

Main points

#1 It's useful to provide students with a "big picture" overview (e.g. a future clinical application, kick-off meeting between all group members). Continual updates for students are necessary.

#2 INTRA-group communication was slow to develop during first year. Suggest that PI take classes from other PIs to get better understanding of neighboring fields. However, many noted that this is not entirely practical for time and distance reasons. Can we expect PIs to deeply understand collaborators' fields before research begins?

#3 Communications Officer: can we appoint students or co-PIs whose focus is facilitating the collaborations?

#4 Students do bear all of the risk – if it doesn't work do we have a 10-year PhD? Biology is difficult and the timelines are longer than that for a typical engineering degree. So we must take time to really look at failure and try to *continually* define what success will look like.

#5 Journal of Negative Results

Big Positives – How has EFRI changed your life?

#1 Project has improved student independence and confidence in expertise.

#2 We now have a new set of contacts/collaborators who are now colleagues and friends

#3 We now know a great deal about fields that are completely unrelated to our degree fields.

#4 We have seen evidence that is really is okay to dream big and aim for paradigm-shifting discoveries. The optimism and excitement generated from these projects is fantastic.

Questions

1) If you were a PI, what would you do to maximize the potential of success of the EFRI program?

PI must be a communicator who can enhance the collaboration between multiple groups/universities/members. Having such a PI is a tremendous strength.

It's useful to provide students with a "big picture" overview (e.g. a future clinical application, kick-off meeting between all group members)

Some had good kickoff meetings, but some found their kickoff meetings fractured – the individual directions may not have been properly conveyed to students, which led to confusion. Students need to see more than their own focused topic.

Initial phases can be overwhelming for few new grad students.

INTRA-group communication was slow to develop during first year. Suggest that PI take classes from other PIs to get better understanding of neighboring fields. However, many noted that this is not entirely practical for time and distance reasons. Can we expect PIs to deeply understand collaborators' fields before research begins?

PIs need to convey to students that they know HOW to conduct research but don't know the solutions to the problems proposed for EFRI. It's useful when PIs let everyone know that any initial confusion is to be expected because we don't clearly know where we're headed.

In order to promote interdisciplinary research, it is necessary to come up with a common language so that students can communicate their ideas. Lab visits and externships are important in this process.

There must be a significant outreach and guidance to help grad students work between groups. Others disagreed that perhaps it is useful to allow students the leeway to find their own way – this may help students begin to become PIs themselves.

2) As a student, how have you benefited/hope to benefit from involvement in the EFRI program to date?

It was beneficial for student to be involved in the crafting of the original EFRI grant proposal because it helped student understand big picture and also helped direct thesis development so that EFRI was not "just one of the many objectives" of some sort of overwhelming thesis project. Students really need to see the entire puzzle and know how their piece fits into it all.

Student is concerned that research tends to overly focus students' knowledge, but EFRI provides the benefit of giving student both depth and significant breadth which will be useful for future work.

Tool sharing, construct sharing, and expertise sharing with people working on similar facets of project are very useful.

Question was posed: Did students feel like their funding was contingent on getting the EFRI? Did the EFRI provide students with the opportunity to see some of the nitty-gritty of grant writing, project planning. – Some said not at all, others somewhat yes.

The prospect of failure is not addressed and we'd benefit from confronting the possibility and starting to define what failure actually would be. If the risk of failure is high, it's necessary to look more deeply into your goals and metrics of success.

Students do bear all of the risk – if it doesn't work do we have a 10-year PhD? Biology is difficult and the timelines are longer than that for a typical engineering degree.

Student wants research progress to occur throughout the project, instead of all at the end. For a student in a PhD program, it would be a benefit for incremental results to come out so that the thesis can take steps forward.

If EFRI is a side project (not the main goal of a students' thesis), how can student contribute to setup and data collection as a way to get funding but also be able to leave before the end of the 4-year timeline. Can EFRI provide enriching experiences for students without being their sole thesis goals?

It would benefit students to explain actual applications of their EFRI technologies. Who will deploy these technologies? Is there an EFRI implementation plan? RESPONSE: One group was able to get a consultant on board to give input about feasibility of various ideas for broader implementation.

3) Do you have recommendations for how to strengthen the student experience in this program?

Can NSF help EFRI students find internships? Future career development assistance or guidance from NSF would be valuable for giving students experience in applying what they learned during their EFRI research.

Having experts involved in project is necessary to guiding students and helping out.

Again, student exchanges are very useful and students seem excited about the prospect of getting to visit other labs to broaden their experiences.

Communication is a big issue. For some groups students felt this communication is working quite well, but if communication were not good, then it would be a big problem.

Make EFRI students aware of other EFRI students nearby for support, issue discussion, sharing concerns.

How can inter-institutional collaborations really be successful without personnel exchanges?

RESPONSE: teleportation.

Would an EFRI leadership council be beneficial? RESPONSE: an online EFRI forum could be really useful for sharing techniques for research and techniques for collaboration improvements. Additionally, we could appoint students or co-PIs whose focus is facilitating the collaborations.