

Report from the Second Workshop for Chemistry REU Site Directors



March 2-3, 2001

National Science Foundation
4201 Wilson Boulevard
Arlington, Virginia 22230



Report from the Workshop for Chemistry REU Site Directors

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**Chemistry Division
National Science Foundation
4201 Wilson Boulevard
Arlington, Virginia 22230**

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Introduction:

It is vital for the nation's scientific infrastructure to have well-trained students enter industry and graduate school in the chemical sciences. Most US students matriculate at colleges or non-research universities where research experiences are scarce. It is imperative to enhance the NSF REU program as a means for providing a venue for significant numbers of these students to have a meaningful research experience. The NSF's REU program is highly effective providing undergraduate students, especially those at institutions that lack research opportunities, with a concentrated experience in research. Research experience is pivotal for many students in their decision to enter chemistry as a career, and the REU program strongly provides for and enhances the student's career training. Past statistics suggest that a majority of students participating in chemistry REU programs proceed to careers in the chemical sciences and are very well prepared for entering industry or beginning graduate studies.

Eleven years ago, the directors of REU programs nationwide convened in Washington, DC to attend a NSF sponsored workshop, "Research in the Undergraduate Curriculum". The REU program had started in 1987 in an effort to attract undergraduates to careers in science and to address a general and growing recognition that our nation would soon be facing an acute shortage of qualified mathematicians, scientists and engineers. It is well documented that experiences during the undergraduate years, particularly opportunities to engage in research, are of crucial importance in determining whether or not a young person will seek graduate education and a research-related career.

From that workshop, site directors formulated several consensus statements and recommendations.

At the 1990 meeting, there was consensus that...

- Chemistry is a dynamic experimental science for which research is an inherent component. Such a discipline requires "learning by doing," an inquiry approach, and an apprenticeship experience. A student's education in chemistry is incomplete without research experience.
- A quality undergraduate research experience requires immersion in a genuine research project in a well-equipped laboratory in professional collaboration with a conscientious senior scientist mentor.
- NSF's REU program in chemistry has clearly shown that undergraduate research experience is very effective in the education of students in chemistry and in convincing students to seek a career in chemistry.

Recommendations from the 1990 meeting were...

- Expand NSF's commitment to the REU program in chemistry by funding more sites at different institutions in order to include both greater numbers of participants and a greater diversity of participation.
- Expand NSF's commitment to the REU program in chemistry by increasing the resources available to each site.
- Assist in ensuring that faculty involved in directing undergraduate research receive increased recognition and support by their home institution -- in the form of instructional costs and released time and other compensation -- for their roles in the vital education effort, and that NSF help inform academic administrators about the role of undergraduate curriculum.
- Provide for the continuous short- and long-term monitoring of the results of the REU program and the career of its participants.

- Assist in publicizing the crucial role played by undergraduate research in chemistry education and in supplying the country its needed future research talent to colleges, universities, the chemical community, scientific societies, legislators, and the public at large.

The 2001 Workshop:

Fourteen years after the program's start, several of the REU directors felt that another workshop, like the one in 1990, would benefit both the individual sites and the program as a whole. Thus, the "Workshop for Chemistry REU Site Directors" was held March 2-3, 2001 at the National Science Foundation Headquarters in Arlington, Virginia. The workshop was sponsored by the Chemistry Division Special Projects office. 53 representatives from 52 of the 64 NSF Chemistry REU sites convened at this workshop. In addition, 16 members of the NSF staff attended all or parts of the workshop, providing invaluable resources and information during the ensuing discussions.

Among its goals, this workshop aimed to provide a venue for the REU site directors to interact and learn from each other about what does and does not work in running a productive undergraduate summer research program. It was a time to share ideas about running an REU site, and to discuss a number of issues related to the development and management of individual sites and the Chemistry REU program. The site directors ranged in experience from veterans of the program, some who had been a part of it since its creation in 1987, to site directors heading into their first REU experience. The workshop provided a forum for more experienced site directors to share experiences and for less experienced directors to ask questions and draw on the experience of more experienced directors. In addition to increasing our understanding about the program, participants compiled the discussions, recommendations and consensus statements reached by the group into this document in hopes that it would help potential PIs interested in establishing a new REU site and new site directors in achieving a successful site.

After reviewing the consensus and recommendation statements from the 1990 "Research in the Undergraduate Curriculum" workshop, participants and organizers agreed that the consensus statements remain as valid 11 years later as they were when they were written. Some of the recommendations remain the same as well. Several additional consensus statements and recommendations arose from the discussions. The topics discussed include program assessment, participant recruiting, impact of the REU program, REU programs with international sites, resources, and communication. A summary of recommendations from the workshop is followed by a synopsis of each topic discussed by the panel, in groups and as a whole, consensus regarding the topics, and recommendations to the sites and to the NSF follow in this report. One of the most often spoken words during this workshop was flexibility. This theme weaves through the reports of each area.

Recommendations from the 2001 Meeting

During the workshop, participants discussed a wide range of differing issues. Some of their recommendations were:

- The primary goal of *all* REU sites should be to provide *bona fide* research experience for undergraduate students. Any additional activities should be secondary to this goal
- Assessment of REU sites is difficult and many measures should be used to evaluate program effectiveness. In particular, while publication with undergraduate student coauthorship should be encouraged, it cannot be the only or primary measure of a program's success. Self-assessment questionnaires should be and already have been shared between sites. Examples can be found at the chemistry REU web site.
- The NSF and individual sites should evaluate of the quality of the REU experience at the individual, site, and program levels.
- Minority participation in REU programs continues to be a prime goal of the NSF. In consensus, the group recommended sites increasing their recruitment efforts via minority professional societies and personal contacts.
- Because the primary goal of the REU program is to increase undergraduate participation in research, the group recommended that a significant fraction of participants be recruited from institutions where the students cannot get real research experience.
- Development of international REU sites was encouraged and interested site directors were strongly urged to develop sites via supplemental funding to help ensure success of the international sites.
- Research experiences for Teachers (RET) programs were encouraged especially as a means to recruit underrepresented minorities from high school. RET participants are expected to pursue *bona fide* summer research projects.
- Sites should do their best to track their applicants and participants in order to make educated decisions about funding for the REU program.
- Communication between REU sites is strongly encouraged. Already a listserv of site directors has been created facilitating long distance communication. Plans for REU participation at ACS National meetings are underway.
- Finally, all site directors agreed that the NSF REU program is valuable for providing research experience to undergraduates and recommended that the NSF find ways to continue funding, possibly increasing grant awards.

Balance Between Research and Other Activities

Doing science, as reflected by students' active participation in research in the laboratory, is the primary focus of the chemistry REU program. Students should be engaged in real research projects that challenge them and expand their understanding of the relevance of chemistry beyond the classroom. Information access, problem-solving skills, and team working are generally developed within the framework of the research groups the students are involved with and with their faculty mentor. The development of these skills is demonstrated by the student's communication of their project knowledge and results in oral presentations, poster presentations, written reports, and sometimes publications or presentations at scientific meetings. Many go on to give such presentations at their home institutions, extending the benefits of their REU participation to other students. The presentations give students an opportunity to begin developing networking skills. The clear communication of science is the result of a successful program and should be evidenced by a public student presentation in the format of an oral or poster presentation. In addition, a written summary of the student's research is a desirable component (independent of future publications).

In addition to providing a concentrated experience in the actual practice and development of original research in a specific area, an REU site can enhance the students' appreciation or awareness of chemistry by offering other activities that reflect the particular strengths of the people and facilities of the site. Virtually all REU chemistry programs provide for general career training experiences in several areas considered important by both industry and academia: 1) Information access; 2) Problem-solving skills; 3) Communication skills; 4) Social or networking skills; 5) Team working; 6) Ethics, and 7) Safety practices. These activities can serve to raise the scientific consciousness of the students, provide professional or ethical training, open up opportunities for career development, or train students in techniques for a specific field. These activities should draw from the expertise of the site and not detract from or reduce the quality of the research experience. For example, a program focussing on bringing a research experience to community college students may spend more time on development or training activities that are directly related to the research projects outside the laboratory, while a program targeting more advanced students may have limited supplemental activities. Safety practices are generally developed both by the REU group and the individual research groups. Although some students receive training in these areas within the academic framework at their home institutions, it is generally not within the research context.

A successful REU site does not fit one particular model but its key feature is active research in the chemical sciences. While a balance between development of scientists and the process of doing science may vary somewhat from site to site...

Consensus:

- An appropriate balance must be struck between research and other activities
- There was consensus that all REU students must give a presentation (oral or poster format) at the host institution. If possible, students are expected to present the results from their projects at regional or national ACS meetings. It was agreed that when students present their work at the REU site, faculty mentors from the home institutions should be encouraged to attend.
- It was agreed that all REU students should submit a short written report to the site director upon completion of their projects.

Recommendation

- The call for proposals for the Chemistry REU program should emphasize that the primary purpose of an REU site in chemistry should be to provide a true research experience for undergraduate students.

Program Assessment

To ensure that the REU program is successful from programmatic and students' perspectives each REU site, and the program as a whole, must be assessed. Students, faculty mentors and institutions are key players contributing to the success of REU sites. Thus a successful program must generate a positive impact on all the components. Because the different REU sites have different goals, the emphasis placed on each assessment tool should be appropriately weighted for the individual site. Each site should be evaluated by a multitude of criteria, some of which are listed below.

In science, publication of scientific discoveries in peer-reviewed journals is a measure of the significance of the work as well as the productivity of the research group. While the number of publications from REU projects might not be a direct measurement of success and productivity, it does provide one indication. Because of the diverse levels of student participants, the number and frequency of publications varies widely. Thus, publications cannot be the only measure of research productivity.

To truly evaluate the success of an REU program two questions need to be addressed:

1. Are students who participate in chemistry REU programs significantly better prepared for entering careers in research, either in industry or graduate school, than comparable students who did not?
2. Do students who participate in chemistry REU programs enter careers in science, either in industry or graduate school, significantly more than comparable students who did not?

Self-evaluation of the REU program using these questions is problematic for two reasons: 1) it requires evaluation of student participants on a comparative, statistical, and sometimes subjective basis, and 2) it requires long term tracking of REU participants. Most REU sites lack the expertise to develop meaningful, reasonably quantifiable tools to answer question 1) and cannot reasonably track students beyond one or two years.

Consensus:

- While there is broad consensus about the value and success of the NSF REU program in chemistry, the current parameters used for evaluation of the programs, both at the site level and at the broader program level, are imperfect. Each REU site is unique, and there should be flexibility in the way each program is assessed. It is tremendously difficult to assess critical program aspects such as enhancing problem solving skills, communication skills, and competence. Because students of different academic levels and preparation participate in REU programs, regardless of the host institution, the number and frequency of publications might vary.
- Traditional, quantitative measures of research productivity, such as number of publications, should not be the only tool to assess a program that is based on research.
- The nature of research at predominantly undergraduate institutions and research-oriented institutions differs drastically. At predominantly undergraduate institutions, undergraduate co-authorship is high but publication frequency is low. In contrast, undergraduate co-authorship is often lower than at predominantly undergraduate institutions, while publication frequency is higher.
- While no consensus was reached on a specific survey, the participants agreed surveys and interviews should be designed to find out what students had learned, whether the REU experience had bolstered

their desire to pursue a career in the sciences, whether their scientific maturity and competence had improved, and whether their personal goals were reached at the end of the program.

- In addition, the group agreed that a broad assessment of the Chemistry REU program, collecting statistics from all Chemistry REU sites nationwide, would be desirable.

Recommendation:

- In situations where ten-week REU undergraduate research coworkers contribute to projects at research oriented institutions but do not impact the project significantly enough to warrant co-authorship, the students should be acknowledged. The NSF should provide a method by which such acknowledgements can be reported and should be considered when assessing the program.
- The use of other indicators of tangible outcomes, such as presentations or the numbers of REU students entering graduate or engineering school or chemical/biochemical industry, should be used for assessment.
- Participants recommended that the survey tools used by various established REU sites be made available to new directors.
- The NSF should help develop tools (e.g. questionnaires) for the meaningful evaluation of the quality of the REU experience at the individual, and site levels. This could be accomplished by commissioning a study by a sociologist and/or chemical education specialist and development of appropriate evaluation tools (perhaps as part of an REU project).
- The REU program as a whole should also be assessed. Details about student applications and participants should be collected and analyzed to assess whether the program is meeting the needs of the community.

Participant Demographics and Recruiting

Key goals of the NSF Chemistry Division's REU program are to expand and facilitate the participation and success of students in chemistry careers by involving undergraduate students in chemistry research activities. Additionally, the NSF Chemistry Division is committed to encouraging underrepresented minorities and women to pursue education and careers in chemistry. While most of the REU sites have achieved parity for male and female students, recruiting underrepresented minorities to chemistry remains a challenge.

REU site directors use many methods to recruit students. The most common method is direct mailings to undergraduate chemistry departments, especially to personal contacts at those institutions. Recently, the Internet has also become a major recruiting tool because it has increasingly become a primary source of information for students. Creation of web pages by site directors was strongly endorsed as a means to disseminate information. Directors were also encouraged to utilize and develop linkages with high student traffic web pages of other organizations and groups. Obvious web sites that might be exploited for general recruitment include those of Chemistry Internet Resources for Research by Undergraduate Students (CIRRUS, <http://cirrus.chem.plu.edu>) and that of the NSF. Other effective recruiting methods include seminar visits to institutions where information about REU activities and opportunities are presented, distribution of materials at national meetings of major science or engineering organizations, and advertisement in newspapers and magazines. Development of partnerships with targeted institutions to direct students to a particular REU site is especially effective for informing and attracting minority and community college students.

Consensus:

- A consensus opinion of the group was that the presence of a significant fraction of non-host undergraduates as the participants within a REU site is enormously important. However, it is imperative that primarily undergraduate institutions be able to support their own students as a part of the REU program. While external student participation can spawn collaborations between home and host faculties, aid retention of students in the pipeline, and provide a range of perspectives as a result of broadened backgrounds of participants, flexibility must be allowed in the composition of any particular site, given existent special factors and opportunities.
- For beginners, research is a daunting task. Thus, where a student decides to do undergraduate research may be critical to his or her intellectual and personal development. Students should have the flexibility to choose an REU site at their home institution or elsewhere.

Recommendations:

- The major recommendation was to ensure that the NSF's web page was kept as current as possible reflecting changes in site directors, phone numbers, etc. This requires cooperation between NSF to post the information and the site directors to provide the necessary information in a timely fashion.
- The group recommended that minority recruiting be expanded by connecting with groups that have special commitments and connections with various minority groups, such as The Society for Advancement of Chicanos and Native Americans in Science (SACNAS, <http://www.sacnas.org>), The National Society of Black Engineers (NSBE, <http://www.nsbe.org>), The National Organization for the Professional Advancement of Black Chemists and Chemical Engineers (NOBCChE, <http://www.nobcche.org>). Site directors and the NSF should develop a presence at conferences sponsored by these organizations and recruit students to Chemistry REU programs in general. Site recruiting for minority students must be aggressive to ensure continued and improving diverse participant representation.

Impact of the REU Program

Well-run REU programs have a positive impact on institutions. Even though the goals for predominantly undergraduate institutions and research-oriented institutions are the same, the exact benefits to these institutions might differ. At predominantly undergraduate institutions, a successful undergraduate research program not only provides valuable opportunities of "hands-on" research experience to students, but results from the projects enhance the caliber, reputation and recognition of the department, the faculty and institution. This positive impact has a significant "ripple effect" throughout the entire institution by enhancing the recruiting effort of prospective students, recruiting and retaining of talented faculty members, securing more grants for individual research projects, increasing leverage for more research funds from the administration, and transforming the institutional culture toward research.

At research-oriented institutions, a strong undergraduate program enhances the level of excitement and "out-of-class" interaction among students and faculty as well as enhancing a sense of community within the department. Everyone agreed that REU sites at research-oriented institutions can use the program as an opportunity to recruit the students into their graduate program. Upon returning to their home institutions and displaying the posters from their research projects, the REU students will facilitate the recruitment of students from the home institution for the host research-oriented institutions. Additionally, a strong undergraduate program gives the department better leverage for funding from the

institution to support the academic programs. Another benefit of the involvement of undergraduates in research is that graduate students at research-oriented institutions have an opportunity to gain critical skills in working with and mentoring students.

To ensure the maximum impact on the students, they must be immersed in "real" and meaningful research, and not merely get a "taste" of research. Real and meaningful projects are those that have scientific merit where the results are ultimately publishable in peer-reviewed journals. The specific project must have clearly defined goals and should aim for tangible outcome. For students working at their home institutions, familiarity with the environment and instrumentation, the opportunity to spend substantially longer time on the project (before and after the REU program), and the enhancement of pre-existing relationships between students and faculty mentors can be a big benefit. Other benefits await students who participate in REU sites at other institutions, for example, exposure to new research ideas and to instrumentation that is not available at home institutions, and interaction with graduate students at research oriented institutions.

While a period longer than ten weeks would permit students to more fully investigate their projects, ten weeks is as long as is feasible at most institutions. This period requires faculty mentors to plan projects carefully for students based on the student's level of academic background. Ten weeks gives students sufficient time to study the background information for the project, and with good mentoring and planning, the students to execute the experiments effectively. If possible, REU students should be encouraged to spend more than ten weeks during the summer on their projects. This arrangement would allow students to immerse themselves more deeply into their work and gain a clearer understanding of the problem and solutions. This arrangement is particularly beneficial and applicable to internal REU students.

Consensus:

- A carefully planned undergraduate research program will have a profound positive impact on the institution and students.
- All participants agreed that research is a central component to the learning of chemistry. It gives students a deeper and clearer understanding of the discipline, and it better prepares students for entering the work force or attending graduate schools. All participants also agreed that undergraduate research experience is one of the strongest motivating forces for students to pursue graduate degrees in chemistry.
- Ten weeks is a reasonable length of time for a summer research project.

Recommendation:

- Faculty mentors at NSF-REU sites are expected to provide students with genuine research projects.
- The thrust of the NSF-REU program is to provide research experiences for undergraduate students, especially those who have not had prior research experience. Programs are encouraged to recruit external participants, but up to 50% participation by internal students can be acceptable at predominantly undergraduate institutions.

REU Programs With International Sites

In most cases, the international REU is envisioned to start out as a small-scale supplement to an existing REU or NSF research grant in a focused area. A larger program can then be phased in as appropriate. The NSF is particularly interested in targeting American investigators *early* in their academic careers for an international research experience. The NSF Division of International Programs (INT) maintains a flexible approach in orchestrating the logistical arrangements for these innovative proposals. PIs are encouraged to contact the geographical area specialist at INT as well as their Program Director for advice before submitting a formal supplement request.

PIs of previous successful REU programs suggest that the selection criteria for undergraduate candidates should be different than for a normal REU program. Undergraduates selected for an international experience should have already taken part in undergraduate research, and show a level of maturity indicative of the ability to adapt to and flourish in an unfamiliar environment. These students will be seen as ambassadors of the U.S. to their foreign hosts. In order to engage a representative cross-section of the U.S. population, underrepresented minorities, women and persons with disabilities are encouraged to participate.

Consensus:

- An international component of the REU Program is enthusiastically supported with the goal of training a globally engaged generation of young scientists for the future world economy. American undergraduates are expected to take part in first rate research experiences in a foreign land, in an environment that encourages cross-cultural exchange and establishes long-lasting ties between the American students and their foreign hosts.

Recommendations:

- PIs who are planning to establish international REU experiences are encouraged to apply for preliminary supplemental support to conduct a developmental visit. This could include meeting with foreign collaborators and administrative officials, and inspection of the overseas research and housing facilities in order to make arrangements for future REU activities.

Research Experiences for Teachers

Supplemental funding is available for REU sites to include kindergarten through twelfth grade teachers as participants in summer research groups. The mission of the two-year-old Research Experiences for Teachers (RET) funding is to utilize the REU sites to provide continued professional development of teachers and thus enhance K-12 science education. Site directors who have participated in RET funding to date feel that the inclusion of teachers in the REU sites has been quite successful and mutually beneficial. Teachers have gained by learning new techniques, methods and subjects they can use in their classrooms, developing relationships with universities for continued outreach, obtaining credit for professional advancement and returning to their schools with renewed vigor. The REU sites have benefited from the increase in research activity that has led to publication and other products, the maturity and stability that teachers (who are generally older than the other laboratory researchers) have brought to the groups and the recruitment of students from the teachers' home schools. The RET is unique; no other NSF program supports it. Thus, it can best be served by inclusion in established REU sites, rather than by creating new specialized RET sites. Several successful approaches for RET supplements have evolved in the brief history of this program:

Consensus:

- The high school teacher should be a working member of the research group with the same responsibilities as an REU undergraduate student.
- A “mentored-mentor” approach in which a high school student and her/his teacher join the site as a team with the student being guided by the teacher, while the teacher is mentored by the university faculty member is highly desirable.
- The RET can be part of a masters degree program in which the teacher ultimately receives a graduate degree in chemistry rather than in education.
- An integrated research/curricular development approach yields a thoroughly competent teacher qualified to teach the discipline through exposure to research.

Recommendations:

- Likewise, RET should not be a separate independent program; its success is dependent upon interaction of teachers with the other participants of REU sites. As a complementary program, RET should receive separate or supplementary support independent of primary REU support.
- High school students can be successfully integrated into summer research with their teachers, but generally need a different level of supervision than REU students. Inclusion of high school students can serve as a means of recruiting members of historically underrepresented groups into science.
- Teachers should be expected to participate in bona fide research projects in much the same manner as REU students.
- Teachers will likely not be able to participate in summer research for the same duration as REU students due to limitations in K-12 school year calendars and family responsibilities. Generally teachers may be able to participate in research and other REU/RET activities for eight weeks, which may include time for follow up work at their schools.

Resources

Workshop discussion about resources centered on the following questions:

If more money were available for REU sites, how should it be distributed? What are the advantages or disadvantages of increasing the number of sites vs. increasing the funds for existing sites? Is there an optimal size for programs? Should successful sites be encouraged to expand? Should supplements receive additional funding at the expense of sites? What are the obligations of the host institution?

In general the participants felt that more data is needed to decide whether more sites should be funded; specifically, they questioned whether the current demand is being met via the REU, and whether deserving students are being missed. There was general sentiment that the NSF should try to ensure geographical coverage such that large regions of the country are not left without sites, and to continue funding of successful sites in underrepresented regions. Participants agreed that the current size of programs (8-12 students) is appropriate, and that funding for additional students should be the institution’s responsibility.

The workshop participants all recognized that NSF REU sites cost more to run than the NSF grants cover. Thus institutions must cover these extra costs. Many sites find support creatively through reduced cost housing and/or board, administrative support or release from teaching.

Consensus:

- There was strong consensus that REU sites are more effective than supplements because the group atmosphere plays a very important role in contributing to a successful undergraduate research experience. It is more important to increase student stipends than the number of sites.
- The current number of sites, number of participants, and funding of sites appears adequate. While funding for most sites is adequate, there should be better support for site directors, such as, one month of summer salary, particularly for those in predominantly undergraduate institutions. PI support is also needed to encourage applications for new sites and to encourage continuation of existing sites.
- Support for student travel to present research results at meetings would be desirable.
- Institutional support and cost sharing is expected. This should be in real dollars and can take the form, among others, of housing, travel, supplies, funding for additional participants, returning indirect costs to the program, administrative support, and teaching release.

Recommendations:

- It is recommended that NSF continue funding of the REU program at somewhat higher levels than it does currently.
- Site directors should track of applicants to ascertain demand for research experience would allow for more informed decisions about allocation of resources.
- Sites should ensure some form of institutional support for their programs.

Communication.

A critical part of the REU program is communication. Communication must extend from the sites to the students but it should also extend between the sites, between sites and NSF, and between the home and host departments and institutions.

Meetings of the REU site directors are probably the best method to transfer information between sites. One of the major results of the most recent workshop was sufficient communication allow the to assessment of the current REU and to plan for the future. While nothing can replace face-to-face contact, once contact has been made, telephone and email communication is enhanced.

Following students once they leave programs is a difficult task. Most site directors try to maintain communication with students after they leave the program. However, this generally relies on students responding to site director inquiries. Some suggestions for improving contact between site directors and REU alumni include periodic email contact, newsletters, an alumni page on the REU website, contact with the home institution, and the expectation that mentors should continue to contact former students. Direct contact between site directors and student mentors from the home institutions may improve tracking. Additionally, it could lead to collaborations and methods for students to extend their summer research experiences to their home institutions.

Consensus:

- To enhance the impact on students and institutions, communication between faculty mentors from the home and host institutions needs to improve. This would ensure that the students had indeed received an excellent research experience.
- Tracking students after they leave the programs can be difficult.

Recommendations:

- The NSF and the site directors should cooperate to ensure that a current and up-to-date listserv exists to facilitate communication between site directors.
- The REU site directors should meet regularly and probably more frequently than once a decade. Meetings could be held in conjunction with national meetings of scientific societies, such as ACS. Periodically, meetings/workshops should be held at NSF.
- The NSF should aid in the development of long term career tracking methods for REU participants. This might be done by establishment of a global REU participant database in conjunction with a study or by establishing information sharing arrangements with professional societies such as the American Chemical Society.

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Agenda

March 2, 2001 (Friday)

6:00 PM - Registration and Reception - Room 375

7:00 PM - Orientation and Overview

7:00 Welcome and Statement of Goals – Heinz Koch (Ithaca College) and John Stevens (NSF)

7:10 Welcome from Chemistry Division – Donald Burland (Acting Division Director)

7:15 History and Overview of REU Program – Barbara Schowen (University of Kansas)

7:35 Current Chemistry REU Program – John Stevens (NSF)

7:55 REU Program from the NSF-wide Perspective – Karolyn Eisenstein (NSF)

8:15 General Discussion on REU Program

8:30 Preparation for Group Sessions – Heinz Koch

Group 1: Dan Akins (CUNY-City College) – Room 320

Group 2: Moses Lee (Furman University) – Room 370

Group 3: Nancy Levinger (Colorado State University) – Room 375

Group 4: Barbara Schowen (University of Kansas) – Room 380

9:00 Adjourn

March 3, 2001 (Saturday)

7:00 Continental Breakfast – Room 375

8:00 Group Sessions

Group 1: Dan Akins (CUNY-City College) – Room 320

Group 2: Moses Lee (Furman University) – Room 370

Group 3: Nancy Levinger (Colorado State University) – Room 375

Group 4: Barbara Schowen (University of Kansas) – Room 380

10:30 Reports from the Groups – Room 375

Recruiting Participant Demographics – Dan Akins

Impact on the Institution and Research Experience for Students – Moses Lee

Assessment and Communications – Nancy Levinger

Resources – Barbara Schowen

Development of a Consensus Report

12:30 Panel Sessions and Working Lunch

Panel 1: Research Experience for Teachers (Dan Akins) - Room 375A

Panel 2: Outreach and Recruitment (Nancy Levinger) – Room 375B

Panel 3: REU and International Sites (Heinz Koch) – Room 320

Panel 4: Balance between Research and Other Activities (Barbara Schowen) – Room 370

Panel 5: Outcomes, Results, and Assessment (Moses Lee) – Room 380

2:30 Reports from the Panels – Room 375

Panel 1: Research Experience for Teachers - Dan Akins

Panel 2: Outreach and Recruitment - Nancy Levinger

Panel 3: REU and International Sites - Heinz Koch

Panel 4: Balance between Research and Other Activities - Barbara Schowen

Panel 5: Outcomes, Results, and Assessment - Moses Lee

Development of a Consensus Report

3:45 Break with Refreshments

4:15 Development of Final Report – Room 375

4:45 Final Report Writing Session and Break

5:45 Approval of Final Reports and Recommendations – Room 375

6:15 Adjournment

THE GROUP SESSIONS

RECRUITING PARTICIPANT DEMOGRAPHICS

How do directors recruit participants? What methods appear especially effective for recruiting external participants? In particular, what works when recruiting students from institutions that do not offer summer research for undergraduates? How have directors addressed minority recruiting and what works? Has the participation of undergraduates from outside institutions been as successful as that for participants from the home institution? What considerations should directors use to decide between recruiting "in-house" and "external" participants? Should the considerations differ for programs at PUIs and Ph.D. institutions?

IMPACT ON THE INSTITUTION AND RESEARCH EXPERIENCE FOR STUDENTS

How do programs impact the environment for science at the home institutions after participating students return? How do REU programs enhance research programs at PUI institutions? How do REU programs impact research at Ph.D. institutions? Is the ten-week summer experience significant if it is not reinforced by additional research at the home institution? Is ten weeks long enough to obtain significant research results? What should be the expectation for publishable results? Is the object of the program to give the student a "taste" of research? Or is it to have the participant really analyze a problem, contribute to the research design, and produce something of permanent value? Is it more valuable for a student from an undergraduate institution to participate at an REU site that is in a graduate department and allows constant interaction with graduate students and postdoctoral researchers? What are the advantages for students from an undergraduate institution to participate at an REU site at another undergraduate institution?

ASSESSMENT AND COMMUNICATION

Should there be regular meetings of site directors to evaluate program effectiveness? If so, how often, where and when should the meetings be held (for example, at ACS National meetings?). Should there be regular regional meetings for programs in the same geographic region? Should there be regular meetings segregating programs from PUI or research oriented institutions? Should meetings be open to individuals considering applying for REU sites or people who are not currently involved in REU programs? Should communication between REU sites be encouraged? If so why? What formats other than NSF sponsored workshops or REU meetings, would enhance communications between the directors of REU sites? Should the NSF program director facilitate communication and transfer of information? How can the Internet best be used to enhance communication?

RESOURCES

If more money was available for REU sites, how should it be distributed? What are the advantages or disadvantages of increasing the number of sites vs increasing the funds for existing sites? Is there an optimal size for programs? Should successful sites be encouraged to expand?

THE PANELS

Panel 1: RESEARCH EXPERIENCE FOR TEACHERS

Room 375A

Chair: Dan Akins (CUNY-City College)

NSF Resource: Robert Boggess (Division of Undergraduate Education)

Frank Wodarczyk (Chemistry, MPS and International – Brazil, SBE)

Should high school chemistry teachers be included in REU site activities? The NSF Research Experiences for Teachers [RET] program typically has had about 50 RET supplements made to REU site grants. Can high school students be integrated into summer research programs with their teachers? This would demonstrate that chemistry is a dynamic field covering all areas of science and is not the sterile field that many high school courses suggest. They could collaborate with the undergraduates and see active summer research solving real chemistry problems of a publishable quality. This might also be the best way to attempt to get minority students into the chemistry pipeline.

Panel 2: OUTREACH AND RECRUITMENT

Room 375B

Chair: Nancy Levinger

NSF Resource: Ty Mitchell (Chemistry Division)

The Chemistry REU Programs are doing a good job of recruiting underrepresented groups, but how can a better job be done? How can the recruitment of students with disabilities and non-traditional credentials be improved? Is the REU program overlooking some students as participants? Should the major emphasis be on the applicant's grade point average? Are there other indicators that could be used to suggest that a student would become successful for a research career? Are there successful programs that recruit participants from two-year college programs?

Panel 3: REU AND INTERNATIONAL SITES

Room 320

Chair: Heinz Koch

NSF Resource: Rose Gombay (International Programs - Western Europe)

Larry Weber (International Programs – East Asia and Pacific)

Alex DeAngelis (International Programs – East Asia and Pacific)

It is more difficult for chemistry majors to take advantage of study abroad programs. Could REU sites offer an alternative to spending a semester in a foreign country? A summer research exchange has the added advantage of foreign chemistry students working for a summer in our laboratories as well as our students working in laboratories in other countries. The University of Florida has an REU site that includes USA students working in various French laboratories. A number of PUI departments started an active summer research exchange program in 1985 with the University of Leiden, The Netherlands. Can these models be incorporated into other REU sites?

Panel 4: BALANCE BETWEEN RESEARCH AND OTHER ACTIVITIES

Room 370

Chair: Barbara Schowen

NSF Resource: Kathy Covert (Chemistry Division)

What is a reasonable emphasis on "extra curricular" activities such as field trips, lecture courses associated with the research, or ethics and social gatherings? These activities can take time away from the research that should be featured in a very short ten-week period.

Panel 5: OUTCOME, RESULTS, AND ASSESSMENT

Room 380

Chair: Moses Lee

NSF Resource: Karolyn Eisenstein (Division of Undergraduate Education)

What are the best methods for assessing the REU site programs? What are reasonable expectations of REU participants appearing as co-authors on publications in peer-reviewed professional journals? How should these be compared to participants presenting their work at national or international professional meetings? Is there real value to publications or presentations in student oriented journals or meetings? What other methods of assessment are available?

Participants List

LIST OF CHEMISTRY REU SITES AND DIRECTORS FOR SUMMER 2001

Alabama-Birmingham, University of Tracy Hamilton	Furman University Lon Knight (not attending) Moses Lee (substituting)
Alabama-Tuscaloosa, University of Lowell Kispert	Georgia Tech Thomas Moran
Arkansas, University of Donald Bobbitt	Harvey Mudd College Shenda Baker
Bowling Green State University Neocles Leontis	Hope College Joanne Stewart (not attending)
Bucknell University Dee Ann Casteel (not attending) Brian Williams (substituting)	Howard University Helen de Clercq
California State University-Fullerton John Olmsted	Idaho State University Dennis Strommen
California State University-Los Angeles Scott Nickolaisen	Indiana University Steven Wietstock
California-Santa Cruz, University of Rebecca Braslau	James Madison University Daniel Downey
Cincinnati, University of John Alexander	John Carroll University Michael Nichols
City University of New York - Staten Island Ruth Stark Jim Batteas	Kansas State University Anne Kelley
Clemson University William Pennington	Kansas, University of K. Barbara Schowen
Colorado - Boulder, University of Kathy Rowlen (not attending)	Kent State University Robert Twieg (not attending) Arne Gericke (substituting)
Colorado State University Nancy Levinger	Kentucky, University of David Atwood (not attending) Art Cammers-Goodwin (substituting)
Columbia University Leonard Fine	Loyola University of Chicago Mary Boyd (not attending) Ken Olsen (substituting)
Connecticut, University of Amy Howell	Memphis, University of Thomas Cundari (not attending)
Florida, University of Randolph Duran	

Miami University Michael Crowder (not attending)	South Carolina-Columbia, University of Catherine Murphy
Michigan, University of Brian Coppola (not attending) Seyhan Ege (substituting)	Southern Mississippi, University of Jeffrey Evans
Mississippi State University Judith Eglin	Syracuse University Karin Ruhlandt-Senge
Montana State University Tom Livinghouse (not attending)	Texas A&M University - College Station Gary Sulikowski
Nebraska-Lincoln, University of John Stezowski	Trinity University William Kurtin
New Mexico, University of Lorraine Deck (not attending)	Utah, University of Richard Steiner
North Carolina State University Thomas Gunnoe	Virginia Commonwealth University Suzanne Ruder
North Dakota State University Gregory Cook	Virginia, University of James Demas
Notre Dame, University of Marya Lieberman (not attending) Paul Helquist (substituting)	Washington, University of Darrell Woodman (not attending)
Occidental College Phoebe Dea	Wellesley College Adele Wolfson (not attending) David Haines (substituting)
Oklahoma, University of Daniel Glatzhofer	Wesleyan University Joseph Bruno
Oregon-Eugene, University of Geraldine Richmond	West Georgia, State University of Victoria Geisler
Pennsylvania State University - University Park William Horrocks (not attending)	Wichita State University Paul Rillema
Pittsburgh, University of Joseph Grabowski	Wyoming, University of Dean Roddick (not attending)
Puerto Rico Rio-Piedras, University of Ana Guadalupe	Youngstown State University Daryl Mincey (not attending) Jeff Smiley (substituting)
Rochester, University of Thomas Krugh	
Santa Clara University Amy Shachter	

Participants List

NSF Staff Participants

Joe Akkara (Chemistry, MPS)

Vicki Bragin (Division of Undergraduate Education , HER)

Robert Boggess (Division of Undergraduate Education, EHR)

Donald Burland (Chemistry, MPS)

Leslie Butler (Chemistry, MPS)

Kathy Covert (Chemistry, MPS)

Alex DeAngelis (International Programs – East Asia and Pacific, SBE)

Lloyd Douglas (Mathematical Sciences, MPS)

Karolyn Eisenstein (Division of Undergraduate Education, EHR)

Rose Gombay (International Programs - Western Europe, SBE)

Susan Hixon (Division of Undergraduate Education, EHR)

Ty Mitchell (Chemistry, MPS)

Terrence Rettig (Physics, MPS)

John Stevens (Chemistry, MPS)

Bonnie Thompson (International Programs – Central & Eastern Europe)

Larry Weber (International Programs – East Asia and Pacific, SBE)

Frank Wodarczyk (Chemistry, MPS and International – Brazil, SBE)

EHR = Directorate of Education and Human Resources

MPS = Directorate of Mathematical and Physical Sciences

SBE = Directorate of Social, Behavior & Economical Sciences