key Points

Subproject Milestones
Integrative Milestones
Directors, Administrative and Management
Leveraging Opportunities
Programs Modified

I. INTRODUCTION. The University of Montana (UM) and Montana State University (MSU) co-produced and co-directed the 2001-2004 NSF EPSCoR program in Montana. Three research focus areas were developed: (a) biomolecular structure and function (UM), (b) nanotechnology (MSU) and (c) integrated analysis of complex biological systems (UM/MSU). Each focus area has been successful as measured by a number of checkpoints (Table 1). The 2001 award set forth milestones for sub-projects (faculty hires, graduate research stipends, etc.) and integrative milestones (multi-investigator awards, increase in institutional awards, program success, diversity, tribal college initiatives, etc.). Importantly, several colleges (Montana Tech and six tribal colleges) throughout the state also entered the EPSCoR partnership from 2001-2004. Historically, MSU was the principal EPSCoR recipient and host institution from 1979 through 1994, at which point The University of Montana entered as a participant. In the 2001-2004 award period, UM and MSU (the state's two PhD granting institutions) shared the award and ushered in a transition period of inter-campus collaborations and initiatives. Given the extraordinary collaborative statewide success of the program, UM will accept the leadership role in this application and will become a host institution for the first time. The change in leadership will not alter the mission for the Montana NSF EPSCoR program, which has been to develop the research capacity and national competitiveness of the state institutions and promote economic development.

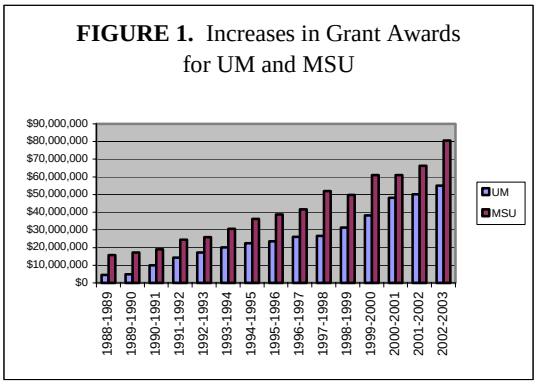
I.A. SUBPROJECT MILESTONES IN THE 2001-2004 AWARD PERIOD. We are pleased to report that each and every proposed program milestone has been met or exceeded. Highlights of specific accomplishments for the subprojects in the prior award are listed in Table 1. We believe that we exceeded our goals because of a real state match, helpful advisory committees and the successful leveraging of NSF EPSCoR funds with other programs.

TABLE 1. **2001-2004 Montana NSF EPSCoR Program**
comparing proposed and ***actual*** funded positions/items

Program	**Year 1 2/1/02**	**Year 2 2/1/03**	**Year 3 2/1/04**	**Proposed Total**	***Actual Total***
New Faculty Hire and Start-up	6	11	3	20	***34***
Graduate PhD	17	18	25	60	***67***
Undergraduate Research	114	117	121	352	***387***
Visiting Scholars	10	12	15	37	***22***
SBIR Phase 0 & 1.5	14	17	20	51	***56***
Technician Support Staff	11	11	11	33	***39***
State Competitive Grants	8-12	8-12	8-12	24-36	***29***
Invited Speakers	125	125	125	375	***434***
External Technical Assistance	1	2	2	5	***5***
Minority Outreach	0	0	0	0	***155***
Conference Hosting	4	4	5	0	***13***
Multi-Media Recruitment	0	0	0	1	***3***
Mid-Range Equipment	2	2	2	6	***13***
Multi-Investigator Awards	***4***	***4***	***6***	***14***	***14***

I.B. INTEGRATIVE MILESTONES IN THE 2001-2004 AWARD PERIOD. The second set of milestones was accomplished through a large increase in multi-investigator awards. Between 2001-present, UM and MSU have been awarded fourteen multi-investigator research grants including IGERT, NIRT, PPG, STC and COBRE. UM was recently awarded an NCRR (new building; $3M) that will assist in the construction of a new 60,000 sq ft research facility (linked to the School of Pharmacy) including office space for the EPSCoR program and lab/office space for twenty faculty/groups. Collectively, the EPSCoR subproject awards and multi-investigator awards have greatly impacted the research capacity of the two PhD granting institutions. Montana showed great institutional success in recent years with extramural funding at UM and MSU with record highs now exceeding $130M for the two campuses ($20M combined in1990) (Fig. 1). Several key factors played a role in this dramatic increase, but most noteworthy are the funding increases coincidental with NSF EPSCoR awards. The School of Pharmacy's rise to a top ten research school (http://www.aacp.org/) and the Thermal Biology Institute (TBI; http://tbi.montana.edu) rise to national recognition are specific examples of institution-based successes at UM and MSU, respectively. The Center for Environmental Health Sciences (CEHS) at UM was a central mission for infrastructure development in the 2001 award. EPSCoR invested $1.1M between 2001-2004 in the CEHS, including five tenure-track faculty hires/startup packages, three graduate stipends, four equipment awards, two technical staff members, conference support, seminar

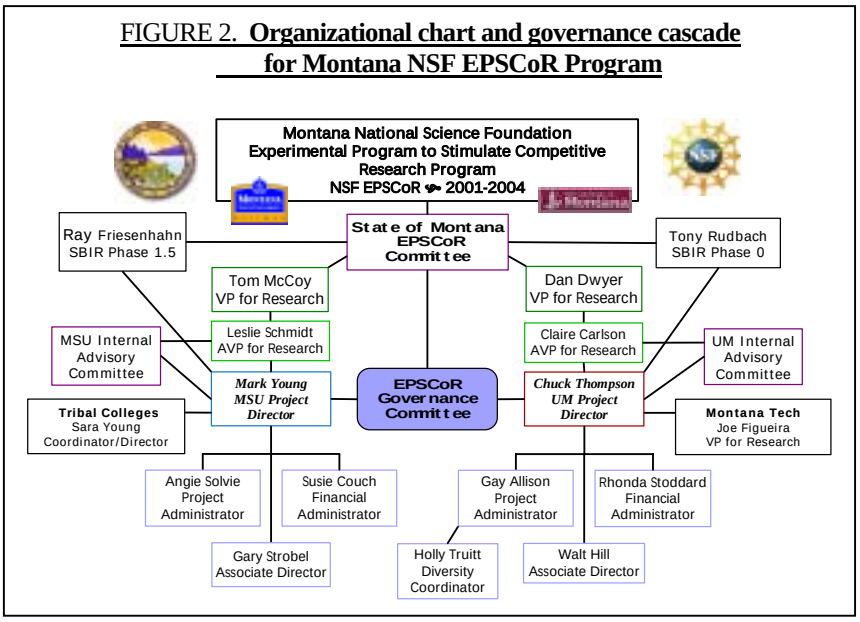
FIGURE 1. Increases in Grant Awards for UM and MSU



speakers and undergraduate research stipends. As of April 2003, the CEHS has been awarded more than $20M in total grant awards, is self-sustaining and will be fully independent of EPSCoR support at the end of the 2001-2004 award period. Likewise, MSU-TBI started with a modest EPSCoR investment of $200K, and now has external funding exceeding $16M. Montana responded to emerging initiatives in the areas of diversity, tribal college involvement, education and outreach, governance and program guidelines, increased economic development and achieved the following milestones:

- **Diversity:** UM Undergraduate Summer Diversity Research program recruited students from predominantly minority colleges (e.g., San Francisco State University). See: www.umt.edu/epscor/diversity.
- **Tribal College Initiatives:** MSU developed novel partnerships with several tribal colleges and provided support and development money for science and technology, appointing Prof. Sara Young coordinator and director.
- **K-12 Education/Outreach:** Expansion of the Undergraduate Research program to include high school students, involvement in NSF supported "Science and Engineering in the high school," BRIDGES program, summer high school research projects, State of Montana science fair support and *Science is Cool*—programming aired on Montana Public Radio.
- **Governance and Program Guidelines:** In 2000, Montana constructed guidelines manuals and coordinated websites (at UM and MSU) that covered subproject application documents, program descriptions and activities. We increased intercampus meetings, meetings with advisory groups and committees and developed stronger inter-campus relationships between EPSCoR offices and key personnel. The amalgamation of existing advisory committees with a new governance structure led to a redefined organizational scheme for the Montana NSF EPSCoR program (Fig. 2).

FIGURE 2. **Organizational chart and governance cascade for Montana NSF EPSCoR Program**



- **Economic Development:** The Phase 0 SBIR program was expanded to include Phase 1.5 (transition award to forward the Phase 2 application). To further enhance our business relationship with the state, we began co-supporting SBIR Phase 0 awards with the State of Montana SBIR program, (L. Brander, program manager).
- **Involvement of Other State Institutions:** UM and MSU shared the current award—a principal step towards statewide involvement and participation. A further advance in the Montana EPSCoR was decided in 2002, in which UM agreed to serve as PI for the current submission, and if successful, host the 2004-2007 award period. In the future, the EPSCoR program will alter between campuses with each subsequent award cycle. To further broaden state institution involvement, Montana Tech and six Montana tribal colleges (all non-PhD granting) will become partners in the 2004-2007 application.

I.C. DIRECTORS, ADMINISTRATION, AND MANAGEMENT. The Montana NSF EPSCoR program will be co-directed by C. Thompson, PhD (UM) and M. Young, PhD (MSU), who are both active researchers. The co-directors are part of an integral partnership and governance network (Fig. 2; see Sect. VI) and meet in several forums including institutional travel, national/regional EPSCoR meetings, state meetings and access grid node

(AGN). Each co-director is partnered with a Project Administrator (G. Allison, UM; A. Solvie, MSU). The Associate VP for Research (AVP) at each institution also plays an integral role in the program execution, specifically fiscal guidelines and governance.

Montana, like many states, encountered a minor setback in the 2001-2004 program execution: the insufficient draw down of funds. The principal reason for this deficiency in the Montana EPSCoR award was brought about by the large number of faculty hires (35-40% of total budget). Faculty hires have a necessary one-year delay in the hiring process, a concomitant delay in spending startup and fractional draw down of salaries resulting in a large surplus of funds. The budget got back on track by the end of 2002, but new guidelines were needed (now in place) to enable investigators to utilize their award wisely while showing an important expenditure rate.

I.D. LEVERAGING OPPORTUNITIES: BROADER IMPACT. Several opportunities to leverage the 2004-2007 NSF EPSCoR award with existing and nascent awards are in place to optimize programmatic and institutional infrastructure improvements. For example, an ADVANCE award will be leveraged with EPSCoR salary/startup funds to augment the package to attract and fill 2-3 positions with senior level women faculty that will eventually occupy director positions. Select examples of other leveraging opportunities are listed in Table 2.

TABLE 2. EXAMPLES OF LEVERAGED OPPORTUNITIES IN PLACE WITH THE MONTANA NSF EPSCoR PROGRAM (2004-2007)

Award Program	Program Objective	Leveraging Item(s)	Additional Leveraging*
NSF NIRT	Bioinspired Nanomaterials for electronic applications	Positions for postdoctoral fellows, graduate students and equipment	NIH PPG
NSF ADVANCE (2004-2007)	Hire women faculty into director and/or leadership positions	Two to three faculty salary/startup packages; Additional support	Provost
NIH BRIN	Hire additional science faculty at each of the six tribal colleges	1:1 match with BRIN	Provost
NIH PPG	Bioinspired Nanomaterials for biomedical applications	Positions for postdoctoral fellows, graduate students and equipment	VP Research
DOE NACOE (2002-2005)	Advance the participation and partnership of Native Americans in public institutions	Hire Native Americans in faculty, student and research trainee positions	Dept of Pharm Sci
NIH COBRE (2003-2008)	Build NIH Centers of Excellence in Neuroscience and Environmental Health	Faculty salary/startup for two bioinformatics specialists; Four technical staff	2nd COBRE; Comp Sci
NIH NCRR (2003-2005)	New 60,000 sq ft research building	NSF EPSCoR space, office and lab space for five EPSCoR faculty; Space for ISLE	Foundation; Pharm Sci
EPA STAR; NSF Pre-doc and NIH Pre-doc Minority Fellowships	Graduate student training	Salary, tuition support, travel and supplies for graduate students	Graduate School
NASA TBI	Life in Yellowstone's extreme environments	Faculty salary/startup for geochemist and biochemist; Graduate student fellowships	3 NSF MOs
NSF IGERT; Howard Hughes	Graduate student training	Salary, tuition support, travel and supplies for graduate students	Provost; VP Research
***MOST PROGRAMS HAVE PROVIDED SOME INSTITUTIONAL MATCHING FUNDS**			

I.E. PROGRAMS MODIFIED IN THE 2001-2004 AWARD PERIOD. The three focus research areas benefited greatly from EPSCoR support, and we will continue subprograms that build Montana's S&T infrastructure. However, certain subprograms achieved or surpassed their proposed goals and need to be converted into new initiatives that will keep advancing our infrastructure projects. For example, UM held a Mid-Range Equipment program that helped to quadruple the scientific instrument base of the university. As such, UM will no longer participate and the program will be modified to benefit Montana Tech, Western Montana College and the Tribal Colleges, primary through faculty hires. A second program that will change is the State Competitive Grants program

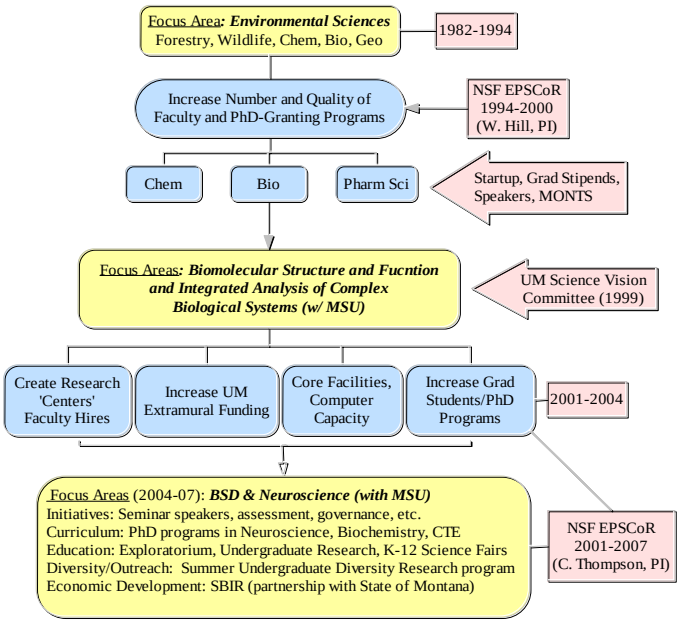
key Points

(formerly MONTS). Although 8-10 investigators per year benefited from these seed research awards (approx. $25K), the impact of these awards has dropped precipitously from prior years, thus the money spent on this program will be used for new SBIR initiatives. Last, the focus area 'Integrative Analysis of Complex Biological Systems' (IACBS) will end due to the overwhelming success of CEHS (UM) and TBI (MSU) and the need to change focus areas from Environmental Sciences to Bioengineering and Neuroscience.

II. INFRASTRUCTURE VIA SCIENCE- AND TECHNOLOGY-ENHANCED PARTNERSHIPS (INSTEP): MONTANA'S INFRASTRUCTURE AND CORE AREAS.

II.A. OVERVIEW. The Montana EPSCoR program has been instrumental in transforming the UM and MSU into research-intensive universities that are nationally competitive. The fundamental principles of the Montana program have been to: (1) have a realistic, long-term vision, (2) make appropriate strategic investments that emphasize the unique advantages present in the state, (3) invest in quality, especially in faculty hires, and (4) be innovative. The past three years of the EPSCoR program have seen the success in building in competitive multidisciplinary groups at UM and MSU in targeted scientific areas. In the next phase, we propose four major scientific thrusts: (1) to enhance and develop a Center of Biomolecular Structure and Dynamics with a concurrent PhD program at UM, (2) to redirect/transform the MSU Engineering Research program to take advantage of the advances in the basic sciences at MSU, (3) to create and develop a Center for Bioinspired Nanomaterials at MSU, and (4) to enhance and augment the Neuroscience research cluster groups at UM and MSU, thereby building the first EPSCoR-supported intercampus PhD program. A second tier initiative at UM is a support platform in 'bioinformatics, proteomics and genomics.' We further propose a broad range of scientific training programs including middle school (with Montana Tech) graduate students, scientific interns and faculty. We will support economic development via the Small Business Innovative Research (SBIR) program in collaboration with the State of Montana and expand our commitment to the State of Montana through the creation of an Integrated Science Learning Exploratorium (ISLE). We will continue to support diversity and grow our partnerships with other funding programs. We have continuing agreements and faculty hiring investments with tribal colleges, the Native American Center of Excellence (NACOE), Health Careers Opportunity Program (HCOP; assisting underrepresented groups) and ADVANCE (NSF) program. We also will continue to construct our distinctive Undergraduate Summer Diversity Research program that builds bridges with minority colleges.

FIGURE 3. The University of Montana NSF EPSCoR planning & development chart and correlation with extramural funding

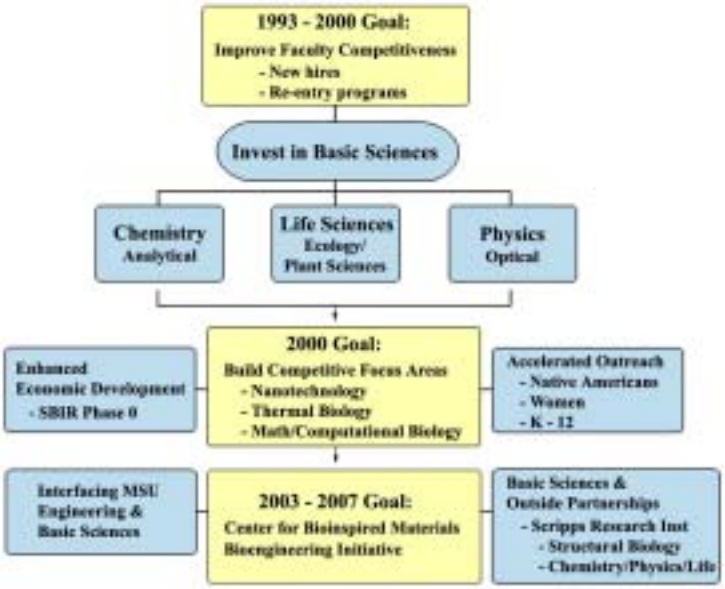


II.B. UM DEVELOPMENT PLAN. The NSF EPSCoR program and the State of Montana have partnered for over twenty years. The UM became a significant EPSCoR participant in 1994, whereupon Environmental Sciences was advanced as a thematic research focus area (Fig. 3). The UM used $50K hiring supplements in 1998-2000 to attract new faculty and established a Science Vision Committee (1999) to set the course of UM's scientific destiny through 2010. When the NSF EPSCoR program advanced to a $13.5M program in 2001, UM and MSU became program partners, thereby furnishing UM with a meteoric boost in resources upon which to develop its national research competitiveness. In 2001, UM began an aggressive program to hire faculty and graduate students, build programs in environmental and biological sciences and leverage grant and funding opportunities to optimize resources, space and facilities. Over the course of the current NSF EPSCoR grant period (2001-2004), UM has experienced growth in every measurable aspect of science and technology, highlighted by a doubling in extramural funding since 1998 (Fig. 1). However, UM lags behind in several infrastructure layers and is still a relatively small

research university with only a few PhD-granting departments in the sciences. As a result, the principal limitation at UM is assembling a critical mass of research investigators to tackle problems of national significance. We must continue to build the number of research-intensive faculty through EPSCoR co-funding and, in parallel, define specific opportunities beyond environmental sciences by which these research investigators can collaborate. Key to this approach is that UM will develop its focus areas using a 'Center model'. One of the most successful EPSCoR-supported programs at UM is the CEHS, which assembled a focused group of investigators around a Center model (rather than a department). The results have been improved funding, increased collaborations and an economy of shared resources and personnel. The Center model was solidified further at UM with the success of the Center for Structural and Functional Neuroscience (CSFN), which received only scant EPSCoR support (two leveraged faculty positions and equipment). As a result of Center model success, UM proposes to support two focus areas around this model: a Center for Biomolecular Structure and Dynamics, to include a PhD program in this discipline, and enhance the Center for Structural and Functional Neuroscience, with a new PhD program jointly operated between UM and MSU. Both PhD programs are state-wide initiatives endorsed by the Provosts and governing committees. (Appendices 1-7).

II.C. MSU DEVELOPMENT PLAN. Over the past ten years, MSU has developed, continuously refined and implemented a roadmap for research competitiveness and sustainability (Fig. 4). EPSCoR investments in the 1990s in the basic sciences, principally through faculty hires and facilities infrastructure, have elevated chemistry, physics and life science at MSU to nationally competitive levels (2000-2003 NSF funding rate >30%). In the last round of EPSCoR funding our focus was centered on the development of groups of multi-investigators in building target areas of MSU research expertise (thermal biology, nanotechnology and computational biology). These areas have attracted eight major multi-investigator grants in the past two years. In this current proposal, we plan to use EPSCoR investments to bring together expertise within the basic sciences and engineering programs at MSU and to build meaningful partnerships with larger research institutions with complementary interests. The merging of basic sciences and engineering has not occurred at MSU because of the traditional emphasis of the engineering school on undergraduate education. Two recently completed AAAS reports clearly indicated the positive synergy that would likely occur by introducing an engineering component to science developed at MSU. MSU is now positioned to partner with larger institutions. The development of the MSU Center for Bioinspired Nanomaterials is, in part, focused on bringing an engineering component to areas of MSU expertise in the basic sciences. The Center would also foster expanded collaborations. In particular, MSU's development and expertise in bioinspired nanomaterials is well complemented with The Scripps Research Institute's (San Diego, CA) expertise in synthetic chemistry and structural biology. Already this partnership has resulted in a shared PPG grant between the two institutions. In this submission, we propose to expand this partnership with Scripps through faculty and graduate student exchanges and shared courses. We also propose to expand to other institutions (MIT, Rice, NIH, Johns Hopkins, etc.) by instituting an Affiliate Faculties program. The long-term goal is to move MSU towards being a national center for advances in bioinspired nanomaterials and applications.

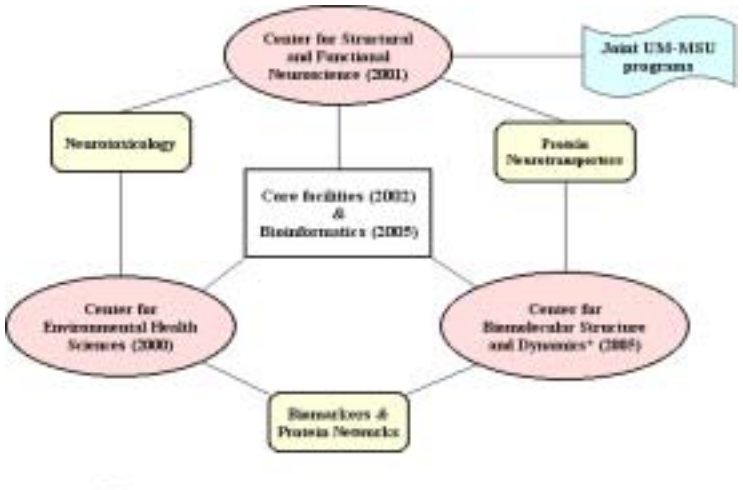
FIGURE 4. MSU Core Research Area Selection Roadmap



II.D. RESEARCH CORE FOCUS AREAS AND SUPPORT PLATFORMS. The following sections describe our selected research focus areas and the type of INSTEP partnership envisioned for each area.

II.D.1. BIOMOLECULAR STRUCTURE AND DYNAMICS (UM): A 'TRIANGULATED' PARTNERSHIP FOR CENTER AND PROGRAM DEVELOPMENT. IN 1999 THE UM STRATEGIC RESEARCH VISION COMMITTEE INITIATED THE CREATION OF A Biomolecular Structure and Function (BmSF) focus area for development over the next five years. As the essential second stage to this initiative (first stage, faculty hiring), a new Center for Biomolecular Structure and Dynamics (CBSD; note change to '*Dynamics*') will be constructed to continue the growth of this focus area. Twelve faculty, including interim CBSD director, Prof. Sandy Ross (Chem), will be blended with seven new faculty, (across five departments) to develop a focus group of CBSD collaborative investigators (Appendix 17). Initially, CBSD investigators will study the rates, motions and dynamics of peptides proteins, membranes, nucleic acids and coupled interactions using time-resolved fluorescence, NMR, computational methods and EPR/ESR. Programmatically, the new CBSD will triangulate with the two existing research centers, CEHS (2000) and the CSFN (2001) to build thematic research bridges in 'protein neurotransporters' (proteins that regulate the uptake of neurotransmitters) and 'protein networks,' (protein architectures that are linked biochemically through structural or functional means) (Fig. 5). The protein neurotransporter group will be led by Prof. M. Kavanaugh and the protein network group headed by co-leaders, Prof. S. Ross and Prof. M. Grimes. The three Centers will share equipment and facilities in a centralized scheme and integrated with a key support platform in bioinformatics. A third research focus area in CBSD will be defined by a new Center Director, who will hire faculty into this 'breaking' area of biomolecular dynamics. The advantage of co-developing the new CBSD with the existing Centers is that the CSFN and CEHS both have NIH Center of Biomedical Excellence awards (COBRE) that can assist CBSD investigators with joint personnel, research seed money, equipment, resources and notably, collaborations. The CBSD builds upon existing research strengths and the partnership of four departments (Chem, Bio Sci, Pharm Sci and Comp Sci) and complementary interests of investigators at MSU, whose faculty and students will benefit from the sharing of mutual core facilities, innovative interdisciplinary curricula, administrative support, space and environment resources, and information and technology infrastructure. The EPSCoR program will also assist the CBSD with development of, gain approval for and execute a new Biomolecular Structure and Dynamics PhD program (Prof. S. Lodmell, PhD, program director), thereby installing long-term, statewide sustainability. The specific goals are to hire and provide startup for seven faculty, including five tenure-track faculty, a senior investigator/Center Director, two bioinformaticians and administrative staff support. Two of the tenure-track faculty hires will be targeted for co-support using an NSF ADVANCE award appointing female scientists as director, deputy director and/or co-director of the CBSD. Support for up to six graduate students (12 student years) and up to twenty undergraduates will be provided. It is expected that the CBSD will achieve financial independence by January 2008 through multi-investigator program project grants and graduate-training applications. (Appendix 17).

FIGURE 5. Triangulation of the new Center for Biomolecular Structure and Dynamics with the existing two Centers



II.D.2. BIOENGINEERING (MSU): DIRECTIONAL PARTNERSHIP. The NSF EPSCoR program has played a central role in transforming basic science departments/groups into highly competitive units. An internal analysis of the strengths and weaknesses of the MSU science capacities identified the Engineering program as the area to benefit from future EPSCoR investment. This is, in part, due to the traditional focus of the Engineering program, which concentrates nearly exclusively on undergraduate education.

Over the past several years the EPSCoR program has supported faculty hires (especially in electrical engineering) to encourage the transition to a more research-intensive engineering program. In this grant, we

propose to target the Chemical Engineering program for EPSCoR investment. Like many traditional chemical engineering programs, MSU is faced with reorganizational challenges that will accommodate changes in the chemical industry, which are increasingly based on bioengineering processing and manufacturing. A recent AAAS review of the MSU Chemical Engineering department strongly recommended that the department should aggressively rebuild itself towards bioengineering in order to meet the needs of its students and national research priorities. In addition, the AAAS team felt strongly that a re-focused Chemical Engineering program would act synergistically with already existing strong basic science groups in bio-inspired nanotechnology, thermal biology and biofilms. The overall goal, therefore, is to create a research-intensive Bioengineering program that takes advantage of existing strengths in the basic sciences at MSU, especially in bioinspired nanomaterials, optical materials and thermal biology.

In partnership with university resources, we plan to invest EPSCoR resources to initiate a program in bioengineering by providing: (1) competitive start-up packages to support the hiring of four tenure-track faculty in bioengineering (proposed areas: bioreactor engineering, bioprocess engineering, bioengineering of nanostructures and biomaterials), (2) support for two postdoctoral fellows in bioengineering, and (3) four graduate fellowships in bioengineering. A competitive startup package to support the hiring of a tenure track faculty member in bioengineering at Montana Tech will also be conducted. This person would begin a competitive research program that will establish a new research link between MSU and Montana Tech.

The restructure of the Chemical Engineering department towards bioengineering provides a welcome and necessary component that will complement groups in the basic sciences. As a result, we expect to see two to three new individual investigator awards to these new hires, recruitment of four to six graduate students with a bioengineering emphasis and a revised chemical engineering curriculum that emphasizes bioengineering as well as new collaborations across campuses and new curriculum development in bioengineering at Montana Tech. (Appendix 18).

II.D.3. CENTER FOR BIOINSPIRED NANOMATERIALS (MSU): A MULTIDISCIPLINARY PARTNERSHIP. EPSCoR investment in the areas of bioinspired materials has been highly successful in creating a unique scientific niche for MSU. This multidisciplinary group of five faculty members (all EPSCoR supported hires) has attracted over $8M in competitive funding from NSF, NIH, DoD, DOE and the EPA in the past three years. In addition, this group has active collaborations with major institutions nationally and internationally. Of particular importance is a strong collaboration with chemists and structural biologists at The Scripps Research Institute that has resulted in a shared $4.8M NIH PPG grant. A recent AAAS review of the MSU program strongly recommended further expansion of this research focus area. The review team felt that MSU was in a unique position to become a major national center for bioinspired nanomaterials. Further enhancement of this effort will be facilitated by the formation of a university-designated center. Center status would: (1) increase national visibility, (2) create a clear draw for hiring new faculty, (3) create a focal point for engaging a broader range of MSU faculty (especially optical materials faculty in physics, chemistry, microbiology and engineering), (4) provide for expanding collaborations with larger institutions (especially Scripps-a letter of support from Scripps can be found in Appendix 10), and (5) enhance recruitment of graduate students and postdocs to the program. The goal of this initiative is to create a nationally and internationally recognized Center of Excellence for the development of bioinspired materials for which MSU is clearly a world leader.

EPSCoR resources will be used to: (1) hire four faculty in the areas of bioinspired semiconductors, biocataysis, biomicro-fabrication and cell targeting and/or bioimaging, (2) establish faculty, postdoctoral fellows, and graduate exchange programs between MSU and Scripps, (3) establish a MSU/Scripps team taught course in bioinspired nanomaterials via the access grid node, (4) fund six graduate fellowships, (3) fund four postdoc fellows, and (4) initiate an Affiliated Faculties program with other scientists working at other institutions (e.g., MIT, Rice, NIH). As a result of this EPSCoR investment the expected outcomes will be: (1) 1-2 additional large multi-investigator grants, (2) sustained partnership between MSU and Scripps, (3) 1-2 new Montana-based start-up companies based on applications of this Center, (4) 10-15 graduate students receiving training through the Center, (5) 5-10 postdoctoral fellows trained through the Center, and (6) application as a stand-alone or partner in an NSF STC award. (Appendix 18).

II.D.4. CENTER FOR STRUCTURAL AND FUNCTIONAL NEUROSCIENCE (UM): A PROGRAMMATIC AND CURRICULUM UM-MSU PARTNERSHIP. PhD programs in the Montana University System (MSU) must develop new ways to attract nationally competitive faculty and increase the number of graduate students. However, the development, promotion and execution of new science PhD programs in Montana can be a difficult process because there are very limited resources to grow new graduate programs. UM and MSU have actively worked to

overcome this fiscal limitation through novel consolidation of resources, facilities and personnel, however, some financial barriers will never be overcome at the state level. Graduate programs that do not participate in 100-level classes are not a state priority in assigning new tenure- track faculty lines or graduate assistantships.

The Association of Neuroscience Departments and Programs (ANDP) published a summary report in May 2000 indicating growth in the number of students applying and accepted into neuroscience programs. Graduates of neuroscience programs continue to find jobs at universities, research institutes and pharmaceutical and biotech laboratories, and the survey also suggested that the number of available jobs for neuroscientists is likely to increase in the future. Using this report, input from the Center for Structural and Functional Neuroscience (CSFN) internal/external advisory panels and feedback from the annual Montana Neuroscience Conference (including NSF Neuroscience program director, C. Platt), a new UM-MSU intercampus neuroscience graduate program is proposed. Faculty expertise at the UM focuses on neurochemistry, neuropharmacology, systems neuroscience, and neurophysiology, while at MSU, faculty focus is in developmental neuroscience, computational neuroscience, and systems neuroscience-complementary programs with which to build a strong inter-campus program.

The CSFN (www.umt.edu/csfn) recently added six neuroscientists (2 co-supported by EPSCoR) to a total of 14 neuroscience faculty at UM, and at MSU, 12 faculty members (Appendices 17 and 18). Establishment of a joint Neuroscience graduate program between UM and MSU will enable the two campuses to use their resources in combination, creating a nationally competitive, high-profile graduate program in neuroscience. The new graduate program will utilize the access grid node (AGN) for inter-campus instruction that will bring classes to UM, MSU and also Montana Tech, UM Western, MSU Billings, MSU Northern and the Tribal Colleges, thereby opening new educational opportunities to faculty and students in the entire Montana University System (MUS). AGN-based curricula will also be developed in parallel with the ISLE program (see Sect. IV.c). To create the inter-campus Neuroscience PhD Graduate program, EPSCoR support will be used to provide for: (1) a technician and software for the AGN, (2) a 0.25 FTE position for a Neuroscience graduate program director, (3) graduate stipends, (4) research stipends for undergraduates, (5) conference and seminar speakers, and (6) a 0.5 FTE graduate program assistant. [***NOTE:*** The CSFN COBRE award does not provide support for curriculum development or a new PhD program.] The goal is to obtain the sequence of approvals from the University, Regents and State for the joint Neurosciences PhD graduate program prior to May 2004 and to have a fully operational program by 2008 with established inter-campus classes, individual institute core curriculum, ten full-time graduate students and established unit standards. (Appendices 17 and 18).

II.D.5. CORE AND FACILITY SUPPORT (UM): BUILDING THE INFORMATICS, VISUALIZATION TECHNOLOGIES AND 'OMICS' PLATFORMS. High-throughput analysis technologies in genomics, proteomics ('omics'), and particularly, bioinformatics are critical to the modern research mission. Research projects must be internationally competitive and this means rapid production of experimental data arrays and high-throughput methods. High-throughput methods create a landslide of data that must be carefully managed, processed and archived. EPSCoR support is intended to assist the instrument and 'omics' core facilities (Fig. 3) with essential staff support and computer hardware/storage to improve throughput analysis and handle the increasing capacity, and to assess the possible development as a future focus area. At the present time, traditional disciplines debate as to whether 'omics' and related high-throughput technologies warrant a research or service investment. The CFSN and CEHS have similar needs and the directors are willing to co-invest in staff and hardware to accomplish the desired goals. Two bioinformatic faculty members will be added in the coming year and either or both will serve as directors of the informatics core facility. A second important element in building core and facility support is visualization technology, particularly at the molecular level. In the prior award period, EPSCoR aided the creation of a Molecular Computational Core Facility (MCCF) as part of the COBRE-leveraged hiring and startup package for Prof. J. Gerdes (Chem). Current projects in the MCCF are aimed at understanding small molecule-biomolecule interactions. To move to the next level of support and collaborate projects in protein networks and neurotransporter research, the MCCF will need to handle more complex problems, specifically large molecule structure and dynamics and biomolecule-biomolecule interactions. This can be accomplished by adding customized software applications to the current suite, additional computing power and workstations and importantly, systems administration to maintain software licenses, archiving and project management. The overall goal, therefore, is to improve the informatics infrastructure including processing, mining, prospecting, visualizing, access and archiving of scientific data, to support these Centers and evaluate informatics and 'omics'

KEY POINTS

as future research focus areas. Prof. M. Pershouse (UM, microaray core director) and Prof. J. Gerdes will co-direct this initiative until the bioinformatics hires are completed.

III. RESEARCH INITIATIVE SUBPROGRAMS. The principal direction of this application resides in the core areas we seek to develop and the faculty hires upon which these core areas are built. The mainstay to successful faculty and programs are the complementary people/personnel and infrastructure tools that allow these programs and faculty to be successful to drive the science and technology engine in the state.

Contract Faculty
Teaching Buyout
Seminar Speakers
Conference Program
Graduate Student Stipends
Visiting Scholars

III.A. CORE SUBPROGRAMS. These six subprograms are aimed to support the focus areas at the departmental/Center level.

III.A.1. CONTRACT FACULTY PROGRAM. A key factor that would contribute to the long-term enhancement of Montana's science and technology capacity would be an overall increase in science and engineering faculty. Even though Montana has been highly successful at attracting some of the nation's top scientists and engineers over the past 10 years, the total number of faculty has remained flat. In the current climate, it is unlikely that the State will expand the FTE for new faculty lines and alternatives are needed to solve this dilemma. We propose to partner with the University to hire 3-5 new non-tenure track faculty members over the next three years in the targeted core research areas and in areas of scientific promise. Contracts of up to five-years would be offered to provide a long enough period of stability to be attractive to applicants. Renewal of contracts would be based upon the ability of individuals to support their research programs with external funding. A second objective would be to generate more scientific depth and/or breadth, critical mass in key areas and reduce teaching loads in order to expand the research programs. At this initiative conclusion, we would expect that the overall number of research active faculty would increase in real terms.

III.A.2. FACULTY TEACHING BUYOUT PROGRAM. One clear difference between the top research institutions and the Montana PhD campuses is the higher teaching load required by most UM/MSU science and engineering departments (UM/MSU teaching load is 2-4 classes per year; top research universities 1-2 classes per year) that limits the time spent on research. In this initiative, we propose to run a yearly competition, whereby individual faculty members/departments may request funds to support the hiring of highly qualified teaching faculty to partner with research productive faculty to cover institutional commitments. Proposals would be peer reviewed and be judged on the basis of likely success and sustainability of an expanded research effort. We expect an expansion of research programs oriented in competitive fields measured by increased publications and awarded grants.

III.A.3. SEMINAR SPEAKER PROGRAM. Over 430 speakers visited the Montana University System (MUS; includes the six Montana public colleges) over the three-year award period 2001-2004 with the EPSCoR-supported Seminar Speaker program. This seminar program allows costs for travel and lodging up to a maximum of $750/speaker or larger, if costs are matched by the department or unit. This program has been highly successful in bringing well respected and talented research faculty and educators to Montana and has led to the hiring of some of these more talented faculty by the UM and MSU campuses. Collaborations, professional relationships and mentoring have been fostered and enhanced by this extremely successful program.

III.A.4. SCIENTIFIC CONFERENCE PROGRAM. Two to three awards per year will be made to assist investigators in the MUS to develop and host scientific conferences on MUS campuses. The goal is to bring international scientists and their research to the campuses allowing our student researchers more exposure to international science at low cost. Student registration to these conference is offset by the EPScoR program.

III.A.5. GRADUATE STUDENT FELLOWSHIP PROGRAM. UM and MSU have been highly successful in recruiting new tenure-track faculty in the sciences over the prior two award periods (1998-2004). These faculty are now settled and have begun productive research programs, however, nearly every lab is in need of graduate students. Obviously, the addition of over fifty new faculty members in the MUS far exceeded its existing graduate student population and larger classes of incoming graduate students are required to fill these laboratories. For the new faculty to be successful, and to draw upon their mentoring skills to ensure retention of these members, we must increase the number of graduate students.

Over the past three years, UM and MSU competitively awarded a total of 50 fellowships to top applicants ($20k/year for two years) of which 90% are still enrolled in doctoral programs. The program requirements are: (1) awards are only for PhD students in science and engineering and are based on GPA, GRE, letters of recommendation and prior research experience, (2) awards are for new PhD

students only, (3) students must be mentored, (4) faculty members are given eight months to recruit the student or the award is withdrawn, (5) student awardees must apply for extramural funding, and (6) faculty members are responsible for funding the student after the two-year award period (sustainability). In this application, fifteen to twenty graduate student fellowships at each institution (UM and MSU) will be supported, of which half are targeted for the research core areas noted in Section II. As a milestone of this program, we expect to see real growth in the number and quality of PhD graduate students in the MUS science and engineering graduate programs (an increase of 30 additional students).

III.A.6. VISITING SCHOLARS PROGRAM. The Visiting Scholars program brings research faculty and their expertise to Montana in the form of sabbaticals, semester(s) in residence, month long research interactions, or short week-long collaborations or workshops. A second benefit of the program is that it provides an opportunity to expose prominent scientists to Montana, to visit first hand and understand our research capacities and strengths.

key Points

Ideally, as MUS research groups pursue larger, multi-investigator competitive grants, visiting scientists are far more likely to become participants, reviewers or even collaborators in such grants.

IV. EDUCATION AND HUMAN RESOURCE (EHR) DEVELOPMENT.

Montana will continue its rich history of supporting EHR in the state through a variety of platforms and initiatives, but we further propose to be inventive, attempting to broaden EHR capacity beyond traditional concepts and barriers. In this section we present five new mechanisms that will support new approaches in EHR, including tribal college faculty hires and women faculty hires. Notably, we have undertaken several projects in this section to purposely overlap with Outreach (Sect. V.).

Women Faculty
History of Science PhD
ISLE - Exploratorium
Science Fair
Center for Teaching Excellence
Undergraduate Research

IV.A. WOMEN IN SCIENCE AND ENGINEERING BRIDGING PROGRAM. A national priority is to increase the number of women pursuing careers in science and engineering. While the number of women who hold science and engineering degrees at UM and MSU has increased over the past 10 years, many of these women decide not to continue in graduate programs or employment in science or engineering. Post-baccalaureate women need to be encouraged to pursue careers in science and engineering. We propose a 'Women in Science and Engineering Bridges' program to increase the number of these post-baccalaureate women. We will support BA/BS women who wish to work in research active laboratories for one year, pending successful approval of a competitive fellowship application ($25K/year). It is expected that involvement of women in research at this critical point in their professional development will have a strong positive influence on their decision to continue their careers in science or engineering. We would anticipate that up to 50% of the women participating in this program would pursue future science or engineering careers.

IV.B. NEW PHD PROGRAM IN THE HISTORY OF SCIENCE AND TECHNOLOGY IN THE WEST (MSU). The impacts of science and technology (S&T) on society are significant and long lasting. As Montana develops its S&T infrastructure, we must address its impact. To do so, it is necessary to have some historical perspective. The MSU Department of History and Philosophy has a number of talented faculty who specialize in the history of S&T, and are prepared to launch a doctoral program that examines the history of S&T and technology in the American West. The goal of this EPSCoR initiative is to launch a new PhD program in the History of Science and American Technology in the West. Three objectives are proposed: (1) support start-up and salary for a new faculty hire in History, (2) support 2 two-year postdoctoral fellows, and (3) support 4 four-year graduate student fellowships. Milestones for this new PhD program include: (1) 8 PhD students enrolled in the program, and (2) at least one new NSF grant to support research in this area.

IV.C. INTEGRATED SCIENCE AND LEARNING EXPLORATORIUM "ISLE" (UM). High-technology jobs in Montana have fallen behind the rest of the nation, in part, because this sector has not embraced the Montana workforce as technology-based. In many instances, it is because Montana has not been identified as a science-oriented (research) or technology-rich (commercialization) state. An integrated concern is that the recruitment of technology-based businesses and the tech workforce is weakened because Montana does not strongly support science and technology (S&T) in the communities. The purpose of this initiative is to change these perceptions by developing education and training opportunities in S&T that are hosted within a community framework. Once S&T opportunities are anchored in a community, we believe S&T based economic development can be catalyzed.

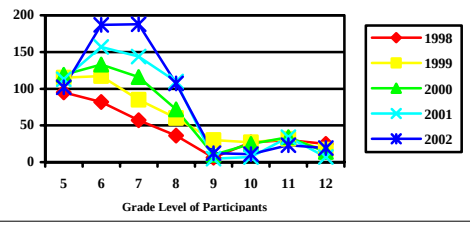
The overall goals of this initiative are to design, develop and create by 2008, an anchor site in Missoula for an Integrated Science and Learning Exploratorium (ISLE). The immediate goal for ISLE is to provide a rich

culture of learning through innovative environments, integrative information technologies, defined programs, presentations and self-navigation tools that enable children and adults to advance their curiosity about science and the world around them. Representative themes within the ISLE may include anatomy, health and performance, Native American Science, environmental science, natural history, genetics and reproduction, proteins, neurosciences, vision and biology of the cell. The Exploratorium will also serve the broader community by hosting lectures, demonstrations and roundtables of local, regional, national and international importance. As a result, the ISLE would serve to host the Summer Diversity program (Sect. V.D) and other outreach initiatives. An important hypothesis to test is whether an ISLE can serve as a catalyst for economic development in a designated area, for example, research park, technology center or university setting. In addition to serving as a technology-based business anchor, ISLE will also aid tourism and bring to Missoula an important recruiting tool for professional families. Some key points about the ISLE include: (1) a $3M National Center for Research Resources (NCRR) building grant awarded to the School of Pharmacy in 2003 in which the ISLE (and EPSCoR) was provided office, computer technology and lecture room space, (2) an active fund raising campaign with Families First Missoula, an organization seeking to partner with ISLE, (3) a plan for traveling and virtual exhibits (using computers to access exhibits) and docking stations for portable laboratories and displays, (4) promotion and education of the public about the contributions of Native Americans to science, (5) development of a Science Teacher Summer Institute to provide summer workshops and instruction for K-12 teachers, (6) a Sentinel Science program to train high school students and adult volunteers to staff and explain exhibits, and (7) the development of a certification program for K-12 educators to better enable them to support students and the general public in the sciences.

Montana K-12 students and schools are in serious need of broadened science instruction and access to state-of-the-art equipment. Exploratoriums are an economical and efficient alternative to supplying the needed scientific discovery tools, especially in rural environments with limited access. Recent advances in Internet (audio/visual) technologies permit distance interactive experiments: a key for Montana's vast geography. In this award period, we will identify a site for ISLE (prior to construction of a new building), build exhibits, establish local and regional IT and visualization connections, hire a director, will begin exhibit construction and file a business plan. Partnering of ISLE with the Center for Teaching Excellence (Sect. IV.e) will position the ISLE for a NSF Science of Learning Center (SLC). (Appendix 16).

IV.D. SCIENCE FAIR PROGRAM (MONTANA TECH). Science fairs are a critical first element in presenting to students in grades 5-12 the opportunities and excitement present in a career in science and engineering. The key to the success of these fairs is instilling in students a feeling of accomplishment and a peer connection to their fellow competitors. The Montana Tech Science Fair showed that smaller rural schools have difficulty in being competitive against their urban peers. This has led to a lack of parental support in the rural schools and a drop in participation (Fig. 6). This lack of competitiveness is presumed directly related to their lack of access to modern research infrastructure and, in some cases, to lack of exposure to interesting problems to pursue. EPSCoR proposes an experimental program to support the rural science teachers to bring to their students the opportunities now available to the urban students, who typically have much better access to mentors and research infrastructure. This initiative will consist of seven program elements: (1) local science fair judging support, (2) local science clubs, (3) outreach (AmeriCorp student advisors), (4) teacher training workshops, (5) internal monitoring program (salary for mentoring coordinator), (6) summer research academy, and (7) teacher release time.

FIGURE 6. Attendance at Science Fair by grade



IV.e. Center for Teaching Excellence (UM). THE MISSION FOR THE CENTER FOR TEACHING EXCELLENCE (CTE) IS TO PROVIDE GUIDANCE AND DIRECTION TO FACULTY AND TEACHING ASSISTANTS WHO WISH TO IMPROVE THEIR CLASSROOM TEACHING THROUGH FRESH METHODOLOGICAL LEARNING PARADIGMS. THE GOAL OF THIS INITIATIVE IS TO ADVANCE OUR UNDERSTANDING OF THE 'SCIENCE OF LEARNING' THROUGH SUPPORT OF RESEARCH PROGRAMS AND PHD STUDENTS AT THE INTERFACE OF EDUCATION AND SCIENCE. EPSCOR WILL PROVIDE FINANCIAL SUPPORT FOR THE DEVELOPMENT OF A NEW LEARNING AND TUTORIAL PROGRAM AT THE 100-LEVEL MATH/CHEMISTRY INTERFACE AND SALARY SUPPORT FOR GRADUATE STUDENTS WHO ARE ENGAGED IN NOVEL SCIENCE LEARNING PROBLEMS. WE EXPECT TO SEE APPLICATIONS TO INCREASE NSF EDUCATION

PROGRAMS AS A RESULT OF THIS SUPPORT.

key Points

IV.F. UNDERGRADUATE RESEARCH PROGRAMS. The Undergraduate Research (about 400 awards from 2001-2004) program awards a $1000-$1500 stipend to undergraduates participating in research or scholarly activity that furthers their declared educational goals. For the purpose of the awards, "research or scholarly activity" may also include examination of a cultural or historical question, documentary or production arts, as well as laboratory or field research more normally associated with the sciences or engineering disciplines. This competition is open to all undergraduate students in good academic standing. Applicants co-apply with a faculty mentor and must have successfully completed their freshman year. All undergraduates in the MUS are eligible, including the tribal colleges. (Appendices 6, 7 and 11).

V. DIVERSITY AND OUTREACH. The EPSCoR program will continue to play a central role in Montana's economic development, enhanced participation of underrepresented groups in science and engineering and expansion in the involvement of the broader university community in S&T issues. The Montana EPSCoR program has been highly successful at stimulating small business development through innovative SBIR programs. The Montana program has also developed highly effective programs to engage Native American students in science and research through Montana's tribal colleges and summer research programs for high school and college students at MSU. In collaboration with the Montana NIH BRIN program, we propose an expanded partnership with each of the tribal colleges through a major, new faculty-hiring program to enhance science education and research. We also propose to expand the role of the university in building science and technology in the state by expanding our commitment to undergraduate diversity research programs and infrastructure building in departments not traditionally aligned with NSF EPSCoR support.

Tribal College Faculty
Undergraduate Summer Diversity Research
SBIR Awards
Science is Cool

V.A. ENHANCEMENT OF SCIENCE AND TECHNOLOGY AT MONTANA'S TRIBAL COLLEGES. Science faculty at Montana's six tribal colleges play a critical role in training Native Americans to pursue careers in science and engineering. The tribal college science faculty are extremely dedicated, but are very limited in resources and time. There is a strong need to institute meaningful undergraduate research programs at these schools. The single most urgent need to be identified is to increase the number of faculty in science education and research at each college. In this initiative, we propose to partner with the NIH BRIN award to hire an additional science faculty member at each of the six tribal colleges. EPSCoR/BRIN will support start-up packages for the first three years, after which, continued support for these faculty members will be sustained by each tribal college. We expect this permanent expansion of science faculty to have a profound impact on the Native American students by providing increased capacity and expanded research experiences to encourage students to pursue careers in science and engineering. (Appendices 8 and 9).

V.B. UNDERGRADUATE SUMMER DIVERSITY RESEARCH PROGRAM (UM). This innovative, highly successful, high profile initiative, that matches undergraduate students from predominantly minority institutions (e.g., Tribal Colleges, San Francisco State, Northeastern Illinois University) with faculty mentors at UM for a summer of hands on research, scientific exploration, seminars, field trips and professional training, will be continued. In sum, diversity and unrepresented undergraduates conduct research at The University of Montana for ten weeks during the summer for an intensive experience that is complete with seminar program, wilderness and outdoor Montana experiences, training and workshops. Approximately 8-12 students/year are in the program. http://www.umt.edu/epscor/diversity/default.htm .

V.C. SMALL BUSINESS INNOVATIVE RESEARCH (SBIR) AWARDS. Montana is expanding its investment in the research enterprise by aiding inventors and entrepreneurs to become more competitive for federal SBIR awards. Three programs, run collectively by the university technology transfer directors, state SBIR program manager and the Research and Commercialization (R&C) Board of Montana, propose to build stronger applications in (S&T) through better promotion of SBIR award writing, increased faculty involvement and investment in company infrastructure. (Appendix 3).

V.C.1. PHASE 1 AND PHASE 1.5 SBIR AWARDS. To help develop the economic S&T base in Montana, the Montana NSF EPSCoR has developed a partnership with the State to help fund SBIR Phase 0 awards (approx. $5,000 awards) aimed to initiate SBIR Phase 1 award applications. Linda Brander will head this program for the State of Montana (UM/MSU technology transfer directors will manage the competitions). These awards show a high correlation with Phase 1 success. We expect to see an increased number of Phase 1 and Phase 2 awards in the State of Montana. (Appendices 13 and 14).

V.C.2. FACULTY – SMALL BUSINESS TRANSITION AWARDS. A limitation in faculty-partnered STTR and SBIR-based companies in Montana is providing the faculty member sufficient time at the site of

business to improve the probability of success. These awards are aimed to pay 1-2 months of faculty salary to build better bridges with companies either owned, in part, by the faculty member, or to provide the faculty member research time at a business. These awards (up to $10K) will be run through our SBIR awards committee.

V.C.3. SMALL BUSINESS INFRASTRUCTURE AWARDS: PERSONNEL/LAB SUPPORT. Several small [bio]technology companies need additional support to complete their preliminary results in route to Phase 1 submission. These companies are developing their business plan and need 'seed' money to generate results that would strengthen their SBIR proposal. Applicants would be eligible for up to $25K and competition/awards would be run through our SBIR awards committee.

V.D. *SCIENCE IS COOL* RADIO PROGRAM (UM). UM's own radio program *Science is Cool*, hosted by Prof. Katie George, is held Saturday mornings (approx. 16 shows/year). NSF EPSCoR supports 'on the air' experiments, wages (for Prof. George) and travel/lunches for children to attend and participate in the "live" taping sessions. We expect to expand this initiative to 50% additional shows. (Appendix 12).

V.E. INFRASTRUCTURE ASSESSMENT AWARDS (UM). Several non-PhD and some PhD granting UM science departments lack integrative programs or clusters that would enable them to become competitive for NSF funding and advance their S&T infrastructure. To ensure they are in a competitive position and ready with program plans and initiatives for the 2007 EPSCoR application round, pilot infrastructure planning awards will be granted. This initiative will bring in panels of experts (e.g., AAAS) in given disciplines and assist in developing a vision plan and charting a course for program projects and infrastructure building that would either lead to an entirely new focus area, or better integrate the program with a more broadly developed research focus area so that the department can partner with EPSCoR. Several departments at UM have been preliminarily identified for development, including psychology, geology, mathematics, computer science, physics and social work.

key Points

VI. MANAGEMENT PLAN (SEE ALSO SECTION I.D). The Montana NSF EPSCoR program proposes broad-based governing and operations partnerships with three well defined and integrated governing bodies: (1) State of Montana EPScoR Committee, (2) NSF EPSCoR Governance Committee, and (3) inter- and intra-campus advisory committees. Each institution also has individual advisors (VP for Research, Associate VP for Research, Deans, chairpersons, tech transfer directors, Center directors, etc.). A strictly defined network and organizational structure for the Montana EPSCoR has been devised (Fig. 2; Sect. 1.D) that properly defines the governance and advisory roles for each unit, and moreover, establishes the relative position of a person or committee within the EPSCoR framework. [*NOTE:* Dr. Daniel J. Dwyer was appointed the new Vice President for Research and Development at UM, July 2003.]

Governing Bodies
Subproject Management
Planning for Sustainability
Public Information Access

VI.A. GOVERNING BODIES, ACTIONS AND STATE INTEGRATION. The State of Montana EPSCoR Committee is the principal management body for all EPSCoR programs (NSF, NHI, DOE, etc.) and dictates overall state policy with respect to S&T infrastructure and related (COBRE, IDeA, etc.) programs. The EPSCoR Governance Committee (GC) is the administrative body of the NSF EPSCoR program, and along with the two co-directors and their advisory board, report the programmatic, educational and financial components of the program to the State of Montana EPSCoR Committee on a quarterly basis. Quarterly and [required] yearly reporting to the NSF is conducted by the two program directors after feedback from the reporting committees and members shown in Figure 2. Montana EPSCoR reports to the State will chronologically lead NSF reporting by one month to allow proper feedback. For most program actions, the EPSCoR GC, program co-directors and internal advisory committees will have oversight responsibilities. Prior to any action taken, all programmatic or financial changes that significantly impact the State, must be approved by the State EPSCoR Committee.

The Montana NSF EPSCoR program management is shared at two office sites, Missoula (UM) and Bozeman (MSU), where each is staffed with a project administrator, funds manager/accountant and diversity/outreach coordinator. Directors (C. Thompson, UM; M. Young, MSU) and associate directors (W. Hill, UM; G. Strobel, MSU-both former EPSCoR directors) coordinate statewide initiatives through service as liaisons to the State of Montana lawmakers. UM is the host institution, accepts financial responsibility for the project and serves as financial hub for the project. The AVPs for Research (C. Carlson, UM; L. Schmidt, MSU) share in fiscal responsibility and will also coordinate the financials for specific subproject awards to institutions, companies, individuals and students. Since UM is the host institution, R. Stoddard (UM, EPSCoR accountant and project coordinator) and P. Haisch

(funds manager, G&C office, UM) will be responsible for overall project accounting, reconciliation, projections and reporting. Quarterly meetings will be held between AVPs and their respective staff to ensure that the financial aspects of the project are up to date and available for NSF reporting. Twice yearly meetings between AVPs, their staff and the EPSCoR office staff will be held to coordinate specific project finances, expenditures and projections.

Each program director is responsible for project progress and fiscal management including subcontracts to partner institutions. Institutional management at UM and MSU is the responsibility of each project director and its Internal Advisory Committee (IAC), which will meet quarterly to evaluate program progress, define milestones and enact policy. The IAC will also be responsible for overall program assessment, individual assessment (Project Director and Project Administrator) and coordinating AAAS reports for individual departments, Centers and Institutes. Economic development and corporate partnerships are the responsibility of the technology transfer directors at UM (T. Rudbach), MSU (R. Friesenhahn) and the R&C Board, who coordinate state and academic activities and initiatives with the state, and award the match funds required for the NSF EPSCoR program, along with the NSF EPSCoR offices, the university Vice Presidents for Research and Montana NSF EPSCoR project directors. (Appendix 15).

VI.C. SUBPROJECT MANAGEMENT. An important layer of governance in the Montana EPSCoR is our subproject or initiatives management. In 2001, the Montana EPSCoR program created a panel of subcommittees, (e.g., Graduate Fellowship Awards Committee) to coordinate, write mission statements and develop policy for each EPSCoR subproject. These committees have served for three years and have aided in award selection, management and importantly, removing the project director from any conflict of interest. The goal for the committee involvement was to bring more program participants into the EPSCoR process, and where appropriate, empower faculty and administrators with post-award decision making. This level of involvement will be continued in the 2004-2007 proposal.

VI.D. PLANNING FOR SUSTAINABILITY. The Montana EPSCoR program identified that the Center/Institute/Cluster (CIC) research model for infrastructure building works best for our state and will be successful because this framework crosses department barriers allowing researchers from different disciplines to better interact, to optimize resources and personnel and to share core facilities. The CIC models proposed in this application will be directed/managed by a senior faculty member with links to one or more academic departments providing a strong academic foundation for development and stability. Each CIC establishes its long-term sustainability and support through a variety of mechanisms including the award of federal grants, program projects, private donations, partnerships, IDC returns and university-based investments in support. Administrative support for this model requires that every new faculty position with affiliations in the research core area CICs be tenure track.

kev Points

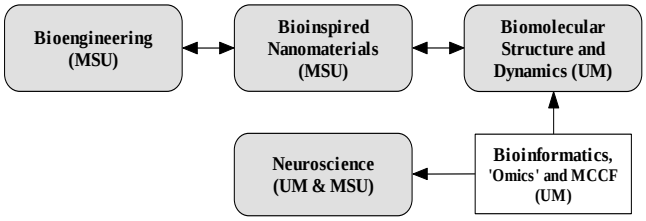
VI.E. PUBLIC INFORMATION ACCESS. In 2001, the Montana EPSCoR program published implementation guidelines and full access websites to provide full public use to our programs and initiatives-UM (www.umt.edu/epscor) and MSU (www.epscor.montana.edu). New implementation guidelines, updated websites and a new primary portal page (consolidating the UM/MSU EPSCoR websites) will be established in the proposed application period.

VII. SUMMARY. We will direct our efforts into four core research focus areas (gray fill), one at UM, two at MSU and one shared at UM/MSU in which each area is linked according to the simple connection point diagram (Fig. 7). Core facilities in informatics, 'omics' and computation at UM will be advanced as a platform to assist the CBSD and the CSFN as well as develop ties to the computational neurosciences and nanotechnology groups at MSU. With the exception of Neuroscience, each research core area will have a number of new faculty hires: Biomolecular Structure and Dynamics – 7, Bioinspired Nanomaterials – 4, Bioengineering – 4, and Neuroscience – 1 (program director), for a total of sixteen tenure-track faculty lines. In addition, two science faculty will be hired at Montana Tech, one faculty member in the sciences will be hired at each of the six Montana Tribal Colleges and one new faculty hire in the Department of History (MSU) will account for an additional nine positions.

Program Integration
The Match-Milestone Link
New Core Areas
Faculty Hires & Startup
Leveraging & Sustainability
Governance
EHS & Diversity

The core research areas and the scientific citizenry of Montana will be supported through a plethora of focused and integrative menu infrastructure initiatives including: visiting scholars, seminar speakers, technical staff, instructional 'backfill' faculty, graduate student stipends, undergraduate research awards, conference support and SBIR awards. Strong emphasis placed on the education, outreach and diversity and a well-planned platform of objectives has been outlined including: tribal college faculty hires, partnerships with on-campus Native American programs (NACOE, HCOP, etc.), unique K-12 initiatives (e.g., Montana Science Fairs), a Science Exploratorium (ISLE), unique diversity programs in undergraduate research and advancing women scientists, teaching techniques at the math/science interface and improving and increasing women/minority faculty hires. In the 2004-2007 award period, Montana will have in place, expanded and greatly improved mechanisms of governance (Fig. 2). Each subcommittee will meet regularly with the project directors (site visit or AGN) and provide feedback on program progress, direction and execution. The Montana EPSCoR governance model will be split into three sections with different, yet integrative responsibilities: (1) research/science/technology, (2) HER, and (3) fiscal.

FIGURE 7. UM and MSU core research focus areas



By 2008 (one year after award period), Montana EPSCoR expects to achieve the following milestones: (1) twenty new science faculty in the State of Montana, (2) three new state- and regential-approved PhD programs, (3) two state approved and nationally recognized Centers: Center for Biomolecular Structure and Dynamics and Center for Bioinspired Nanomaterials as indicated by single-investigator and multi-investigator awards directly tied to Center activities, (4) twenty new single-investigator awards and five new multi-investigator awards that directly resulted from Montana NSF EPSCoR support, (5) increased number of women (5-8) and a 10% increase in minority program participants, (6) improved outreach and diversity, and (7) increase the national ranking of the State of Montana's science intensive universities.