Integrative Graduate Education and Research Traineeship (IGERT)

What is it and why should we apply?

What have we done so far?

Why we would like your help!
What is IGERT and why should we apply?

Preliminary Proposal Due Date(s) (*required*):
April 29, 2004

**Full Proposal Deadline(s)** (due by 5 p.m. proposer's local time):
October 29, 2004
BY INVITATION ONLY

7th Annual Competition

U.W. has three. Urban Ecology, Astrobiology are two.

**Up to $3.0 M per award over 5 years**

A counter to:
“For goodness sake – just give money to good people doing great work!”
Synopsis of Program:

... to meet the challenges of educating U.S. Ph.D. scientists and engineers who will pursue careers in research and education,

... with the interdisciplinary backgrounds, deep knowledge in chosen disciplines, and technical, professional, and personal skills to become, in their own careers, leaders and creative agents for change.

... intended to catalyze a cultural change in graduate education, ... by establishing innovative new models for graduate education and training in a fertile environment for collaborative research that transcends traditional disciplinary boundaries.

It is also intended to facilitate diversity in student participation and preparation, and to contribute to the development of a diverse, globally-engaged, science and engineering workforce.
While the program is interdisciplinary the first reviews are done within traditional NSF Divisions and there has been considerable variation in how pre-proposals and proposals have been assessed relative to the detailed requirements.

Applicable Catalog of Federal Domestic Assistance (CFDA) Number(s):

• 47.074 --- Biological Sciences  
• 47.070 --- Computer and Information Science and Engineering  
• 47.076 --- Education and Human Resources  
• 47.041 --- Engineering  
• 47.050 --- Geosciences  
• 47.049 --- Mathematical and Physical Sciences  
• 47.078 --- Office of Polar Programs  
• 47.075 --- Social, Behavioral and Economic Sciences
Limit on # of Full Proposals: Invitation to submit a full proposal is based on merit review of the preliminary proposal. An institution may submit no more than two single-institution full proposals and, as lead institution with other participating U.S. institutions, one multi-institution full proposal.

Estimated Number of Awards: 38 - new and renewal awards, depending upon the quality of proposals and availability of funds

Anticipated Funding Amount: $30,800,000 Up to $3.0 M per award over 5 years, plus, for new awards, up to $200K additional in the first year for appropriate purposes, and up to $200K total per award for projects that include strongly integrated international research activities in years 2 - 5.
What is required in a proposal?

…. organize around an interdisciplinary theme involving a diverse group of faculty members and other investigators

The interdisciplinary theme provides a framework for integrating research and education and for promoting collaborative efforts within and across departments and institutions.

Students should gain the breadth of skills, strengths, and understanding to work in an interdisciplinary environment while being well grounded with depth of knowledge in a major field.

As an opportunity for faculty to experiment with new approaches to graduate education, the IGERT project should provide students with experience relevant to both academic and nonacademic careers.

Globalization of research and career opportunities places importance on providing students with an international perspective.

Equip students to understand and integrate scientific, technical, business, social, ethical, and policy issues to confront the challenging problems of the future.
Features of IGERT Projects

IGERT projects are expected to incorporate and integrate the following features:

A comprehensive *interdisciplinary theme*, appropriate for doctoral-level research, that serves as the foundation for traineeship activities;

Integration of the interdisciplinary research with *innovative graduate education and training mechanisms*, curricula enhancement, and other educational features that foster strong interactions among participating students and faculty;

An environment that *exposes students to a broad base of state-of-the-art research* instruments and equipment and educational tools and methodologies;

*Career development opportunities*, provision for developing professional and personal skills, *fostering an international perspective*, and instruction in *ethics* and the responsible conduct of research;
Program strategy and **plan for recruitment, mentoring, retention, and graduation of U.S. graduate students**, including efforts aimed at members of groups underrepresented in science and engineering;

Strategy and methodology for **formative assessments** of the project’s effectiveness by individuals internal and external to the institution and program improvements based on these assessments;

**Administrative plan** and organizational structure that ensures effective management of the project resources;

Plan for **dissemination** of innovative graduate education activities both within and outside the institution; and

**Institutional commitment** to facilitating and furthering the plans and goals of the IGERT project, to creating a supportive environment for integrative research and education, and to institutionalizing the successful elements of the project after NSF funding ends.
The Nine Requirements

interdisciplinary theme

innovative graduate education and training mechanisms

expose students to a broad base of state-of-the-art research

Career development opportunities, fostering an international perspective, ethics

plan for recruitment, mentoring, retention, and graduation of U.S. graduate students

formative assessments

Admin plan

dissemination

Institutional commitment
What have we done so far?

Started the Pre-Proposal – due April 29

Items a through g are limited to a combined total length of 7 pages

a. List of Participants (1-page limit):

b. Vision, Goals, and Thematic Basis:

c. Major Research Efforts:

d. Education and Training:

e. Management, Assessment, and Institutional Commitment:

f. Other Resources and Connections:

g. Recent Traineeship Experience and Results from Prior NSF Support

References Cited (1-page limit)

At the preliminary proposal stage, up to five letters of commitment or endorsement from the submitting institution or other organizations may be included.
We have come up with an interdisciplinary theme!

Biologists are now asking increasingly specific questions of more complex systems and attempting to explaining larger structures in finer detail.

Biology is fracturing as new and more specialized university departments are formed with their own graduate programs and undergraduate specialities.

Our concern is that in this new biology students are not well served by teaching that focuses on one level of biological organization whether it is the chromosome, cell, tissue, individual or population. Defining characteristics of each level are how they interact with other levels and students need to be able to bridge between them.
Vision, Goals, and Thematic Basis

Different levels of biological organization present similar challenges to understanding and important biological and mathematical themes transcend levels of organization and can unify biology.

*The New Mathematical Biology.* Just as developments in physics prompted numerous innovations in mathematics our desire to solve increasingly complex biological problems is spurring developments in the mathematical and computational sciences. This new challenge is posed by the extraordinary complexity and massive information richness of biological systems, contrasted with the relative simplicity of physical systems.
Biological Themes

Information

Networks

The environment

Mathematical Approaches

Nonlinearity and noise

Biological geometry

Model structure and inference
# Major Research Efforts

Must be a synthesis that supports our VISION!

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<tr>
<th>Networks</th>
<th>Hong/Carl</th>
<th>(a) Metabolic/Regulatory</th>
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<td>(b) Semantic</td>
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<td>Information</td>
<td>Carl/Hong</td>
<td>(a) Evolutionary processes,</td>
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<td>(c) Signal transduction</td>
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<td>Environment</td>
<td>Mark/David</td>
<td>(a) Acclimation</td>
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<td>Non-linearity</td>
<td>Hong/Mark</td>
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<td>Biological Geometry</td>
<td>Mark/David</td>
<td>(a) Invasion</td>
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<td>(b) Community structure</td>
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<td>Model Structure</td>
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<td>(a) Model identification and</td>
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The disciplines of mathematics and biology provide one of the greatest challenges to interdisciplinary study. Mathematics provides the language of general theory, biology is the study of variation. Our proposal for a New Mathematical Biology is interdisciplinary in the most fundamental way - it sets new challenges to both mathematicians and biologists. Mathematicians must be prepared to develop new techniques where they are needed and not attempt to shoe-horn new problems into an old technique. Biologists must seek the mathematical patterns in their subject that can produce illuminating generalizations and not simply rest on an empirical result.
From this inter-disciplinary co-teaching emerges a new way of practicing science. The teaching process itself, and in particular the process of seeking out connections and common threads to communicate effectively with those trained in other areas, becomes a vital component of the research effort. This is the experience that generates the inter-disciplinary mind - once gained there is no going back.

**Interdisciplinary Research Topics:**
across all biological areas, focus groups, student syntheses.

**Minicourses:**
senior students will present to people in other IRTs, web, “international” involvement.

**MathBio Seminars**
Why we would like your help!

Ideas to make this stick, and/or adjust it so that it does.

All we have looked at so far are the first three of the NINE requirements

We still have to consider:

Career development opportunities, fostering an international perspective, ethics

plan for recruitment, mentoring, retention, and graduation of U.S. students – started on a diversity plan with Johnella Butler

formative assessments

Admin plan – we do have a page of “stuff”

dissemination

Institutional commitment – Tom HAS made some promises!

All in 7 pages!

The Grad School, the “Reinventing” Project
Specifically!

Faculty who would like to participate

People who would like to contribute ideas

People who would be prepared to offer critical reading