This section is limited to 2 pages.

14. Biographical Sketches and Individual Support: For each of the key personnel, provide a curriculum vitae or short biographical sketch (1-2 paragraphs), a list of up to 10 publications (to include the individual's 5 most important and up to 5 other, relevant publications) and a complete list of current support. The information may not exceed 2 pages for each individual. NSF Form 1362 may be used; however, do not include a list of collaborators (item C of the form) as part of the biographical sketch.

15. Students and Collaborators: In an appendix (Appendix 4), provide a list of current and past collaborators for each of the key personnel who will participate in the project. The list should be arranged alphabetically (by key personnel name) and include the names of their graduate and postdoctoral mentors, the names of all graduate students and postdoctoral fellows who have trained with the key personnel, and the names of those with whom the key personnel have co-authored papers within the last four years.

16. Appendices: Only the appendices described above in sections 6, 7, 12 and 15 are allowed.

Formal Proposal Submission

The formal proposals must be submitted electronically no later than 5:00 PM (EST), December 15, 1997. All required information must be submitted together. The PI is responsible for the completeness and accuracy of the proposal as submitted. Unless requested by the NSF, additional information may not be sent following proposal submission.

Evaluation of Formal Proposals

Multidisciplinary panels with relevant expertise will be convened to review proposals using the NEW merit review criteria approved by the National Science Board on March 28, 1997 (NSB97-72).¹ Panel review of formal proposals may be supplemented by *ad hoc* reviews and site visits as necessary. The primary basis for award decisions will be the merit of the education and research training activities proposed. The new merit review criteria are

What is the intellectual merit and quality of the proposed activity?

The following are suggested questions that the reviewer will consider in assessing how well the proposal meets this criterion. Each reviewer will address only those questions which he/she considers relevant to the proposal and for which he/she is qualified to make judgments.

How important is the proposed activity to advancing knowledge and understanding within its own field and across different

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

What are the broader impacts of the proposed activity?

The following are suggested questions that the reviewer will consider in assessing how well the proposal meets this criterion. Each reviewer will address only those questions which he/she considers relevant to the proposal and for which he/she is qualified to make judgments.

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

In light of the IGERT program's objectives, reviewers will be asked to consider both Merit Review criteria with emphasis placed on:

- excellence of the research environment;
- quality and innovativeness of the planned graduate education and training activities;
- effectiveness of the integration of the participating scientists and engineers;
- effectiveness of the integration of research and education; and
- effectiveness in preparing a diverse science and engineering workforce.

Award Administration

Awards will be administered in accordance with the terms and conditions of the NSF document "Grant General Conditions" (GC-1; rev. 10/95) or Federal Demonstration Project III (FDP III; 3/97). Copies of these documents are available at no cost from the NSF Forms and Publications Unit (address above), or via e-mail (pubs@nsf.gov). More comprehensive information is contained in the NSF Grant Policy Manual (NSF 95-26) for sale through the Superintendent of Documents, Government Printing Office, Washington, DC 20402. The telephone number at GPO is (202) 521-3238 for subscription information.

¹ For additional information on NSF's new merit review criteria, see the Merit Review Task Force Final Report on the NSF Home Page at <http://www.nsf.gov/cgi-bin/getpub?nsbmr975>.

Other Information

As warranted, NSF will assemble a listing of Frequently Asked Questions (FAQ) relating to this announcement. Any FAQ prepared can be found by following the instructions for accessing IGERT on the NSF home page as described above in the section on *Proposal Format and Electronic Submission*.

Inquiries regarding the IGERT program should be directed to one of the following:

BIO: <i>Gerald Selzer</i> (703) 306-1469 (<i>gselzer@nsf.gov</i>)	GEO: <i>Jewel C. Prendeville</i> (703) 306-1521 (<i>jprendev@nsf.gov</i>)
CISE: <i>William W. Agresti</i> (703) 306-1911 (<i>wagresti@nsf.gov</i>)	MPS: <i>Henry N. Blount, III</i> (703) 306-1946 (<i>hblount@nsf.gov</i>)
EHR: <i>Paul W. Jennings</i> (703) 306-1696 (<i>pjenning@nsf.gov</i>)	OPP: <i>Douglas Siegel-Causey</i> (703) 306-1030 (<i>dsiegel@nsf.gov</i>)
ENG: <i>Joy M. Pauschke</i> (703) 306-1380 (<i>jpauschk@nsf.gov</i>)	SBE: <i>John Perhonis</i> (703) 306-1743 (<i>jperhoni@nsf.gov</i>)

The Foundation provides awards for research in the sciences and engineering. The awardee is wholly responsible for the conduct of such research and preparation of the results for publication. The Foundation, therefore, does not assume responsibility for the research findings or their interpretation.

The Foundation welcomes proposals from all qualified scientists and engineers and strongly encourages women, minorities, and persons with disabilities to compete fully in any of the research related programs described here. In accordance with federal statutes, regulations, and NSF policies, no person on grounds of race, color, age, sex, national origin, or disability shall be excluded from participation in, be denied the benefits of, or be subject to discrimination under any program or activity receiving financial assistance from the National Science Foundation.

Facilitation Awards for Scientists and Engineers with Disabilities (FASSED) provide funding for special assistance or equipment to enable persons with disabilities (investigators and other staff, including student research assistants) to work on NSF projects. See the program announcement or contact the program coordinator at (703) 306-1636.

Privacy Act. The information requested on proposal forms is solicited under the authority of the National Science Foundation Act of 1950, as amended. It will be used in connection with the selection of qualified proposals and may be disclosed to qualified reviewers and staff assistants as part of the review process; to applicant institutions/grantees; to provide or obtain data regarding the application review process, award decisions, or the administration of awards; to government contractors, experts, volunteers, and researchers as necessary to complete assigned work; and to other government agencies in order to coordinate programs. See Systems of Records, NSF 50, "Principal Investigators/Proposal File and Associated Records", 60 Federal Register 4449 (January 23, 1995), and NSF-51, "Reviewer/Proposal File and Associated Records", 59 Federal Register 8031 (February 17, 1994).

Public Burden. Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of your receiving an award. The public reporting burden for this collection of information is estimated to average 120 hours per response, including the time for reviewing instructions. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Gail A. McHenry, Reports Clearance Officer, National Science Foundation, 4201 Wilson Boulevard, Suite 245, Arlington, VA 22230.

The National Science Foundation has TDD (Telephonic Device for the Deaf) capability, which enables individuals with hearing impairment to communicate with the Foundation about NSF programs, employment, or general information. To access NSF TDD, dial (703) 306-0090; for FIRS, 1-800-877-8339.

The program described in this announcement is in categories 47.074 (BIO), 47.070 (CISE), 47.076 (EHR), 47.041 (ENG), 47.050 (GEO), 47.049 (MPS), 47.075 (SBE), and 47.078 (OPP) of the Catalog of Federal Domestic Assistance.

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