Biology
Research Experiences for Undergraduates

Principal Investigators Workshop

April 10 – 12, 2014

Bio REU Leadership Committee

2014

National Science Foundation
WHERE DISCOVERIES BEGIN

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Executive Summary

A workshop for principal investigators of Research Experience for Undergraduates (REU) Sites funded by the Biological Sciences Directorate at the National Science Foundation was held on April 10-12, 2014 at the Holiday Inn Rosslyn in Arlington, Virginia. The workshop was held to bring principal investigators together to network, share best practices and to provide the Leadership Committee with feedback to inform the development of recommendations to funders about how the program might be improved. The workshop theme was "Using Evidence-based Approaches to Enhance and Strengthen the REU Experience."

In attendance at the 2014 workshop were 145 representatives from REU site grants, several representatives from the National Science Foundation and four plenary speakers. Activities included a poster session, a presentation by NSF program officers, three plenary talks with follow-up small group discussions, several "How To" sessions that addressed common issues faced by REU Site directors and networking meals. This report includes detailed summaries of the presentations and discussions held at the workshop.

Based upon the feedback received during the workshop, the Leadership Committee has identified three general areas, presented here as recommendations, where investment could potentially improve the impact and effectiveness of REU Site programs. These recommendations provide guidance for all stakeholders, including but not limited to the Leadership Committee, interested in identifying actionable items to improve the nation's capacity to support STEM training through undergraduate research opportunities.

Recommendations

1. Pursue opportunities to better understand the impact and value of undergraduate research learning experiences, including understanding the effectiveness of varying strategies within and across different demographic groups of students.

2. Identify and disseminate effective strategies to reduce the costs and increase the efficiency of administering REU Site programs.

3. Develop a collection of resources that enable REU Program Directors to improve their programs.

The Leadership Committee

The Bio REU Leadership Committee (LC) was established following the 2007 Bio REU PI workshop. Its mission is to promote an active and diverse undergraduate Biology research program. The LC plans and hosts the Bio REU PI workshops; compiles and disseminates "best practices" and resources for REU program development and implementation (e.g., common assessment tool, Responsible Conduct of Research resources, mentor training resources); compiles and disseminates data about REU students; and develops and maintains a web site with information for current and prospective REU Site directors (www.Bioreu.org).

Bio REU PI Workshop History

The 2014 workshop was the fifth workshop held for Bio REU PIs. The first was a combined REU and UMEB PI meeting, which was held September 24-26, 2003 at the National Science Foundation (NSF) and hosted 140 participants and practitioners. The second, held in March 2007 hosted 133 Bio REU PIs and 10 speakers and was also held at NSF. As a result of the March 2007, the Bio REU Leadership Committee was established and has assumed responsibility for planning and hosting the PI workshops since. In 2010 the LC hosted a workshop for 149 REU program representatives and 10 speakers that focused on the American COMPETES Act (Responsible Conduct of Research and Assessment). In 2012, the workshop hosted 128 REU program representatives, several speakers, who were also PIs, and focused on assessment, strategies for enhancing and sustaining REU programs and training in the responsible conduct of research.

2014 Workshop Overview

Goals

All workshop participants will:

- develop concrete ideas, strategies and plans to incorporate evidence-based practices into their REU programs
- deepen their understanding of NSF's expectations for operation of programs, including expected changes in the pipeline (e.g. funding, assessment, demographics of participants)
- have opportunities to provide the Leadership Committee with feedback on how well the program is working

New PIs will:

- become oriented to the relationship between programs, the NSF and the Leadership Committee
- develop a better understanding of what are considered "best practices" for REU programs
- have opportunities to have their questions answered and to meet experienced colleagues to whom they can turn for guidance and advice as they launch their programs

Objectives

Workshop activities were designed to provide PIs the opportunity to:

1. **network** and **share** best practices
    - Venues: poster session, welcome dinner and lunch, "How To" panels and workshops

e.g. recruitment, logistics, mentoring, enrichment activities, assessment, tracking, etc.

2. **learn** about educational research findings on student learning and student development in undergraduate research experiences
    - Venue: plenary talks
        i. Overview of documented benefits of undergraduate research experiences (Cliff Poodry).
        ii. Research on mentor cultural competence: training and impacts (Angela Byars-Winston & Christine Pfund).
        iii. Research on the development of science identity (Mica Estrada).

3. **translate** the research findings **into practice** in their programs to improve the student experience
    - Venue: plenary follow-up discussions
        i. How can I use what I just learned from the plenary talk to improve my REU program?

4. **provide feedback** and **recommendations** to the Leadership Committee and Bio-funded PIs;
    - Venue: all sessions
        i. Consider, share and document feedback and recommendations

Activities

Networking Dinner - Workshop participants met one another and shared experiences and best practices around common interests.

Poster Session - Workshop participants presented posters (Appendix 3) highlighting the best features of their REU programs to share best practices and models.

Plenary Talks - Speakers shared research findings (their own and others) about what is known about student learning and student development in undergraduate research experiences.

Plenary Breakout Discussions - Using discussion questions provided by the plenary speakers, workshop participants discussed how to translate what they learned in the plenary talk (research findings) into practice in their programs.

"How To" Sessions - Experienced/Expert PIs shared their best practices and identified evidence from the literature or their own program evaluation data to support their practices.

Workshop participants volunteered to take notes at each plenary discussion and "How To" session. In addition to capturing the main points of the discussion, they recorded feedback and recommendations for the LC generated by the group.

2014 Workshop Notes and Summaries

NSF Updates

Dr. Sally O'Connor, Program Director

Dr. O'Connor presented an overview of the results of BIO REU demographic surveys that have been conducted by NSF interns for several years, an overview of program wide REU initiatives, tips for renewing REU Site grants, and information about supplements to REU grants.

National Science Foundation interns have been collecting survey data from REU Site PIs about their programs since 2006. The data show a steady increase in REU Site applications from an average of 129 applications per site in 2006 to 224 per site in 2013 and a resulting decrease in acceptance rate from approximately 31% in 2006 to 17% in 2013. The gender of participants has remained relatively steady at 60 – 65% female, while the percentage of underrepresented minority students (Hispanic/Latino(a), African American, Native American, Pacific Islander, persons with disabilities) has increased from approximately 42% to 51%. The academic level of REU Site program participants over this time period has remained relatively constant with approximately 55% just having completed their junior year, 30% their sophomore year and the remaining their freshman year. The vast majority of the students (approximately 85%) have had no prior REU experience.

The BIO REU program wide initiatives are primarily activities that have been organized by the LC in response to feedback and suggestions at previous workshops. They are described on the Bio REU website (www.Bioreu.org) and include the student conference travel scholarships program, the just-in-time review and mentoring program for students preparing conference research presentations, resources for training in ethics and the responsible conduct of research, and instructions for using the common assessment tool. Additional program-wide initiatives currently in development are virtual workshops about applying for the Graduate Research Fellowship Program (GRFP) for REU students and a pre-REU Boot Camp program that would help students get ready to apply for REU programs.

Regarding tips for renewing REU grants, Dr. O'Connor explained that although all grants are reviewed like new submissions, the renewal grants are compared to previous submissions from the same REU Site. The prior results section of renewal proposals is *very* important and should include details on REU students' papers and presentations, as well as a discussion of the lessons learned about how to most effectively run the REU program, ideally supported by program assessment and evaluation data. As with initial program grants, renewal grants should include detailed descriptions of the research projects, with sample research questions and identified skills and knowledge that students will gain from working on those projects. Generally, REU Site grants do not fund academic components (e.g. formal courses or tutoring), so these types of requests should not be made. Finally, a cost effective, justified budget that is aligned with the program solicitation should be proposed. Current funding rates are at 30 – 40%.

NOTE: There is a revised proposal classification form and the third category it is important for classifying REU proposals. PIs were advised to consider this carefully.

Several supplements are available and workshop attendees were encouraged to consider applying for them. They included the Research Assistantships for High School Students (RAHSS), Research Experiences for Teachers (RET), Research Opportunity Awards (ROA) for faculty at predominantly

undergraduate institutions, supplements to support international collaborations and supplements to fund REU extensions.

Plenary 1 – Lessons Learned from Research on Undergraduate Research

Dr. Clifton Poodry, Howard Hughes Medical Institute

Dr. Poodry reviewed the expected benefits of undergraduate research experiences for the students and for the institutions hosting them. He presented a summary of qualities needed for success in graduate school and challenged workshop attendees to consider whether their REU programs were actually developing these talents in their student participants or simply selecting for these talents in the admission process. He pointed out the importance of measuring gains resulting from the REU experiences and considering who will gain the most when making selection decisions. He proposed that undergraduates come with a mosaic of achievements and potentials and that if our selection decisions are based solely on achievement, the potential for gains is limited. Finally, he noted that our faculty mentors may not see their job as developing talent, but that program directors can play a key role in educating them about the mission of the REU program and their critical contribution to it.

Plenary 1 Breakout Discussions

Dr. Poodry provided three questions to guide discussions in the breakout groups. A summary of the responses from the combined notes provided by the groups follows each question. Ideas and feedback resulting from the discussions are provided in the final section.

1. How can programs assess the multiple measures of an individual's potential versus achieved performance in making selections?

GPA: Most programs go beyond using standard academic measures such as GPA. The GPA itself should not be fixed but used in combination with information from other parts of the application. There is merit in selecting students with relatively modest GPAs, as the risk in taking such students is balanced by the positive impact on the student and the program. Participating in an REU enhances scientific credentials and subsequent competitiveness for graduate programs and scientific careers—this could be instrumental for the success of students lacking strong academic credentials.

Student statement: Personal statements can provide important insights about applicants. If designed appropriately they capture important indicators of potential in addition to research experience. These include work experience and personal challenges to overcome. Indeed students without research experience have more to gain from an REU, and are specifically sought by some programs. Asking students about their long-term goals and how an REU will help them reach that goal will provide useful information and allow an assessment of how student goals match to a specific REU program. One program gives students the opportunity to rewrite a 'weak' statement following guidance (by phone) from the program directors. Some programs use multiple essays to reveal specific requirements.

Letters of recommendation: In many programs these are heavily weighted in the selection process. Letter writers often speak to the potential of a student. The best letters contain valuable information because the writer knows the student well. But not all students know how to request such letters and recommenders vary in the effort they put into writing—so this cannot be the only indicator of potential.

Interviews: Some programs conduct phone or Skype interviews that can involve mentors in addition to the admission committee.

Programmatic considerations: Programs often aim for a balanced portfolio representing students with different backgrounds and experience. Programs should be cognizant of how their recruitment goals match or vary with those of the NSF and be able to provide appropriate rationale, as necessary.

Other measures: Research suggests 'grit' is the strongest indicator of student success (Duckworth, references in link below). Devising ways to assess this in the application could be beneficial.

Grit comprises a suite of traits and behaviors, including:

- *Goal-directedness (knowing where to go and how to get there).*
- *Motivation (having a strong will to achieve identified goals).*
- *Self-control (avoiding distractions and focusing on the task at hand).*
- *Positive mind-set (embracing challenge and viewing failure as a learning opportunity).*

(taken from http://www.ascd.org/publications/educational-leadership/sept13/vol71/num01/Grit-Plus-Talent-Equals-Student-Success.aspx)

Rubrics: A matrix of potential could be generated for initiative and preparation with information taken from the application materials. These should, however, be balanced with other considerations, such as, nontraditional and socioeconomic status.

Special examples: Programs should be sensitive to the different kinds of students and encourage applications by making special arrangements, such as, off campus housing for students with families. In some instances, past participants could be invited back to 'activate' a hidden talent that only became apparent during the first REU.

2. Should REU programs have explicit training activities to develop the non-cognitive skills or character strengths associated with success in postgraduate training?

Most programs already have many events tailored to enhance these non-cognitive skills in preparation for graduate study. These include professional development, team-building events and exploring relationships in the scientific workplace. (As noted by some discussants these attributes may better be described as 'soft skills' or 'emotional intelligence'.)

Professional development:

- Training in scientific communication
    - Journal club
    - Poster session
    - Oral presentation
    - Conference attendance
    - Social media
    - Project report and other scientific writing
    - Elevator speech
    - Explaining project to different audiences from family member, to scientist in another field to expert in the same field.
- Graduate school application workshops including meetings with directors of graduate programs and information on other careers for example, industry and teaching
- Workshops in ethical conduct of research

Team building:

- Group outings to local places of interest, such as museums, and parks.
- Group social events, typically meals involving students only, to develop the cohort and together with faculty for networking
- Extended trips (for example, camping) to enhance group bonding.

Scientific relationships:

- Mentor training to enhance effectiveness in working with students from different cultural and academic backgrounds
- Mentee training
    - What to expect from your mentor
    - How to communicate with your mentor
- Program coordinator and/or near-mentor (graduate student or senior undergraduate) to handle potential problems best solved by someone not affiliated with the project lab.

Notes: There is a balance to be struck between these activities and the research project itself. Many discussants noted the inherent value of research, which is often conducted in a team environment, to develop these 'soft' skills. Adequate time for research must be available so as not to impose a conflict between 'other activities' and time for research. It was also noted that gains in these skills are hard to measure.

3. How can programs assess their value added? (What degree of improvement should be expected by funders?)

Student gains:

- Leads to improved academic success
- Helps in deciding career pathway
- Research credential improves future competitiveness
- 'Intangibles'
    - 'ah ha' or 'eureka' moments when students recognize their passion and/or aptitude for science
    - shared experiences
    - interpersonal relationships
- Recommendation letters

Program gains:

- Recognition of value of program from institution
- Faculty benefit by increasing their involvement in broadening the impact of science
- REU applicant pool itself and involvement of students from groups underrepresented in science

Assessment of 'value added':

- Publications
- Entry to graduate school or other science careers
- Subsequent research experience sought after positive REU internship
- Open-ended student reflections (perhaps on the SALG)
- Mentor reflections pre- and post-REU program

Notes: Assessment of 'value added' including student outcomes involves long-term tracking for which most REU programs do not have good systems. Data that compares REU Site programs with individual REU students is not available and would be useful for evaluating 'value added' for the cohort experience.

PI Feedback

1. The selection process

All groups noted the importance of a multifaceted application for selecting students with potential for science, rather than a proven academic or research track record. This is in keeping with program-specific and national goals to develop new scientific potential. Components of the application that most programs use include elements such as student statements and letters of recommendation. In many cases, strong emphasis is placed on these measures when selecting students. The credentials of REU students may, therefore, differ from those typically encountered by mentors. The requirements for mentoring students with 'potential' identified by non-standard measures of aptitude in science may require mentor training.

Idea: A common application has been discussed at previous meetings and is an idea that warrants further consideration. Careful crafting of a common application could be effective in requesting information for student selection that includes components in addition to numerical data. Mechanisms could be in place to limit the number of REU Sites selected by a given student, and program-specific requirements could be used in the subsequent selection process.

2. Complementary skills

These include activities that lead to the scientific, professional, and personal development of participants. They may be more aptly called 'soft skills' or 'emotional intelligence'. Most programs have multiple related activities including workshops, research presentations, and group social events. There are both tangible (publications, number of students entering science careers, etc.), and intangible (development of a student's scientific identity) outcomes from these activities. In some cases, these can be difficult to enhance and measure.

Ideas: 1) It may be useful to provide a conference on 'scientific identity' so that program directors and mentors could better understand how to potentiate development of this in REU students. 2) Creation of a student module that outlines how to help students in their interaction with mentors. This will allow the student to maximize the benefit of the mentor-mentee relationship in their future career. 3) Long-term tracking is difficult for individual programs and the community should consider developing a centralized system.

3. Assessing the 'value-added' benefits of an REU program.

There are many advantages that result from a research experience that can be considered as 'value added' and above purely achieving the immediate scientific goals. These include benefits for students, mentors and institutions. Some of these Individual components can be measured and advance science (publications) and the scientific workforce (students entering scientific careers). Some of these outcomes result from the undergraduate research itself. There is, however, a strong belief among program directors that the REU Site experience has 'value added' over the individual research experience.

Idea: A specific study that measures student outcomes in participants in REU Site programs versus students conducting individual research is needed to test the perception that there is a 'value added' group effect.

Plenary 2 – Promoting and Supporting Culturally Competent Research Mentoring

Drs. Angela Byars-Winston and Christine Pfund, University of Wisconsin, Madison

Dr. Byars-Winston introduced cognitive, cultural and contextual factors as critical indicators in academic and science career development. Importantly, she differentiated between the culture within an individual (values, beliefs, worldviews, identity) and the culture outside of an individual (norms, institutional and disciplinary practices) and explored how these interact to influence an individuals' level of motivation for a given task or pursuit. She introduced Social Cognitive Career Theory (SCCT; Lent, Brown & Hackett, 1994, 200) as a tool to understand and study these factors. She uses SCCT to understand the influence of research mentoring relationships on critical indicators, the influence of culture, and to study the impact and guide the development of research mentor training interventions. She presented recent research results showing misalignment of mentors and mentees views on the role of culture in the mentoring relationship. Specifically, her data indicated that mentees were significantly more likely to think that diversity should be directly addressed in the mentoring relationship when compared to mentors, suggesting that integrating cultural responsiveness into mentor training is needed.

Dr. Pfund presented an overview of the *Entering Mentoring* training curriculum for research mentors and mentioned the *Entering Research* training curriculum for mentees. She presented data that was self-reported from mentors who had participated in the training and also from a more recent randomized control trial that showed the positive impact of this training curriculum on mentor behavior. She described several discipline and career stage adaptations of the *Entering Mentoring* curriculum and a train-the-trainer workshop that is available for those who are interested in implementing the training. They concluded the talk with a description of mentor training modules currently in development, which are designed to raise awareness and build cultural competence. They invited the workshop attendees to participate in the implementation and testing of this new module.

Plenary 2 Breakout Discussions

Drs. Byars-Winston and Pfund provided three questions to guide discussions in the breakout groups. A summary of the responses from the combined notes provided by the groups follows each question. Ideas and feedback resulting from the discussions are provided in the final section.

1. In what ways do your current program activities prepare both the research mentors and their mentees to work effectively together in their mentoring relationship?

Few existing programs implement mentor training; individual room polls suggested maybe 20% include it. Some programs did not incorporate formal mentor training because they were time limited and some worried that mentors would have difficulties with the suggestion that they might need additional training. Some programs had informal meetings with mentors (whether they are faculty, post-docs, or graduates students) before the program to explain program goals and to share "local knowledge" of mentoring best practices. Most of these workshops were informal and lasted less than 2 hours and many expressed that 8-hour mentor workshops would be difficult to complete. Some encouraged peer mentoring for mentors by matching experienced REU mentors with less-experienced ones.

Many programs created activities aimed at improving the mentor-mentee bond through activities focused on the mentee. Some programs requested that mentors send a project background to students prior to their arrival to encourage early mentor-mentee communication; some concerns existed about asking students to work prior to the start of the program. Some programs implemented mentee orientation workshops at the beginning of the program to try to improve the mentor-mentee relationship. These workshops included informal faculty talks about minorities in science; stereotype preparation in career workshops, and open discussions about difficulties for minorities in STEM fields. Many activities were mentioned that might strengthen the mentor mentee experience throughout the duration of a program. Many programs implement mentor or mentee checks frequently during the program to try to catch potential mismatches and ineffective relationships. These included making abstracts and proposals due early in the program to check the progress of the mentor-mentee relationship. In addition, several encouraged weekly emails of research progress to mentors, mentor interviews, and weekly mentor-mentee meals together.

2. How might you better prepare the mentors in your program to be more culturally responsive in their mentoring relationships?

PI's answers to this question focused on best practices for pairing mentors with mentees and on ways to improve mentor-mentee interaction. Understanding each mentor's style and trying to pair them with a student was mentioned often by the PIs. A networking approach was often used that included pairing seasoned mentors with new mentors to the program; incorporating an additional mentor who can be contacted if the research mentor-mentee relationship breaks down; and pairing the mentee with another undergraduate, graduate, or post-doctoral fellow from a similar cultural background to aid with the transition to the research group. Suggestions for improving the mentor-mentee relationship included sending mentors and mentees information about each other prior to the program, mentor-mentee retreats (e.g., hikes, campouts), mentor-mentee interviews, and inclusion of mentor and mentee families in REU social activities.

Many groups indicated that workshops for training culturally responsive mentors should be required for all possible types of mentors and that it could be included with the other required training (e.g., lab safety, sexual harassment). There was some discussion that inclusion of this mentor training as a requirement in tenure and promotion recognition, continued participation in REU programs, and a broader impact in proposals might encourage mentor participation.

3. How can you determine if the interactions between the mentors and mentees in your program are effective and that the needs of both are being met?

Group answers were broken down into methods aimed at real-time assessment of mentor-mentee matches during the program and end-of-the-program assessments for future improvement. Most programs incorporated regular meetings with all of the REU students to gauge their progress and interaction with their mentors. Some programs also included regular meetings with mentors. Many programs included deliverables, such as proposals, mini-presentations, and abstracts, due at various times early in the program that could be used to help gauge the success of the mentor-mentee pair. An additional mentor outside the formal research group (a peer, graduate student, post-doc etc.) was also often assigned that could talk with the student freely about the mentor-mentee relationship. Including mentor-mentee assessments at the end of the program and informing mentors of mentor-mentee quotes in those assessments was another approach discussed to gauge effectiveness.

Program directors were very supportive of having some kind of mentor training activity. The vast majority spoke of informal activities that they engage in to identify good mentors. However, they all

recognized the benefit of having more formal training in order to equip their mentors with approaches that could lead to more successful outcomes for their students. The PIs also mentioned the benefit of multiple mentors that include graduate students and program facilitators so as to provide the REU student with "safe" opportunities to share negative experiences. This seems particularly important in working with diverse student populations where unconscious biases could lead to unintended consequences. Some PIs felt that it would be difficult to oversee a mentorship training workshop at their home institution and that faculty may respond better to an "outside" expert. This "outside" expertise could come from a diversity office on the campus. Moving forward, many PIs recognized that their REU mentor pool does not reflect the diversity of their students and that having a more diverse pool of mentors would be a benefit to their program and their students. Most programs do not measure the effectiveness in the mentor-mentee relationship. The URSSA assessment tool may provide some feedback here.

PI Feedback

- Link the mentor training workshop and materials to the REU Bio website so that PIs have access to the materials and can share them with their mentors. Preferably, online workshops could consist of a series of short 1-hour workshops that the mentor could progressively work through.
- Provide mentorship training to the PI's so that they can take this knowledge and share it at their home institutions.
- Implement a contract between the mentor and mentee. Upload samples of these contracts to the REU Bio website.
- Use mentor meetings to discuss best practices.
- Share "Entering Mentoring" program with grad students as well as faculty.
- Provide more general education to faculty mentors about culture and subtle bias issues.
- Share an assessment tool that measures the effectiveness of the mentor-mentee relationship.
- Help broaden mentor participation training by giving credit for the training in other grants/programs (e.g., broader impacts NSF)
- Long-term investment – mentor training contingent for program continuity or grants (e.g. CAREER)
- Waive application fees for graduate school (like MARC, RISE) for students with mentor training
- Letter from Program Officer thanking them for participation - individual mentor AND site as a whole (individual PIs supply contact information)

Plenary 3 – Program Ingredients for Increasing Persistence: Science Efficacy, Identity and Values

Dr. Mica Estrada, California State University, San Marcos

Dr. Estrada presented data showing the disparity of STEM degree attainment by major ethnic groups, with URM groups (Black, Hispanic or Latino/Latina, American Indian and Alaskan Native) earning significantly fewer STEM degrees relative to their White and Asian counterparts based on their percentages in the population. Her presentation outlined the results of an ongoing longitudinal research study, "The Science Study," examining the impact of NIH RISE and MARC programs to address this disparity and to specifically determine the elements of these training programs that make a difference. A matched control group is used for each RISE or MARC student and survey data are collected twice yearly from both groups of students. These data are augmented with degree attainment data from the National Student Clearinghouse. Data collected 7 years into the study show that approximately 70% of

RISE and MARC students pursue graduate education compared to 35% of control group students. Analysis of the program elements (mediators) that produced these outcomes indicates that the top three mediators are a research experience, faculty mentorship and financial support. Building on Kelman's Social Influence Theory, Estrada and her colleagues have developed the Tripartite Integration Model of Social Influence (TIMSI), which proposes that 1) scientific self-efficacy, 2) scientific identity and 3) internalization of scientific values combine to predict integration and maintaining intention to pursue a STEM career. Importantly, over time these factors increase or remain constant in individuals who pursue science careers, while they decline in individuals who pursue medical or non-science careers. In particular, the endorsement of science community values increases over time and can be used to predict the probability that an individual will remain in STEM careers.

Plenary 3 Breakout Discussions

Dr. Estrada provided three questions to guide discussions in the breakout groups. A summary of the responses from the combined notes provided by the groups follows each question. Ideas and feedback resulting from the discussions are provided in the final section.

1. In what ways are your current program activities building science efficacy, identity and values among participants?

Some group members felt current REU programs were focused on efficacy, including benchmarks throughout the summer with a plan that includes clear expectations. Most PIs felt efficacy is important and necessary to becoming a scientist. Some ways that REU programs are currently helping REU students build their scientific identity involve informal social interactions with faculty, graduate students, and postdocs, as well as in the lab environment. Interactions in the "home lab" are very important in building scientific identity. REU participants should be given the same responsibilities as other lab members. For example, participants could make presentations in lab group meetings, not just special REU meetings. REU scholars should also develop ownership over their research project. Scaffolding of near-peer mentors was also suggested as a way for REU students to develop a science identity. In this case, the REU student could mentor a high school student or do a presentation at a local school or community event. In this way they would start to feel like a science expert.

2. What types of innovations could be developed to more intentionally increase efficacy, identity and values among students?

To increase the likelihood that REU participants develop a strong scientific identity it was suggested that providing diverse role models would help. If this was a limiting factor in a particular REU program then the suggestion was to possibly partner with other REU programs to bring in diversity. This approach would allow the students to recognize that the scientific community is much larger than the REU program on their campus. The group discussed that having good peer mentors available either as more experienced undergraduates or former REU participants coming back and working within the program are important as well.

3. How important do you feel it is to not only know your programs have impact, but understand *why* they have impact?

Given the length of typical REU programs, 8-10 weeks, it was discussed whether this was enough time to build a student's scientific identify. Programs can develop stronger connections with the home institution to make sure that the impact of the summer is longer lasting.

Be explicit about the values that are important for becoming a scientist. Highlight the values of the science and discuss real life problems. Make the science relevant to the REU students.

Work collectively to examine which aspects of REU programs are having the intended impact on REU students.

PI Feedback

- Make the presentations available to workshop participants. Notify the REU PIs with a link to the talks.
- Make a standard assessment tool that also addresses values and identity questions or use the 3 main focal characteristics and add to the current URSSA survey.
- Focusing on faculty mentor effects may disregard peer, graduate student, and post-doctoral mentorship. URSSA question on mentor is not specific and should more specifically define what the mentor is—some students may automatically consider the PI as the mentor even though they are primarily mentored by another lab member.
- Provide diverse role models so that REU students could see themselves pursuing a science career path.
- To measure gains with regard to "science identity", the community could use a pre and post survey that uses validated questions such as those presented in the third plenary workshop
- In general, the PIs wanted more clarity on what NSF means by "success" in an REU program, particularly considering the input from the REU community. This would be particularly important for renewal applications if the PIs are suppose to focus on mentoring students with "potential" versus demonstrated "success".
- Provide PIs access to Mica's survey, if possible.
- Expand the travel budget by reducing the number of programs or funding per program so that students have easier access to scientific meetings that would help reinforce scientific identity.

"How To" Sessions

Program Assessment

Undergraduate Research Student Self-Assessment (URSSA)

Many individuals came into the session assuming that the purpose of URSSA was for reporting, only. However, several individuals talked about ways they were able to use URSSA survey results to make modifications to their programs. For example, a lower than desired score in gains in reading and understanding primary literature motivated one group to institute a literature review in the program. In the first year after the change was made, scores were higher in this area. Questions PIs added about housing, speakers, and other programmatic activities were helpful in planning for subsequent years.

Many said they felt the written comments were of more value than the quantitative data. There was discussion of how to motivate students not to rush through their surveys. One method was to have them arrive 45-60 minutes before an activity at the end of the summer, and let them know they have that full time to fill out the survey before the activity. The captive audience may be willing to spend more time in that situation than if they are trying to do it on their own time. Additionally, everybody agreed that it is critical to tell the students that their input is important and that previous input has been used to improve the program.

Non-survey Approaches

At Woods Hole, a group of semi-retired scientists serves as advisory committee – they meet with students in weeks 2, 5, and 9 in order to formulate a report. Most did not have this resource, but many

PIs make it a point to meet with students one-on-one at intervals throughout the program to talk about how the students' experiences are going, and also in groups where students give research updates. One faculty member suggested asking students one-on-one how *other* students are doing in the program; perhaps a student is hesitant to bring up issues, but sometimes a friend will talk about it. Some programs ask students to prepare a weekly short report—a paragraph about what was accomplished last week, and what they plan for the upcoming week. Many programs also use exit interviews to gain richer data than the URSSA survey usually inspires.

Direct Measures of Assessment

These are harder and take work on both sides. Most programs require a paper or a presentation in first few weeks, something similar in middle and poster at the end. It was suggested that it could be possible to use an AAC&U value rubric to evaluate the work. Another method could be for students to prepare a concept map at the beginning of the summer and add to it over the course of the summer and look at a before and after shot of the map.

PI Feedback

- Provide examples of assessment tools for both students and for mentors
- Develop and make available a common mentor assessment tool.
- Direct quantification of mentor contributions (in terms of time as well as products and mentee improvement) could be a useful tool for demonstrating the value of these programs to higher administration for tenure and merit evaluations.
- URSSA default is too long. Have the default be just the core questions.

Responsible Conduct of Research (RCR) and Ethics Training

Professor John Pijankowski, University of Arkansas, gave a brief presentation on the Responsible Conduct of Research (RCR) and Ethics training modules that he is developing for REU programs, which was followed by a discussion. In the presentation Dr. Pijankowski outlined three questions that guide his teaching of ethics in REU programs: 1. What do students know? 2. What do students think? 3. What do students do (behaviors)? These questions can be used to shape discussions around ethical and moral dilemma situations and case studies. Important points from the discussion are outlined here:

- It is better to have students discuss ethical and moral dilemma scenarios and case studies for which there is no single answer, but multiple answers (in other words, end discussions without cognitive closure) – this promotes deeper discussion and helps them get more comfortable considering the factors influencing various answers
- Set up rules for interaction when discussing cases (e.g. argue ideas, not against people)
- We should strive to train students to identify ethical values with being a good scientist; you can not be a good scientist unless you are an ethical scientist
- Build ethical conversations into informal meetings such as dinners
- Spreading RCR and ethics training sessions across several weeks provides time for reflection and thinking between sessions, yielding deeper discussions
- Make sure the materials being used for training are career stage or developmentally appropriate (don't use cases developed for faculty with undergraduate students)

PI Feedback

- It would be helpful if there were clear goals articulated for Responsible Conduct of Research training in the context of REU programs. Comprehensive training in ethical and moral decision making seems to be beyond the capacity of an REU program to deliver, so what is reasonable?
- The RCR training resources developed for REUs should be made available to non-REU institutions as well.
- Make sure that Bio REU PIs are aware of the existing resources available to support their RCR training efforts.
- Supplemental funding to support an ethicist, like Dr. Pijanowski, to visit the REU sites and deliver in-person training would be useful.

Institutional Support

Two sessions on the topic of institutional support for REU programs converged on some common themes and recommendations. Chief among these was the realization that several university/college administrative units have the potential to share costs in support of REU funded programs. These include graduate colleges, diversity offices, partnering academic colleges, and development offices. It was also observed that, in general, a non-zero sum logic should be employed in negotiating with administrators on costs. This includes encouraging the long view of using federal funding to raise the profile of the university and to create synergistic funding effects. Overhead cost (indirect cost) from grants was noted as being desirable to support REU programs, especially in the early stages when support is being developed with campus administration. The effect of revolving administrators, especially at the level of provost and president, was noted as a common phenomenon. One solution to this problem was to garner ongoing faculty support for student-centered programs that will then augment the support of REU programs; the latter approach assumes that faculty members will resist policy change in the wake of exiting deans, provosts and presidents. Encouraging an understanding by faculty members of revenue streams (e.g., state-appropriated versus private funding sources) and their use in developing innovative funding models was suggested as well. Along this vein, it was suggested that the LC encourage more involvement of administration in venues like this workshop in order to promote their roles in developing institutional support of undergraduate research by sharing best practices.

PI Feedback

- Employ cost-sharing strategies with units across campus.
- Allow grants to fund more overhead costs that include staffing by reducing the number of programs or reducing funds available for student support.
- Involve the campus development office through endowments.
- Build support mechanisms that resist turnover in administration.
- Help administrators meet together in order to share best practices.
- Employ non-zero sum approach to communication with administration.

Broadening Participation

In the Broadening Participation sessions, attendees worked together in small groups to share successful strategies and approaches for attracting diverse student populations to their programs, including obstacles that they have encountered when recruiting mentors to work with these students in their programs. Importantly, though, several useful strategies were identified; the participants stressed that it is important for individual program directors to assess their local environment before deciding which to adapt and/or adopt. A summary of the useful strategies is presented here.

1. Useful strategies for recruiting diverse populations of students:
   - Offer excellent research experiences and highlight this on your website and other recruiting materials; videotape 2 minute presentations about research by faculty mentors
   - Highlight the relevance of the scientific research experiences you are offering and connect them to issues that matter to students; build in outreach and/or service experiences; explicitly articulate and advertise learning objectives for your program that address societal issues
   - Consider the underlying reasons that students seek out an REU experience and capitalize on these motivating influences (e.g., graduate school interest, summer job, advice from home institution advisor, etc.)
   - Build relationships and personal connections with minority serving institutions with which you can form partnerships for recruiting students; personally visit these institutions on recruiting trips
   - Engage previous REU students as recruiters; send REU brochures home with them; create a Facebook page where former and prospective students can interact
   - Highlight the success of your program's previous participants on your website
   - Engage in career development, not just research training
   - Incorporate a near-peer mentoring component in your program

2. Useful strategies for recruiting mentors:
   - Mentoring these students can contribute to a research grant's Broader Impact
   - Show potential REU mentors REU-wide data that highlight the success of students who participate in the program
   - Including students from diverse backgrounds on your research team can lead to better research and research in new directions
   - Articulate the potential for growth, rather than research productivity, as a goal for your program

PI Feedback
   - The Leadership Committee could create a one page document outlining the challenges and importance of recruiting diverse students that PIs could use to educate faculty mentors
   - The Leadership Committee could pool the national data that show students who participated in REU have been successful and that these students can add value

Scholarship of Teaching and Learning (SOTL)

The purpose of the Scholarship of Teaching and Learning session was to encourage PIs to think about contributing REU program outcome results to the literature. Three questions were addressed:
   - What is SOTL and why it is important?
   - How do we use the available assessment tool to "backward engineer" SOTL questions?
   - From various perspectives (i.e., PI, reviewers and editors) what makes a great journal article?

A panel of experienced PIs was asked to address these questions followed by small group discussions. Erin Dolan, editor of CBE Life Sciences Education and one of the panelists, shared recent copies of the journal and several relevant sample articles. As an editor she gave examples of scholarly questions of interest to the community that could be used to guide investigation and publication of REU program outcomes. Participants raised a concern about the small sample size in most REU programs, which Dolan addressed by suggesting collaborative projects across more than one site and longitudinal studies. Specifically, it was suggested that field stations might work together to do a comparative comprehensive evaluation.

Julio Soto, REU PI and LC member, presented the research approach he used to study and publish outcome results from his REU program. In order to go beyond students' self-reported gains, which are collected using the URSSA tool, he used objective methods to measure their actual gains. For example, gains in students' writing ability. This allowed him to make comparisons from the two data sources and study the alignment of students' self-reported and actual gains.

Participants expressed concerns about doing research and publishing in educational journals outside their disciplinary area. The panel recommended that they collaborate with colleagues in the social sciences (e.g., education, sociology, anthropology), who are trained in the research methods needed to study educational interventions. These colleagues can contribute to designing a study and will also be familiar with what is already known and what research questions remain unanswered in the field.

PI Feedback

- Create a match-making tool to facilitate connections between REU Sites interested in participating in research studies.
- Design research studies around themes such as: specific challenges for Native American Students, Hispanics; benefits of REU Sites at field stations; benefits of REU Sites at museums

Networking Dinner & Lunch

Charge to Discussion Groups
Select two (or more) of the challenges and discuss strategies in groups at your table. At the end of the meal, we will ask for best practices from around the room.

Day 1 Dinner
Challenge 1: What are some methods to maintain mentor enthusiasm for the REU program and minimize burn-out?

Challenge 2: Given expanding REU program goals, what are some ways a PI can manage time and effort? Do institutions (University/Department) recognize and compensate PI time and effort?

Challenge 3: What are some best practices for managing and reviewing sometimes hundreds of applications?

Challenge 4: How do we maximize the impact of the 8 to 10-week program on REU participants after they leave the program?

Challenge 5: What are best practices for longitudinal tracking of REU alumni?

Day 2 Lunch

Challenge 1: What are some successful strategies for recruiting diverse participants who are interested in research careers (*i.e.* not medical school)?

Challenge 2: Recruitment of field-specific participants--how important is this?

Challenge 3: Encouraging publications--how feasible is this in a 10-week summer program that focuses on novice scientists?

Challenge 4: Assessing program activities and outcomes. How does one publish novel programmatic findings? What are some examples of novel programmatic findings?

Suggestions: What can the BIO REU Leadership Council or NSF do to help with the implementation of your REU program?

Appendix 1: Workshop Agenda

Thursday, April 10		
1:00 – 5:00 PM	Registration and Name Badge Pickup	Promenade
4:30 – 5:00 PM	Poster Session Set up	Rosslyn Ballroom
5:00 – 6:15 PM	Poster Session	Rosslyn Ballroom
6:15 – 6:30 PM	Welcome & Meeting Goals *Janet Branchaw, LC Chairperson*	Rosslyn Ballroom
7:00 – 8:45 PM	Networking Dinner	Vantage Point Rooftop Restaurant

Friday, April 11		
7:30 – 8:30 AM	Continental Breakfast & Informal Poster Session	Rosslyn Ballroom
8:30 – 8:45 AM	Welcome & Introductions *Janet Branchaw, LC Chairperson*	Rosslyn Ballroom
8:45 – 9:30 AM	Welcome & Updates from NSF *Dr. Scott Edwards, Division Director* *Dr. Jim Deshler, Deputy Division Director* *Dr. Sally O'Connor, Program Director*	Rosslyn Ballroom
9:30 – 10:15 AM	Plenary 1 – Lessons Learned from Research on Undergraduate Research Experiences. *Dr. Clifton Poodry* *Howard Hughes Medical Institute, formerly National Institutes of Health*	Rosslyn Ballroom
10:15 – 11:15 AM	Plenary Talk Breakout Discussion 1 (see pp. 14-25 for assignments) • Discuss the plenary talk and how to incorporate what was presented into REU programs	*Various Rooms*
11:15 – 12:00 PM	Breakout 1 Reporting	Rosslyn Ballroom
12:00 – 1:00 PM	Networking Lunch	Rosslyn Ballroom
1:00 –2:00 PM	"How To" Sessions (see pp. 14-25 for assignments) • Program Assessment: How to design a comprehensive assessment plan • Ethics Training: How to teach ethics in your REU, including how to use the Inventory of Science Ethics Training Tools • Institutional Support: How to work with your institution to secure support for your program • Broadening Participation: How to increase the diversity of your applicant pool	*Various Rooms* • Georgetown • Jefferson • Shenandoah A • Club

	• Scholarship of Teaching and Learning: How to share through publication the accomplishments and innovations of your REU program	• Dogwood
2:15 – 3:00 PM	Plenary 2 – Promoting and Supporting Culturally Competent Research Mentoring *Drs. Angela Byars-Winston & Christine Pfund* *University of Wisconsin – Madison*	Rosslyn Ballroom
3:00 – 4:00 PM	Plenary Talk Breakout Discussion 2 (see pp. 14-25 for room assignments) • Discuss the plenary talk and how to incorporate what was presented into REU programs	*Various Rooms*
4:00 – 4:15 PM	PM BREAK – Beverages and Light Snack	Rosslyn Ballroom
4:15 – 5:00 PM	Breakout 2 Reporting & Announcements	Rosslyn Ballroom
5:00 – 6:00 PM	"How To" Sessions (see pp. 14-25 for assignments) • Program Assessment • Ethics Training • Institutional Support • Broadening Participation • Scholarship of Teaching and Learning	*Various Rooms* • Georgetown • Jefferson • Shenandoah A • Club • Dogwood
6:00 PM	Adjourn for the Day	Dinner on your own

Saturday, April 12		
7:30 – 8:30 AM	Hot Breakfast	Rosslyn Ballroom
8:30 – 9:15 AM	Plenary 3 – Program Ingredients for Increasing Persistence: Science efficacy, identity and values *Dr. Mica Estrada* *California State University - San Marcos*	Rosslyn Ballroom
9:30 – 10:30 AM	Plenary Talk Breakout Discussion 3 (see pp. 14-25 for room assignments) • Discuss the plenary talk and how to incorporate what was presented into REU programs	*Various Rooms*
10:30 – 10:45 AM	AM BREAK – Beverages and Light Snack	Rosslyn Ballroom
10:45 – 11:30 AM	Breakout 3 Reporting & Discussion	Rosslyn Ballroom
11:30 – 12:00 PM	Meeting Adjourned	

Appendix 2: Workshop Registration

Workshop attendees registered through an online site managed by the University of Wisconsin, Madison's College of Agricultural and Life Sciences. Contact information was collected and attendees were invited to volunteer as a "How To" panelists and/or breakout session note-takers. The list of attendees is presented here.

The workshop attendees are listed in the table below. Leadership Committee members are highlighted in yellow and Plenary Speakers are highlighted in blue. The Bio REU 2014 workshop was sponsored by a grant to Janet Branchaw at the University of Wisconsin, Madison (NSF DBI-1348417).

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NOTE: Leadership Committee member Ian Billick (director@rmbl.org) from the Rocky Mountain Biological Laboratory was unable to attend the workshop.

Appendix 3: Workshop Poster Presentations

#	Authors	Institution	Poster Title
P01	Dolan E., Aikens, M. and Sadselia, S.	University of Georgia	National study of the impacts of graduate / postdoctoral mentoring of undergraduate researchers
P02	Kimball K., Renfro J.L. and Chen X.	University of Connecticut	Accomplishments and Challenges: A Seven-Year Review of the REU program in PNB at UCONN
P03	Puniwai N., Ziegler-Chong S., Ching M. and Ostertag R.	University of Hawaii at Hilo	The Pacific Internship Programs for Exploring Science: Changing the Face of Conservation in Hawaii
P04	Barcenas N.M.	Heritage University	A Pilot Project to Engage Underrepresented Minority Students in a Research Experience
P05	Fraley G.S., Best A., Barney C.C., Bultman T.L., Burnatowska-Hledin M.A., Chase L.A., Murray K.G., Li J., Putzke A., Stukey J., Winnett-Murray K. and McDonough-Stukey V.	Hope College	Impact of NSF-REU Research Program on Undergrad Education and Success in Biology at Hope College
P06	Westneat D.F., Bouwma-Gearhart J. and Xiang L.	University of Kentucky	Kentucky's "Suburban Ecology and Invasive Species": Mechanisms for Successful Mentorship
P07	Patel M.V., Rose B. and Ellison A.M.	Harvard University	Insights into a Summer Research Experience using Pre- and Post-Evaluations
P08	Doze V., Conway P., Sens D., Cisek K., Boeckel J., Hanson B., Olimb S. and Wages J.	University of North Dakota	REU for Rural & Tribal College Students: Recruiting Efforts & Impact on Educational & Career Paths
P09	Hua J. and Jander G.	Cornell University and Boyce Thompson Institute	REU Site: Plant Genome Research

#	Authors	Institution	Poster Title
P10	Potlakayala S., Shuler A. and Rudrabhatla S.	Penn State University - Harrisburg	NSF-REU at Penn State Harrisburg-Towards A Secure and Sustainable Energy Future
P11	Noble D.B., Regan L.J., and O'Hern C.S.	Yale University	REU Site: Integrated Research at the Frontiers of the Biological, Physical, and Engineering Sciences
P12	Allen M.R., Jones T.W., Clark J. and Moser F.C.	Maryland Sea Grant College	Enhancing Student Understanding Of Estuarine Dynamics Using An Orientation Research Cruise
P13	Ozbay G., Chintapenta L.K., Kalavacharla V., Schirtzinger S., Clark K., Dixon C., Wiggins B. and Everett L.	Delaware State University	Studying the Macrophyte-Microbe Interaction in the Salt Tolerance Mechanism of Marsh grass species
P14	Silberg J.J. and Bennett G.N.	Rice University	The Rice University REU in Biological Networks: a site for students in science and engineering
P15	Wilson G., Pruyn M. and Fahey T.	Hubbard Brook Research Foundation	Paying it back: training young scientists to connect with the public that funds them.
P16	Taylor K.D., Piccoli B. and Martin J.V.	Rutgers University - Camden	REU Site: Computational Biology Summer Program at Rutgers-Camden
P17	Melmaiee K., Kalavacharla V., Wiggins B., Hankoua B., Sabanayagam C., Ozbay G., Dhillon H., Lee J., Chintapenta K., Davis L., Everett L., Harrington M., Temburni M., Quadros-Mennella P., Elavarthi S., Taylor S., Mennella T., Smolinski T., Ayyappan V., Fondong V. and Liu Z.	Delaware State University	Delaware State University-NSF REU site: Seven Years of Experiential Learning in Molecular Genetics
P18	Haynes K.J. and Lutzow-Felling C.	University of Virginia	REU students gain training and experience in K-12 science education outreach

#	Authors	Institution	Poster Title
P19	White D., King S., Soetan N., Silva M., Kramer L., Choquette K., Lahey C., Colon T., Becker J., Kurgan G., Marquez A., Gaffigan B., Cerutti H. and Blum P.	University of Nebraska-Lincoln	The Future of Natural Gas: A Millenial Perspective from NSF REU Scholars
P20	Cohen C.S. and Domingo C.	San Francisco State University	SFSU: Research in Environmental Studies and Evolutionary Developmental Biology
P21	Belthoff J., Barber J., Heath J., Smith J., Bechard M., Carlisle J., Kaltenecker G., Miller R., Anderson D., McClure C., Watson R., Thorstrom R. and Perkins D.	Boise State University	Hawks, Owls, Falcons, and Eagles: A new REU Site in Raptor Research
P22	Vig K. and Singh S.R.	Alabama State University	REU Site: Development of Safe Nanomaterials for Biological Applications
P23	Miller W.R. and Lowman M.D.	Baker University	In the Canopy with Tardigrades, Herbivory and Wheelchairs
P24	Bogler D.	Missouri Botanical Garden	Evolution of a Botanical REU Program at the Missouri Botanical Garden
P25	Gustafson Jr., D.E., Parker J.D. and Hines A.H.	Smithsonian Environmental Research Center	Preparing the Next Generation of Scientists: Professional Training in Global Change Ecology at SERC
P26	Hurley L.M., Martins E.P. and Demas G.E.	Indiana University	REUs in animal behavior at the Center for the Integrative Study of Animal Behavior
P27	Gleason J.M. and Mort M.E.	University of Kansas	REU Site: Models in Evolution, Ecology and Systematics
P28	Snyder B.A. and Morgan T.J.	Kansas State University	Two Decades of Undergraduate Research in Ecology, Evolution, and Genomics at Kansas State University
P29	Moyer-Horner L., Wassarman D. and Branchaw J.	University of Wisconsin - Madison	Vision and Change Core Concepts and Nested Learning Communities Unify a Large REU Program

#	Authors	Institution	Poster Title
P30	LeCleir G., Buchan A., DeBruyn J., Zinser E. and Wilhelm S.	University of Tennessee	Microbial Community Interactions and Functions REU: A Successful First Summer in Knoxville, TN
P31	Ayoob J.C., Gentille K., Russel L. and Chennubhotla C.	University of Pittsburgh	Tiered Mentoring and Training in a Medical School-housed Computational Biology REU
P32	Moss E. and Gardner L.	Alabama A&M University	Research Experiences for Undergraduates & Graduates at Alabama A&M and Nanjing Forestry Universities
P33	Mensinger A.F.	Marine Biological Laboratory	Biological Discovery in Woods Hole
P34	Kim D., Heidelberg K. and Marinelli R.	University of Southern California	REU Coastal Ocean Systems and Sustainability: Year 1 Strengths
P35	O'Day P.M. and Yablok S.	University of Oregon	Sharing infrastructural elements - University of Oregon REU Site Program
P36	Bolden-Tiller O. and Alexander A.D.	Tuskegee University	Tuskegee University Research Experiences for Undergraduates (REU) Participants as Near-Peer Mentors
P37	Rypstra A.L., Campbell K.U. and Berg D.J.	Miami University	REU enrichment activities promoting growth as scientists and citizens.
P38	Boettcher A., Turrens J.	University of South Alabama	Ethical Decision Making: A Critical Component of REU Training
P39	Juliussen E. and Schottel J.	University of Minnesota	Student Recruitment for the Summer Undergraduate Research Programs at the University of Minnesota

#	Authors	Institution	Poster Title
P40	Cole S.E. and Simcox A.A.	The Ohio State University	Ohio State REU in Biochemistry and Molecular Genetics

Appendix 4: Workshop Evaluation Results

N = 110

Q1. Please rate the networking and sharing activities (1 = poor to 5 = excellent; ave ±sd).

Poster session	4.25 ± 0.86
Thursday dinner	4.3 ± 0.83
Friday lunch	3.7 ± 0.97

Q2. Please provide comments on the networking and sharing activities.

Summary of comments:

- Make the poster session longer, leave the posters up longer and use a larger room
- Posters could be more focused on a particular topic, rather than an overview of a program
- Thursday dinner questions were helpful, but the report out was not efficient or very useful
- Attendees were not aware of the Friday lunch discussion questions
- Having simple discussion questions as conversation starters was useful and effective

Q3. Please rate the plenary talks and breakout discussions (1 = poor to 5 = excellent; ave ±sd).

Plenary 1	3.52 ±1.00
Plenary 1 discussion	3.91 ±0.89
Plenary 2	4.25 ±0.81
Plenary 2 discussion	4.14 ±0.86
Plenary 3	4.63 ±0.66
Plenary 3 discussion	4.40 ±0.82

Q4. Please provide comments on the plenary talks.

Summary of comments:

- Plenary talks were excellent, but in some instances a bit too academic for a non social science audience
- Breakout session facilitators varied in their ability to keep the conversation moving and to make sure all group members had a chance to talk
- Large group report out sessions were not very helpful as much of what was said was repetitive
- During the breakout discussions participants learned that "best practices" are context specific and that there are many ways to run an excellent REU program
- Some of the slides were difficult to see and it would have been helpful to have hard copies to refer to

Q5. Please rate the "How To" sessions (1 = poor to 5 = excellent; ave ±sd).

Program Assessment	3.73 ±0.94
Ethics Training	4.10 ±0.86
Institutional Support	3.95 ±0.94
Broadening Participation	4.11 ±0.90
Scholarship of Teaching and Learning	3.16 ±1.17

Q6. Please indicate the extent to which you agree with each statement (1 = strongly disagree to 5 = strongly agree; ave ±sd). As a result of participating in the 2014 Bio REU PI Workshop:

a. I have concrete ideas, strategies or plans to incorporate evidence-based practices into my REU program. 4.26 ±0.71

b. I was able to network and share best practices with my colleagues. 4.56 ±0.55

c. I learned about educational research findings on student learning and development in undergraduate research experiences. 4.51 ±0.62

d. I can translate research findings into practice in my REU program to improve the student experience. 4.13 ±0.75

Q7. Please rate the pre-workshop activities (1 = poor to 5 = excellent; ave ±sd)

Online registration	4.32 ±0.96
Online poster abstract submission	4.28 ±0.93
Pre-workshop communication and service	4.43 ±0.75
On-site registration and check-in	4.62 ±0.61

Q8. Please provide comments on the pre-workshop activities.

Summary of comments:

- Provide more explicit directions for the content of the posters
- The registration deadline seemed early
- Provide more information about what each "How To" session would cover
- In general, things went smoothly

Q9. Please rate the conference facilities and meals (1 = poor to 5 = excellent; ave ±sd)

Rosslyn ballroom	4.01 ±0.86
Breakout rooms	4.07 ±0.89
Sleeping room	4.09 ±0.96
Thursday dinner	3.96 ±1.01
Friday breakfast	3.43 ±0.99
Friday box lunch	3.15 ±1.11
Friday afternoon snack	3.54 ±0.94
Saturday breakfast	3.70 ±0.97
Saturday morning snack	3.47 ±0.92

Q10. Please provide comments on the conference facilities and meals.

Summary of comments:

- Not exceptional, but adequate; good price
- Thursday dinner meals were not brought out at the same time
- Vegetarian options were not adequate
- Computer projector in the Rosslyn Ballroom was not very bright; lights in the back of the room were too bright and those in the front too dim

- Pillars in some of the breakout rooms made it difficult to see
- More choices for foods, especially at breakfast; plain yogurt

Q11. Overall, how would you rate the 2014 Bio REU PI Workshop (1 = poor to 5 = excellent; ave ±sd)?

Poor	0%
Fair	2%
Good	6%
Very Good	36%
Excellent	56%

4.45 ±0.70

Q12. Is this the first time that you have attended a Bio REU PI Workshop?

Yes	50%
No	50%

Q13. What suggestions do you have to improve the workshop?

Summary of suggestions:

- Provide more specific instructions for the discussions
- Allow more time to share and network
- Find ways for participants to share materials immediately
- Review the previous conference outcomes at the beginning
- Create opportunities for programs with similar themes to get together; organize breakout sessions by research topic
- Provide more information from NSF on funding for REU
- Have experienced PIs give short 15 minute talks on what works and what does not
- Allow less time for breakout reporting
- Shorten Friday or insert a break in the afternoon; make the first day a full day; give more time to discuss topics
- Incorporate a venue in which to present new business or issues

Q14. What topics would you like to have covered at future Bio REU PI Workshops?

Summary of topics:

- Pre- or Post-meeting workshops (e.g. research mentor training, developing assessment tools, ethics training)
- Common application
- Strategies for leveraging REU funding to expand an undergraduate research program; More information on supplementary funding from NSF
- Strategies to engage faculty (decrease burnout) and university administrators in REU programs
- Explore the question of how many students we should be training and/or encouraging to pursue research careers; best practices in research career exploration
- Consider how recent reports (e.g. Vision and Change) impact Biology REU
- Institutional support for REU programs
- "How To" session on discussing diversity with students
- Best practices for getting students to conferences to present their research
- Address the incongruence of NSF's broadening participation goal and the criteria upon which programs are judged (broadening participation leads to less certain outcomes)

- REU program administration and day-to-day operations
- Best practices for working with particular populations of students
- Best practices in recruitment

Q15. If a funded 1-day train-the-trainer workshop to learn how to implement the *Entering Mentoring* training program were offered to REU PIs at no cost, would you participate?

Yes 91%
No 9%