

SD-IGERT Annual Assessment Report May 2014  
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Notes from IGERT student interviews

BENEFITS/OPPORTUNITIES/DRAWBACKS/CHALLENGES OF IGERT PARTICIPATION

The financial benefits of IGERT participation was a benefit that was mentioned several times. In two cases, financial assistance was gratefully provided through IGERT for costs associated with presenting at a conference for one student and for another, financial assistance was provided for attendance at a symposium in Kentucky. One student made a point of noting the substantially greater stipends provided through this IGERT as compared to the stipend this grad student received at another university.

One student mentioned the advantages of “getting to do research with other disciplines.” The student reported that it helped him understand the engineering mind – “understanding what [the engineers] like to hear and what they want as information.” In the same vein, one student said he was looking forward to his rotation in the fall [to School of Mines]. ‘It seems that you get access to a bunch of different facilities and different professors. [And access to] a lot of different instruments that we don’t have at this university. I can take advantage of what they have – their strengths.”

Another individual also mentioned the interdisciplinary rotation: “...took a class from an organic photovoltaic professor. My research involves both organic work and calculations of nanoparticles. [It was good] to learn and to be able to work independently.”

For another student “the major asset for me was coordinating outside speakers for presentations to the IGERT students.” A second student also mentioned outside speakers and reported that he thought that the outside speakers invited to speak at IGERT meetings were a definite advantage.

One observation made by a member of the group was that “research isn’t the only thing we need to do. We need to understand how to communicate with each other and get together and talk about our research.”

All seemed to agree that there were many benefits of participating in IGERT.

An IGERT student who has not yet done a rotation observed that the outreach activity she was involved in is “having a really big impact on my life.” She and some other students were involved in teaching a two-semester chemistry course at Nebraska Indian Community College. The impact on her came from gaining understanding of “the challenges and barriers the [Native Americans] have to their education...understanding why they are not coming to class...the type of situations they have at home...I didn’t dream.”

Drawbacks/challenges mentioned: One student noted, “Nothing major, I would say.” But he also noted that “the monthly group meetings can get kind of competitive – or kind of fall apart....though better this

year.” It was a drawback for one student to have to attend IGERT meetings when the speaker was a “professor that we already knew. We were forced to be there but we were not gaining anything.”

One individual mentioned that he felt that his professor was not providing him a strict critique and wasn't sure if he was really doing a good job or if the professor was favoring him by not being as critical as he was of other students.

One challenge that seemed to be felt by many, if not all, was the time crunch. A couple of students reported that some advisors/professors expected them to continue the research work that was being done under his/her professor's stewardship during the student's rotation at another location – and that this expectation made it really very hard on them. “[My professor] wants me here all the time.” The student who made the last observation also reported that he was interested in doing an internship at the National Renewable Energy Laboratory, and, in fact, had made an introductory connection with an investigator who worked at NREL “who does water-splitting, photo-electric chemistry: John Turner.” He reported that he had mentioned his desire “several times” to his professor but that “it has kind of fallen on deaf ears.”

Another student later observed that he thought that: “One of the biggest barriers for IGERT students in South Dakota is to [be able to] get this National Lab experience. I was just lucky enough to get this experience through my advisor, who had a connection with someone in a National Lab – because it wasn't through IGERT that I had this great opportunity. It would be very beneficial to every IGERT student to get to go to a National Lab.”

Another student responded: “I think that potential is built in to the IGERT program but you have to do most of the work. You have to find a National Lab, you have to find the connection.”

The first student preferred to make a point: “The connection isn't already there between the IGERT program and a National Lab.”

## COLLABORATION WITH OTHER STUDENTS/INVESTIGATORS

A sample of student comments:

“I work with other students in my group....Also collaborate with Professor Killian doing some calculations on silicone materials....and with Professor Fan and one of his post-docs.”

“I collaborate with different members of my group doing different analysis with the water-splitting.”

“I've worked with a lot of individuals over the years....I [also] got to go to the NASA Ames Research Center as a visiting scientist a couple of summers.” The experience was reported by this student as a great opportunity, partly because he could continue the very same research work that he was doing with his USD professor, a big advantage in his eyes.

A different student reported: “I've collaborated with someone from a National Lab.”

All IGERT students seemed to have experienced ongoing, meaningful collaboration. In conversation, many referred to “my group’s work” or “collaboration with \_\_\_”.

#### ACCESS TO APPROPRIATE RESEARCH INSTRUMENTATION

Most IGERT students reported they had access to the research instrumentation they needed:

“I have access to the instrumentation I need or know where to find it.”

Another student observed, “Between the TEM, our Single-Crystal XRD, our Powder-XRD, and our upcoming SEM, I think we’re pretty well covered on a lot of the bases for our research.... We have such close ties to Mines and State.... Our close ties and collaborative work would help us get done the things we needed to.”

“As far as computing resources, we have a very nice facility on campus, but if I ever need anything more we can have access to the nurse computing center at Lawrence Livermore Lab. We previously had a grant to work at the EMSL Lab in Washington. We just recently got a new NMR machine that has been very helpful to my group’s work.”

One student has a wish list for an XPS – apparently a very expensive machine and one that administration has attempted to procure through collaboration with other groups. This student understands it is a “challenge.” And “upwards of 1 million dollars” to get. But one of the “key characteristics” in his research “could be ascertained if we had one.”

An IGERT student from SDSU is “using a handheld device so it has some error to it. But when I go to School of Mines, [for his rotation] it will all be automated – so I’m looking forward to that.”

#### WORK WITH OR AT A NATIONAL LAB

Student comments:

“Collaboration with a National Lab [the nurse computing center at Lawrence Livermore Lab and also the EMSL Lab in Washington] has made it easier to do more calculations more quickly because we can put it on many more processors. The biggest benefit is that access to a National Lab has expedited my work within the groups I collaborate with.”

“The biggest benefit for me was I actually got to go to a National Lab for three different summers and learn from those scientists that were high up in their positions: to see how these established scientists do their work, how they present their work, and how they talk with other individuals about the research work. Because one of the biggest difficulties for scientists is to get their work to the public – to explain to the general public what is the importance and what is actually happening in the research and how it benefits the general public – where this work is important to them. So the biggest benefit for me is to see how these established scientists communicate with each other and with the general public.”

This last student valued the National Lab opportunity enough to say that he believed that it would be a great benefit for every student to have the same opportunity.

#### USE OF THE ACCESS GRID

The students use the Access Grid as another tool in their learning experience. According to them, the Grid is used for IGERT meetings once a month, for classes, and for their committee meetings when they defend their proposals. One negative associated with the Access Grid is that, according to one student, "Sometimes the classes on the Access Grid were not known to me."

#### OTHER DISCIPLINES INVOLVED IN ADVANCING EACH INDIVIDUAL'S RESEARCH

The IGERT engineering students reported that they both apply some chemistry to their work. "A lot of what I do is chemistry based." Another student who had a different vantage point saw his interactions with various disciplines as "bringing together people...as parts of a puzzle that come together.... The synergy, I guess you'd call it."

#### BENEFITS/ OPPORTUNITIES/DRAWBACKS/CHALLENGES TO INTERDISCIPLINARY ROTATIONS

No matter which discipline the IGERT student came from, the biggest benefit for most seemed to be that the interdisciplinary rotation provided a greater understanding of the engineering mind or of the chemist's mind – and also a greater respect for the expertise at which the chemist could do chemistry or the expertise at which the engineer could design and apply the research other disciplines engaged in. Some who had not yet done a rotation were looking forward to new professors and new facilities.

The biggest drawback for one student "was getting the approval or finding the right people to do the research needed at the other location." He explained one has to go through "a lot of political stuff." Students have to get approval – and training – to use the professor's instrumentation, which takes "two days or three days to get approval to use that single instrumentation. Training must be gotten even if "you know how to do it... [so your name] is on a list to say you're OK to use that instrument."

Another student responded that rotation "takes you away from what you are doing." But he admitted that "I guess it's supposed to take you away from what you are doing. But it's hard to step away from – comfort."

#### ORIENTATION TOWARD COMMERCIALIZATION – OR NOT

One student observed: "There's two schools of thought on [commercialization]. A lot of engineers say you have to have a purpose for [your research]. It isn't anything unless there's an application and goal in mind. As chemists, we're interested in how it's happening and why it's happening without necessarily [knowing] the application process.... We know this is going to help something, but we don't know what."

A different student seemed to agree: "I'm just happy exploring fundamentals."

But a third student said that commercialization was the "drawing card for me to come here. It's a big deal for me." But this student also said he did not want to go into industry.

A couple of students wanted to continue research – perhaps in an industrial research center – though the opportunities were "sparse."

Another student responded: "I identify with the commercialization goal. I want to develop things that are practical."

#### PROFESSIONAL GOALS/POSTDOC WORK AFTER RECEIVING DEGREE

Following are the responses to this question: "What type of work do you want to do after obtaining your degree?"

"Meaningful. I plan to look at companies that can directly benefit mankind."

"My goal as an engineer is to help make us better stewards of the resources we have on earth.... I would like to get an internship with industry. Industry is my number one choice. I think a National Lab would look great, as well, but industry would be better for me, I think.... Networking may be pretty important for me, I'm realizing."

"I'd like to stay and do something related to solar energy utilization or conversion. Strongly considered doing a postdoc fellowship. Or do a postdoc fellowship in battery technology. I don't really want to go into industry....but I'll do just about anything. My first choice would be a postdoc fellowship. My second choice would be a teaching position. The third would be industry.... I am also interested in an internship at National Renewable Energy Laboratory...in water-splitting and photoelectric chemistry."

"My main goal is to make science important to the younger generation.... I want to get a job where I can give back to the community. I want to do outreach stuff but at the same time I want to do research." He said that the research stimulates his imagination so he can give back better.

"My goal, at some point, is to be a professor. I'd like to do a postdoc fellowship and would like to transition over to more on the biophysical side. I'd like to understand more how drugs interact with cell membranes and receptors. I'd like to continue research but also be able to interact with kids about my research. I would like to help people out."

"I agree that whoever offers us a job may be the way to go. Truly, though, I'd like to go into industry." The IGERT speakers, who have been from industry, have been "very beneficial to me.... My first preference is industry, second would be teaching, and third would be academia. I would like to do an internship."

## Summary

All of the IGERT students interviewed exuded the theme that one student verbalized when asked about drawbacks/challenges of the IGERT program. “Nothing major, I would say.” All seemed grateful and happy with the program. Financial assistance was acknowledged as being very beneficial but experience provided by the interdisciplinary rotations was also acknowledged as well as the outside speakers who spoke at IGERT meetings and who were scheduled by the president of the IGERT student group. Outreach activity was reported by one student as having a “big impact on my life.”

All seemed focused on and stimulated by the research they were doing. All seemed able and pleased to work independently and all seemed to have experienced ongoing, meaningful collaboration and also all seemed pleased to collaborate with their group or groups. In conversation, many referred to “my group’s work” or “collaboration with \_\_\_\_.” As one student put it, “Like we’ve been saying the whole time, our research is really based on collaboration.” Another student characterized his three summers at a National Lab as a great opportunity - and not as an internship but as one where he was more like “a visiting scientist.” That characterization, the evaluators believe, likely reflects the attitude he has gained from his experience within IGERT and the way he is treated by the professors who are guiding his research.

One student observed that his IGERT experience gave him the insight that “research isn’t the only thing we need to do. We need to understand how to communicate with each other and get together and talk about our research....One of the biggest difficulties for scientists is to get their work to the public....to explain [to them]what is actually happening in the research...and where this work is important to them.”

Challenges/drawbacks reported by the IGERT students included having to attend IGERT meetings when the speaker was a “professor that we already knew” because “we were not gaining anything.” Another challenge, mentioned by a couple of students, was the amount of work to do and the seemingly little time to do it. It was also reported it was really very hard that some professors expected them to continue to do the research work planned for them even while they were away from campus doing their rotation. “My professor wants me here all the time.”

Another barrier to the IGERT program, as seen by a participating individual, was that the option of experiencing three summers of work at a National Lab was happen-stance for him and not a connection made by the IGERT program but by his professor. He was of the opinion that “it would be very beneficial to every IGERT student to get to go to a National Lab” though he also acknowledged that it was quite advantageous that he was able to do the very same research work at the National Lab that he did on campus.

One individual mentioned he felt it was a drawback for him that he wasn’t sure if his professor’s lack of providing a strict critique was due to his good work or if the professor was unjustly favoring him over other students who were more harshly criticized.

One IGERT student lamented that, “Sometimes the classes on the Access Grid were not known to me.”

All the students said that they had access to appropriate research instrumentation. “I have access to the instrumentation I need or I know where to find it,” was the way one student put it. Access to appropriate instruments is apparently partly due to the “close ties” and “collaborative work” between the three participating regental institutions in South Dakota. The students report that it is not uncommon for them to go to another campus to use an instrument or for someone from another campus to pick up a sample and do the required measurement/analysis for them.

The Access Grid is another collaborative tool for the students to use. According to them, the Grid is used once a month for IGERT meetings, for classes, and for proposal defense with his/her committee so the “fifth member of the committee [located on another campus] doesn’t have to travel.”

At least half of the IGERT students have collaborated with a National Lab or worked at a National Lab. One of the students worked at a National Lab for three summers. All the students who experienced National Lab work seemed to benefit from it and value it very highly.

The interdisciplinary rotations seemed to have both benefits and drawbacks for the IGERT students. The biggest benefit for most was that the rotation gave them an understanding of how those involved in another discipline used their knowledge, what kind of information was expected by that discipline – a greater understanding of the engineer’s mind or of the chemist’s mind. The experience also seemed to provide a greater respect for other’s disciplines. “I came to appreciate that [chemistry] is black magic and the work should be left to chemists.” The engineering student’s work was interdisciplinary -- both applied chemistry to their work. “A lot of what I do is chemistry-based.” Those who had not done rotations were looking forward to new professors and new facilities.

The biggest drawback, according to one student, was the “political stuff” he had to go through to gain access to the instrumentation needed to do his planned research activities. Approval and training are required from each professor, who rules the required instrumentation, that takes “two or three days to get approval to use that single instrumentation.” According to him, training is required even if you are quite familiar with the instrumentation - so that your name appears on a list “giving you the OK” to use the instrument.

Another individual responded that rotation “takes you away from what you are doing.” But he admitted that “I guess it’s supposed to take you away from what you are doing. But it’s hard to step away from – comfort.”

Possible commercialization of the research undertaken by the students seemed a high priority for some but, for others, it was not a goal. One student said, “I’m just happy exploring fundamentals.” Another agreed. “We know [our research] is going to help something, but we don’t know what.” However, a third student said that, though being employed by industry was his third choice, the focus on commercialization “was the drawing card for me to come here.” A couple other students seemed to agree with the goal verbalized by another individual: “I want to develop things that are practical.”

The post-doctorate goals of the IGERT students interviewed varied from post-doctoral fellowships or internships with a National Lab – continuing to do research – to internships or positions with industry, to an eventual professorship. Several listed as their first or second choice, a teaching position. A couple of the students seemed to feel that “whoever offers us a job may be the way to go.”

It was noteworthy that a majority of the interviewed students wanted to do meaningful work, to give back, or to do outreach work with kids.

All seemed not to want to give up their research. Many verbalized that they expected research to be part of their life’s work.



## Recommendations

### **Continue the IGERT program largely as it is now.**

Based on the evaluator's observations and interviews of six of the IGERT students, the program is quite successful. The students are appreciative of the interdisciplinary approach and focused on their individual, but collaborative, research. They indicate that they have good support from the participating professors. Several students reported they were appreciative of the collaboration with or work at a National Lab. All agreed that they had access to the appropriate research instrumentation with the exception of one whose wish list included a million-dollar XPS.

### **Stress to professors/advisors that it is a hardship on students to expect them to continue the research work at the home campus during the time the student is doing a rotation at a different campus.**

It would seem to the evaluators that this expectation is perhaps defeating the purpose of the interdisciplinary rotation. While a continuation of the expected research work at the home campus may benefit the advisor, it may not benefit the student.

### **Consider trying to make more connections with National Labs for summer work opportunities – or internships – for IGERT students.**

Students seemed to highly value their interactions with scientists at National Labs and greatly benefit from them.

### **Evaluate the way the schedule of classes offered over the Access Grid are communicated to students.**

One student lamented that he did not know about a class offered over the Access Grid. This situation may or may not be the student's fault.

### **Encourage IGERT students to continue to do outreach work.**

One student was especially grateful that she had done some outreach with Native Americans. She reported that it had a large impact on her life. Other IGERT students expressed interest in doing outreach after receiving their degree.

### **Consider trying to develop a post-doctoral fellowship program that will financially assist post-doc students and lets them continue their research.**

Several IGERT students expressed interest in trying to obtain a post-doctoral position. One student reported that he could do post-doc work with one of his professors, but only if "I brought my own money."

### **Stress to the President of the IGERT student group that outside speakers are highly valued by the group whereas, seemingly, local professors are not valued so much.**

The evaluators believe that this attitude is known as "the grass is always greener on the other side of the fence." However, one student commented that because she'd like to go into industry, the IGERT speakers, "who have been from industry, have been very beneficial to me."

**Consider trying to develop internships with industry for IGERT students about to graduate.**

Several students (three or four) expressed interest in an internship with industry. However, the evaluators recognize (and so do the students) that developing meaningful internships for IGERT students may be extremely difficult because of the rural nature of South Dakota. One student observed, “The distance factor is difficult. Minneapolis is probably closest place where I could find an internship – maybe Omaha – but I don’t see many opportunities that I would be interested in and are close to this area. So it’s difficult to try and relocate for a few months and then come back.”