NSF Broader Impact Activities and MU Resources

From the NSF-grant proposal guidelines: The Project Description must describe as an integral part of the narrative, the broader impacts resulting from the proposed activities, addressing one or more of the following as appropriate for the project:

1- How well does the activity advance discovery and understanding while promoting teaching, training and learning?

2- How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)?

3- To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks and partnerships?

4- Will the results be disseminated broadly to enhance scientific and technological understanding?

5- What may be the benefits of the proposed activity to society?

WV and MU statements

1-How will the project integrate research and education by advancing discovery and understanding while at the same time promoting teaching, training, and learning?

NSF Examples of Activities:

1.1 Integrate research activities into the teaching of science, math, and engineering at all educational levels (e.g., K-12, undergraduate science majors, non-science majors, and graduate students).

MU examples:

- Oversee research-based courses. For example, Dr. Harrison organized a Research Rotation course for the Spring 2005 semester, to provide talented, enthusiastic freshmen hands-on experience in undergraduate research in biology.
- Describe your previous involvement with students in capstone and independent study projects.
- For courses you teach, develop labs or sets of labs that are class- or student-directed research projects.
- Develop seminars and problem-based courses within your discipline.
- Emphasize courses that are cross-listed in collaboration with other (especially non-major) programs.
- Include MS students' research and any collaboration involving faculty from other departments or other institutions. Interdisciplinary projects are especially noteworthy.
- Develop curricular material for a specific group of courses or development of a track, emphasis, or major within your B.S. and M.S. program at Marshall University.
- Develop and teach courses that enhances research capabilities for undergraduate and graduate students.

1.2 Include students (e.g., K-12, undergraduate science majors, non-science majors, and /or graduate students) as participants in the proposed activities as appropriate.

MU examples:

- Summarize previous supervision of undergraduate research for PI and CoPIs, providing expected outcomes for participants in the proposed activities (number of students, level of involvement, opportunities to present their results).
- Summarize previous supervision of graduate student research.
- Partner with K-12 teachers to bring updated laboratory experiences into their schools.
- Indicate ways in which non-science-major participation in the sciences has been encouraged (e.g., medical, environmental, and/or agricultural activities).
- Include oversight of research-based activities of high school teachers and/or students in the proposed projects.

1.3 Participate in the recruitment, training, and/or professional development of K-12 science and math teachers.

MU examples:

- Coordinate with existing initiatives such as HSTA, COMETS, and Upward Bound.
- Include interactions with education students as part of their training (e.g. in your research, or as Master's students).

1.3 Develop research-based educational materials or contribute to databases useful in teaching (e.g., K-16 digital library).

1. 4 Partner with researchers and educators to develop effective means of incorporating research into learning and education.

MU examples:

- Develop lab exercises and materials that can be loaned to participating teachers.
- Discuss any e-courses (or exercises) that are available to high school students.

1.5 Encourage student participation at meetings and activities of professional societies.

MU examples:

- Include the number of students who have attended and/or presented at professional meetings, including on-campus presentations such as Sigma Xi Research Day and the SOM Research Day (as examples of university support of student research), as well as at regional, state, national, and international meetings.
- Provide examples of dissemination of results in professional journals.
- List student participation in other professional activities such as field trips, panel sessions, and other sponsored activities.

1.6 Establish special mentoring programs for high school students, undergraduates, graduate students, and technicians conducting research.

MU examples:

- Discuss examples where graduate students mentor undergraduate research projects or where senior students mentor junior undergraduates or high school students.
- Include mentoring of high school research projects by you or your students.
- HSTA, etc.?

1.7 Involve graduate and post-doctoral researchers in undergraduate teaching activities.
MU examples:

- Discuss integration of graduate students in your course activities (e.g., as a TA or overseeing class projects).

Include graduate and post-doctoral researchers sharing their experiences through teaching undergraduate courses.

1.8 Develop, adopt, adapt or disseminate effective models and pedagogic approaches to science, mathematics, and engineering teaching.
MU examples:

- Discuss any innovative methods you've used to approach integration of teaching and research that can serve as a model for others at Marshall.
- Publish results of pedagogical experiments in education-related journals.

2- How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)?
NSF Examples of Activities:
1.2 Establish research and education collaborations with students and/or faculty who are members of underrepresented groups.
MU examples:

- LSAMP specifically supports undergraduate research for minority students. Contact David Cartwright about collaborating with this program.

2.2 Include students from underrepresented groups as participants in the proposed research and education activities.
MU examples:

- Point out research opportunities to Appalachian undergraduates, many of whom will be first-generation college students.
- Include number of student researchers in your lab, along with their demographics. Examples:

  "Collectively, the participating faculty from Biological Sciences have overseen 48 undergraduate student research projects over the last 5 years. Of these students, 50% were female and 20were minority or first generation college students."

  "The PI has mentored nearly a dozen physics majors (including two American women, one Chinese woman, one Chinese man, and six American men) during his tenure at Marshall on research projects that have resulted in co-authored papers at meetings of the Ohio Section of the American Physical Society."
- Indicate how you will work with current departmental and college student recruiting programs (e.g. open houses, major fairs, high school visits).
- Provide a list of students (including Master's level) who have worked under your direction at Marshall. Include their current employment and educational status.

2.3 Establish research and education collaborations with students and faculty from non-Ph.D.-granting institutions and those serving underrepresented groups.
MU examples:

- Outline opportunities for students to participate in collaborative projects.

- This activity might be a carrot for those individuals looking to find collaborators at PUIs.

2.4 Make campus visits and presentations at institutions that serve underrepresented groups.
MU examples:
- Integrate with recruitment efforts to primarily black institutions or provide materials for those visits.

2.5 Establish research and education collaborations with faculty and students at community colleges, colleges for women, undergraduate institutions, and EPSCoR institutions.
MU examples:
- Collaborate with MU-EPSCoR, MU-ADVANCE, and/or the Community and Technical College.

2.6 Mentor early-career scientists and engineers from underrepresented groups who are submitting NSF proposals.
MU examples:
- Participate in writing groups that foster professional activities (e.g., MU Writing Groups).
- Present at internal workshops or seminars that focus on grant preparation.
- Collaborate with, and include these scientists as grant co-PIs where appropriate.

2.7 Participate in developing new approaches (e.g., use of information technology and connectivity) to engage underserved individuals, groups, and communities in science and engineering.
MU examples:
- Develop innovative e-courses that reach rural high schools.
- Develop e-courses for schools that lack the proper college-prep courses.

2.8 Participate in conferences, workshops, and field activities where diversity is a priority.
MU examples:
- Partner with diversity-oriented organizations offering summer internships, jobs, and admission into graduate programs.
- Support a student in the Marshall University Upward Bound Program. This program serves –seventy tenth through twelfth grade students from Cabell County (Cabell Midland and Huntington High), Mingo County (Tug Valley), and Wayne County (Tolsia and Wayne High Schools) in southwestern West Virginia. The students spend six weeks on the Marshall campus during the summer, becoming oriented to a variety of issues that help them prepare for a college education. Classes include mathematics, science, literature, communications, computer science, drama, career exploration, and much more. The students also travel, attend cultural enrichment activities, and live in the Twin Towers Residence Halls.
- Participate in HSTA and/or LSAMP events

3- To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks and partnerships?

NSF Examples of Activities:

3.1 Identify and establish collaborations between disciplines and institutions, among the U.S. academic institutions, industry, and government and with international partners.

MU examples:

- Discuss the current infrastructure and how the new facilities or equipment will strengthen the research capabilities and increase potential for collaboration.

3.2 Stimulate and support the development and dissemination of next-generation instrumentation, multi-user facilities, and other shared research and education platforms.

MU examples:

- Discuss how new facilities will integrate into current facilities and be maintained as shared research to greatly impact the research capability for the participating faculty.
- Discuss the impact of the new facility relative to significantly improving the quality of student training, course development, and collaborative interactions between the academic units.

3.3 Maintain, operate, and modernize shared research and education infrastructure, including facilities and science and technology centers and engineering research centers.

MU examples:

- Discuss how major upgrades and additions of equipment to your department and others in the College of Science have markedly improved our ability to do research.
- Discuss the impact of MU core facilities on your access to necessary research equipment and/or techniques.

3.4 Upgrade the computation and computing infrastructure, including advanced computing resources and new types of information tools (e.g., large databases, networks and associated systems, and digital libraries).

MU examples:

- Provide resources through on-line library or web-based access that helps overcome the financial limitations of a rural PUI. One example is Suzanne Strait's PaleoView database.

3.5 Develop activities that ensure that multi-user facilities are sites of research and mentoring for large numbers of science and engineering students.

MU examples:

- Discuss management of facilities and training programs or workshops that will increase the usage of the facilities.
- Develop a website of available facilities, with equipment list and contact information for facility manager and users (for potential collaboration).

4- Will the results be disseminated broadly to enhance scientific and technological understanding?

NSF Examples of Activities:

4.1 Partner with museums, nature centers, science centers, and similar institutions to develop exhibits in science, math, and engineering.

MU examples:

- Propose an exhibit with the Clay center.
- MU faculty who are on the speaker's bureau for the master naturalist program?
- Outreach to/through Nature Conservancy and the Non-game weekend? (Pauley used to do this – not sure if he still does)

4.2 Involve the public or industry, where possible, in research and education activities.
MU examples:

- Linda Hamilton LEGO, for example.

4.3 Give science and engineering presentations to the broader community (e.g., at museums and libraries, on radio shows, and in other such venues.).
MU examples:

- Propose an exhibit at the county library
- Interviews with the newspaper or public radio

4.4 Make data available in a timely manner by means of databases, digital libraries, or other venues such as CD-ROMs.
MU examples:

- Suzanne's PaleoView database.

4.5 Publish in diverse media (e.g., non-technical literature, and websites, CD-ROMs, press kits) to each broad audiences.
MU examples:

- Propose the development of a website for dissemination of your material. Include suggestions of non-technical sites (schools, etc.) that could include a link to your website on their website.
- Prepare press releases about your research results.

4.6 Present research and education results in formats useful to policy-makers, members of Congress, industry, and broad audiences.
MU examples:

- Present research at events at the Capitol (undergraduate research day) and other state-wide activities that involve legislators (STaR Symposium).

4.7 Participate in multi- and interdisciplinary conferences, workshops, and research activities.
MU examples:

- Faculty and student participation in minority- or women-oriented programs or events when attending professional meetings.

4.8 Integrate research with education activities in order to communicate in a broader context.
MU examples:

- Preparing science demo or activities for an elementary school

5- What may be the benefits of the proposed activity to society?
NSF Examples of Activities:

5.1 Demonstrate the linkage between discovery and societal benefit by providing specific examples and explanations regarding the potential application of research and education results.

MU examples:

- Tina Cartwright's COMETS Program outlines the specific populations that will benefit, detailing targeted grades and number of students that will be impacted. Discuss professional development for teachers and pre-service teachers.
- Include statements specific to the potential application of your research, such as a cure for cancer, development of pest-resistant crops, or production of an inexpensive solar cell, etc.

5.2 Partner with academic scientists, staff at federal agencies and with the private sector on both technological and scientific projects to integrate research into broader programs and activities of national interest.

MU examples:

- Tina Cartwright's COMETS Program promotes teaching and learning by involving a community of educators, including formal, informal and pre-service, in long-term professional development. Through on-line dissemination of COMETS activities, COMETS will serve as a model for other OST Earth and Space Science programs.

5.3 Analyze, interpret, and synthesize research and education results in formats understandable and useful for non-scientists.

MU examples:

- Provide newsletters to specific groups.
- Involve local newspapers in presenting and explaining the importance of your research results.

5.4 Provide information for policy formulation by Federal, State or local agencies.

WV and MU background narrative:

Marshall University and West Virginia state initiatives enable Appalachian students to attend college and prepare for science careers

West Virginia is the only state situated entirely within Appalachia. According to 2007 recent statistics, the state ranks 49th in terms of per capita income and persons younger than 25 with a Bachelors degree or more. Therefore, educational development must become a foremost priority in West Virginia.

Marshall University (MU) is strongly committed to West Virginia's efforts to increase educational opportunities and build a competitive West Virginia workforce. MU offers scholarship programs that augment the state's need-based and merit-based financial aid. The outcome of these coordinated efforts will be an educated work force that attracts new businesses to West Virginia and spurs its economy.

WV educational problems have resulted in only 14.8 % of West Virginians over the age of 25 attaining a college degree compared to 21.7% in the southeastern states and 27.6% in the United States as a whole. West Virginia has instituted strong countermeasures to address these problems. Current scholarship initiatives in West Virginia will have a positive impact on MU by:

- Providing better-qualified students
- Requiring additional mathematics and science classes for scholarship applications
- Encouraging academically talented individuals to pursue careers in science and technology

The West Virginia PROMISE (Providing Real Opportunities for Maximizing In-state Student Excellence) Scholarship Program was approved by the Legislature in 1999 has been available for high school graduates since 2002. PROMISE offers each West Virginia high school graduate with a 3.0 grade point average and composite ACT score of at least 21 (combined SAT score of 1000), a full tuition scholarship to a state college or university or an equivalent dollar amount scholarship to an in-state private college.

Marshall University is the second largest university in West Virginia, with a 2006 enrollment of more than 9,723 undergraduate and 4,213 graduate students. Marshall predominantly serves West Virginia residents (~83%) and more than 70% of our student body are first generation college students. Marshall offers 41 baccalaureate programs and 46 graduate programs, including a Ph.D. program in Biomedical Sciences, M.D. in Medicine, and Psy.D in Psychology. Marshall currently offers several highly competitive scholarships to attract extremely well-qualified students, including a total of 40 Yeager Scholars and approximately 240 John Marshall Scholars. These programs offer students generous scholarship support, a challenging curriculum within an Honors learning community, and preparation for graduate and professional education and employment.

College of Science

The 2007 College of Science (CoS) enrollment is 1,157 undergraduate students. While the minority population of WV is only 4.6% compared to 33.1% in the US at large, the CoS has attracted a higher minority population of 8.6%, which is above the Marshall University minority student population of 6.4%. As part of the Louis Stokes Alliance for Minority Participation (LSAMP) Program, the CoS actively works to recruit and retain minority students in the STEM disciplines. In addition, 53% of CoS undergraduates with declared majors are female. Our students are typically from rural communities with inadequate high school systems (West Virginia ranked 44th in the nation on the 2005 National Assessment of Educational Progress scores for mathematics). To address these shortcomings, the University has developed programs (e.g., Yeager, John Marshall, and Honors programs, Writing Across the Curriculum, Global Studies, Computer Literacy, and Capstone Experiences) to help students achieve their full potential.

Marshall's CoS places special emphasis on experiential learning through participation in activities such as undergraduate research and internships. To encourage undergraduate research, the College oversees the West Virginia Space Grant Consortium's NASA Research Scholarships Program, which awards student researchers small scholarships (up to $1000) for research supplies and as a stipend. The scholarship program has awarded 124 undergraduate scholarships

over the last 5 years. NASA scholarship awardees represent a wide variety of disciplines in science, engineering, and behavioral science, and all participants present their results at the Annual MU Sigma Xi Research Day. Of the 24 awardees for the 2007-2008 academic year, 41% were female and 20% represent minority students. Other students engage in research during the academic year through independent study and capstone experiences. Additionally, the CoS has offered summer research programs for several years. These include the NSF EPSCoR's SURF: Summer Undergraduate Research Fellowship Program (1999-2005); NSF REU: Research Experience for Undergraduates in Bio-inspired Chemistry at Marshall University (PI: Bush, 2003-2005); and currently, WV EPSCoR's Research Challenge Fund's MU SURE: Summer Undergraduate Research Program (2005-2007). The SURE program supports 14 students for a 10 week summer research program that includes laboratory research as well as a presentation of research results in weekly meeting and at a research day at the end of the program.