2008 IGERT Project Meeting
Session VI: Technical Session
Materials, Physical Science & Nanosciences

PI Responses:

- **How to ensure IGERTs are leading the way on transformative interdisciplinary research?**
    - The five year time-scale was seen as being barely sufficient in making IGERTs truly transformative.
    - Creation of interdisciplinary courses that leverage existing research collaborations between different science units was seen as a key first step in building infrastructure to support interdisciplinary research. This new collaboration on curricular issues has improved existing collaborations, built new ones and increased the body of potential students.
    - Continuation of these successes, especially when multi-institutional, is a point of concern. Cross-department and/or cross-institutional appointments were seen as being a good route.
    - Co-advising of students is seen as being sometimes effective and sometimes not, and is highly dependent upon the faculty involved.
    - Develop strategies to alleviate conflicts that arise from the differing expectations and standards of disciplinary and interdisciplinary training.

- **How to optimally integrate interdisciplinary research and education?**
    - This is of course the point of the IGERT funding, which is to figure out how to navigate this route. Lab rotations are seen almost uniformly as being excellent ways of doing this, though the faculty involved must be carefully vetted.
    - Taking courses/modules that lie outside of the students specific disciplines is another avenue. In one inter-institutional IGERT, lab courses at each participating institution, with a mixed student body, led to informal research collaborations between students and different institutions.
    - Involving students in teaching interdisciplinary courses that incorporates the students' research activities, and/or developing a central hand-on laboratory that emphasizes a broad range of key scientific skills, builds a collaborative community.

- Using students as the links in creating research networks amongst faculty was seen as a general key to success.

- **How has globalization of interdisciplinary research in your topic area had an impact on graduate education and research?**

    - International training activities and collaborations have increased the research and training possibilities for trainees, and has led to a reverse information flow from foreign research institutions and companies to American institutions. This was seen as being a very positive experience for students. We encourage NSF to continue to actively support and fund such international activities within IGERT programs.

    - To build partnerships, American institutions need to have resources to bring to the table, and that this will induce international parties to also substantively support these activities. Some felt that such international training was not useful for a graduate student in his/hers first two or three years of training.

    - International workshops, combined with prior cultural training, were also seen as being very positive.

- **What are the career opportunities for Trainees, and how are Trainees being prepared to be successful?**

    - Career opportunities for IGERT students are very diverse, with students in multiple IGERT landing jobs not only as university faculty, but also in non-traditional careers, such as patent law, intelligence agencies, K-12 teaching, and start-ups. One student who became a faculty member felt that her interdisciplinary training was actually a disadvantage when trying to land a job in a disciplinary department. This concern was generally echoed by the participants, especially with regards to traditional disciplinary fields such as physics.

    - The soft skills that are part of many IGERT programs were seen as giving a strong advantage in students pursuing their career goals.

    - National labs were seen as being very supportive in hiring and training of such students. IGERT students sometimes finish more quickly simply because they have jobs lined up.

- **What role does the interdisciplinary research in your topic area play in recruiting and retaining a diverse group of trainees? (Please think: Broadening participation)**

    - An IGERT at an HBCU found that funding had a tremendously positive effect in attracting and recruiting students to the program. The fellowship support levels were seen as attractive, as was the possibility of working at other institutions, having internships, and attending international workshops and training. Another positive aspect was being able to attract a broader base of students, across a range of disciplinary training. Indeed, this success was had as the students felt they had a quicker and better career path. There has been success in attracting and retaining women, but the results seem mixed in recruiting with minority students, with some feeling that the IGERT was decisive in helping, and some not seeing much of an effect.

    - We recommend that consideration be given to how IGERT programs act to increase the body of diverse and under-represented trainees, so that one is not merely increasing competition over a fixed pool.

    - One advantage of the IGERT was that it provided a degree of latitude in providing students with soft-skills training and industrial and extra-institutional opportunities. The level of support also attracted students who have a mature point of view and personal obligations, which were seen as being very positive contributions to the goals of IGERT.

- **How can the IGERTs in this topic area collaborate or cooperate to further the goals of each IGERT?**

    - Having meetings that are more regional amongst topical IGERT groups, and using new collaborative tools, such as grid access, or simply workshops, are seen as mechanisms to bring the groups together.

    - The group was very supportive of having rotating summer workshops, or facilities training at NSF centers, or symposia, attended by IGERT trainees, especially if organized by them, and with participation across the topical groups. This will lead to networking by the students through research collaborations and shared training.

    - Access Grid was seen as a great follow-up tool rather than an initiating tools for such activities.

    - One suggestion was to have an additional meeting at the annual meeting, but where the time is unstructured and allows for informal discussion amongst the PIs. Having such "break-out" sessions that are not necessarily topically oriented, but focus on issues such as recruiting.

- REUs are seen as being a crucial accompanying activity that will further IGERT goals. Experience has shown that such students attend graduate school in high numbers, and so furthers the IGERT goal of increasing the available pool. One specific suggestion was to supporting REU programs where students spend summer time shuttling amongst IGERT sites where they are exposed to the research and training activities of these differing programs. To further this, it is important that information concerning the different IGERT programs be gathered for distribution to REU programs.

- **PLEASE feel free to add any other questions you wish and provide your input!**

Trainee Responses:

- **How to ensure IGERTs are leading the way on transformative interdisciplinary research?**
    - Have IGERTS present their research to each other for interdisciplinary feedback
    - Encourage (not force) research collaborations between fellows
    - Hold interdisciplinary seminars/classes
    - Use internships as a means to encourage interdisciplinary research, especially outside academia (eg: National labs, industry)
    - Increase visibility among departments within a given IGERT program
    - Encourage collaboration across fields in grant applications

- **How to optimally integrate interdisciplinary research and education?**
    - Similar to the first point, hold interdisciplinary activities amongst the IGERT fellows
    - Coursework can be a great attribute of an IGERT, but it can't be an afterthought. At the same time, must be careful not to make IGERT workload overbearing.
    - Weekly seminars of various sizes have had mixed results.
    - Incentives for outreach activities so PIs are encouraged to help establish sustainable outreach programs for students
    - Connect other NSF undergrad programs to the IGERT trainees for mentoring

- **How has globalization of interdisciplinary research in your topic area had an impact on graduate education and research?**
    - The program provides more exposure to other labs by funding research experiences in other labs and access to international/domestic conferences that the PI may not have been able to fund
    - The interdisciplinary aspect of the program makes the fellows more attractive to the potential host institution

- The interdisciplinary aspect of some of the programs has allowed fellows to take classes at other universities either by travel to those proximally or via video conferencing
- Globalization of interdisciplinary work has made it easier for researchers to "catch up" to researchers in other countries that are higher up on learning curve in specific topic.
- Following topic-specific literature made easier and more difficult (in terms of quantity, quality, and availability of publications)
- Brings up issues regarding copyrights and IP.
- With the increasing collaboration internationally the rate of research has significantly changed
- Travel VISAs for visiting researchers has become much more difficult with DHS rejecting more and more people even from EU countries for seemingly illegitimate reasons

- **What are the career opportunities for Trainees, and how are Trainees being prepared to be successful?**
  - Trainees have learned out career opportunities that they otherwise wouldn't have known about
  - Broader knowledge-base makes the fellows more attractive to potential employers especially in industry settings
  - PhD is more valuable (in terms of job flexibility and market) in some physical science areas than others.
  - In job search for jobs within specific area of depth, IGERT experience can be the "icing on the cake". IGERT experience also gives trainee better shot at jobs traditionally outside of area of depth.
  - Collaboration and networking skills are valuable for career advancement
  - Increase network among faculty from various fields for Post-docs, jobs, etc.
  - Increases adaptability in research projects by requiring students to work in fields outside of direct expertise. Valuable job skill.
  - Provides initiative to start independent projects outside of expertise which would otherwise seem impossible
  - Prestigious fellowship is good for resume or CV.

- Inherent nature of IGERT encourages outreach activities and fosters leadership skills.

- **What role does the interdisciplinary research in your topic area play in recruiting and retaining a diverse group of trainees? (Please think: Broadening participation)**
  - Some programs mention that to prospective students that they would be able to work with/learn from people in other departments, interactions they might not otherwise have
  - Outreach programs through IGERT, especially to diverse communities, create exposure to prospective students K-12
  - Retention and recruitment of IGERT trainees could be increased in some programs if they weren't overburdened with multiple extra credits

- **How can the IGERTs in this topic area collaborate or cooperate to further the goals of each IGERT?**
  - Retreats with similar IGERT programs with topic specific and related poster sessions/talks
  - More inter/intra-university IGERT communications
  - Encouragement of internships between IGERT programs
  - Make funds available for traveling between IGERT programs
  - IGERT alumni database
  - Website to share information regarding various physical science IGERTS
    1. Video clips
    2. Student websites/Facebook
    3. Student section access grid

- **PLEASE feel free to add any other questions you wish and provide your input!**
  - Course requirements in some IGERTs should be less rigorous or the trainee should at allowed to audit
  - Potential for equipment sharing should be available

- IGERT trainee rotation, enable trainees to visit other Physical science sites to familiarize students with both research and IGERT logistics
- Standardize course, funding, travel funding, and funding lengths between programs