Many of today's innovative models for preparing teachers, especially at research universities, call for building partnerships between teacher education programs and the colleges of arts and sciences, university research labs, local schools, and businesses.

Research universities have the special opportunity to connect the excitement of research directly to the preparation of teachers. Major funding agencies, such as the National Science Foundation (NSF) and the National Aeronautics and Space Administration (NASA), increasingly require research projects to demonstrate their involvement in K-12 education.

AAU institutions, as the nation's premier research universities, share a particular obligation to help prospective teachers experience firsthand what it means to do science rather than just learn it. Since many K-12 teachers have never had such an encounter with real science, they can benefit greatly from being part of a research experience in an AAU university. This might be either part of a summer program or a school year opportunity.

As one researcher said about a science teacher who worked with him through NSF's Research Experiences for Teachers (RET) program:

I strongly encourage others to participate in and support the RET program. I have had two science teachers work in my laboratory during the summer. In both cases, my research group and the teachers have benefited tremendously and I can state that the program was an unqualified success.

[Hannah's] work was outstanding and prompted me to invite her to stay on as a part-time researcher in my group. In addition, her high level of maturity and enthusiasm inspired many of my graduate students to do better work. The results of her research are currently being written-up for submission to a scientific journal. In addition to doing great research, Hannah actively pursued involvement in our educational outreach activities. We currently consult with her on a frequent basis about issues
related to educating teachers in a university environment. Hannah has demonstrated an amazing commitment to her teaching craft and is genuinely interested in the betterment of her students. A good deal of this was inspired by her participation in the RET program.

--Michael F. Rubner
TDK Professor of Polymer Materials Science and Engineering
Massachusetts Institute of Technology

RESOURCES

The NSF remains the principal source of support of research activities for current and prospective teachers. All proposals submitted to NSF research programs may include undergraduate research, and faculty are encouraged to involve undergraduates who are prospective teachers. Undergraduate student stipends can be incorporated into the proposal budget request.

NSF Grant Programs

The Research Experiences for Undergraduates (REU) program is the largest single NSF source of support for undergraduate research assistants. REU projects involve students in ongoing research programs or in research projects specially designed for the purpose.

There are two types of REU grants, available through each of the research directorates of the NSF:

- REU supplements to ongoing NSF-funded grants and cooperative agreements,
- REU sites, which are based on independent proposals to initiate and conduct undergraduate research participation projects. REU sites serve a number of students, primarily from outside of the host institution.

The website for REU information is http://www.nsf.gov/home/crssprgm/reu/start.htm.

Supplements to NSF Research Grants

Some NSF research directorates (including Engineering and Math & Physical Sciences) also support Research Experiences for (in-service) Teachers (RET). Funding requests may be submitted as supplements to existing NSF projects as in the REU program or may be requested as parts of new proposals. Interested faculty members should contact the appropriate research directorate for further information.

NSF Science and Technology Centers

NSF’s Science and Technology Centers program mandates a K-12 educational
component in each grant. This requirement can be fulfilled by having either in-service or pre-service teachers or both participate in research.

**NASA Projects**

NASA requires an educational component in all research grants, which can include K-12 education. While every individual investigator is not required to participate in education and public outreach, all NASA flight projects and major research projects are expected to contribute to education, public understanding, and appreciation of science in a substantive and continuing manner. In fact, all major flight projects must have not only an education and outreach component, but also a person responsible for planning such activities and serving as their focal point.

**PROGRAMMATIC SUGGESTIONS**

Faculty interested in designing a research experience for prospective or current teachers should understand that the experience must have transfer benefit to the teacher's classroom. This will require thoughtful preparation by both the scientist and the student. Some points to keep in mind include the following:

- In order for research experiences to help improve K-12 instruction over the long-term, Research Participation Teachers (RPTs) must be part of a community of teachers with research experience. Such communities can help teachers develop curricula, answer questions, and help them overcome local barriers to the "learning-science-by-doing-science" paradigm.

- Professional curriculum and instruction expertise is valuable for RPTs as they develop units or lesson plans incorporating aspects of their research experience or using the learning-science-by-doing-science paradigm on a project of interest to their students. Use of high quality standards-based curriculum materials that appropriately match with the research will facilitate transfer to the classroom.

- Multiple years of research experiences are better than one year.

- Maintaining daily journals of research accomplishments and personal reflections provides a valuable resource for RPTs after the research experience.

- Whenever feasible after the completion of the research experience, the faculty researcher and the teacher should maintain contact through e-mail and occasional lab visits.

Each AAU university should have individuals on campus who are aware of current opportunities and who can help faculty members wishing to initiate research experiences for teachers and prospective teachers. Such programs offer an important
way to improve the K-12 preparation of all students, including those who will enter AAU universities in the future.